Changing Patterns in Household Ownership of Municipal Debt: Evidence from the 1989-2013 Surveys of Consumer Finances

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(First draft May, 2015. Current draft July, 2015. Comments welcome)

Abstract

The period since 1989 has seen significant changes in the structure of household ownership of municipal debt, with ownership becoming concentrated in a smaller number of households over time. The share of households holding any municipal debt fell from 4.6 percent to 2.4 percent between 1989 and 2013. The share of total debt that is held by the wealthiest 0.5 percent of households rose from 24 percent to 42 percent over the same period. These changes have coincided with the growth of tax-deferred retirement investment accounts such as 401(k) plans as a primary location of household investing. Municipal bonds, which pay tax-exempt interest, are almost never held inside of these tax-deferred accounts. These changing patterns of ownership have implications for the political economy of the municipal bond market.

Keywords: Municipal bonds.

We are grateful for support from the Brandeis International Business School. We are grateful for comments from seminar audiences at Brandeis and at EAFIT University and from Michael Baumrin, Robert Donahue, Robert Doty, Philip Fischer, Thomas Goda, Bart Hildreth, Tom Kozlik Andrew Lutz, Colin MacNaught, Justin Marlowe, Zhuan Pei, Andres Ramirez Hassan, Diego Alexander Restrepo Tobon, Richard Ryffel, Michael Stanton, and Stephen Winterstein. In addition to their academic appointments, both Bergstresser and Cohen work as consultants for Definitive Capital Management, which manages funds that invest in municipal securities.

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Municipal bonds have historically been an extremely safe investment, with defaults for rated municipal issuers averaging 0.01 percent per year during 1970-2007 and still only 0.03 percent per year over the more turbulent 2008-2013 period (Moody's, 2014).[1] This safety has made the debt attractive as an investment for many households, and direct investment by households has been an important part of the ownership structure of municipal debt. Municipal debt markets also often have a local flavor, with households disproportionately investing in debt from issuers in their own states (Kidwell et al, 1984). There is an interplay between safety and breadth of direct holding – repayment of municipal debt is based in part on the political will of the issuer to repay, and a broad base of holders who are directly exposed to an issuer's municipal debt creates a significant constituency that can be counted upon to support repayment.[2]

But the structure of household ownership of municipal debt appears to be changing over time, and in ways that are not visible in aggregate statistics. In this paper we use household data from the 1989 through 2013 Surveys of Consumer Finances to look at disaggregated data on municipal debt ownership. A clear picture emerges: the share of households holding municipal bonds appears to be shrinking significantly over time. Household ownership rates have fallen from 4.6 percent to 2.4 percent. **Figure 1** shows this drop, and shows the contribution of direct and indirect (through mutual fund) holdings to this drop. This drop in ownership rates has occurred even though aggregate household holdings of municipal debt have increased over time. Municipal bond ownership is becoming concentrated in a smaller and smaller number of hands. **Figure 2** shows the increasing concentration over time of municipal bond ownership in the top 0.5 percent of households.

[1] A recent study by the Federal Reserve Bank of New York (Appleson et al, 2012) found (not surprisingly) much higher default rates among the set of bonds that do not carry ratings.

[2] In the end, households own all of the assets in the economy. Corporate bonds are often owned by insurance companies, which are in turn often owned in part by mutual funds, and those funds are owned by households. But the link from the issuer to the household is particularly direct in the municipal bond market.

When we look at changing patterns of ownership of other assets, for example shares of stock and holdings of other bonds, we find that municipals are unusual in their falling household ownership rates. The share of households owning any stock has risen from 27.3 percent to 42.7 percent since 1989, and the share of households owning any non-municipal bonds has risen from 45.3 percent to 46.8 percent. But the location of household investing has shifted since 1989 toward tax-deferred accounts such as 401(k)s, 403(b)s, and IRAs. Municipal bonds' tax-exemption reduces their pre-tax yields and makes them a very unusual (and even inappropriate) asset for tax-deferred accounts. So the declining ownership rates for municipal bonds have coincided with a shift in household portfolios towards accounts where municipals are a tax-disadvantaged investment.

When we fit empirical models explaining the determinants of the household decision to hold bonds, more interesting patterns emerge. In particular, the drivers of household municipal bond holdings have changed over time. In 1989, family income was a very strong predictor of ownership of municipal bonds, as was a household's estimated marginal tax rate. The relative predictive power of net worth and income has changed over time: by 2013 net worth was a much stronger predictor of owning municipal bonds. Conditional on net worth, higher-income households are no longer more likely than lower-income households to own municipal bonds. In addition, the share of household financial assets held through tax-deferred accounts is a strong predictor in each survey of whether or not a household holds municipal bonds.

A number of market commentators have made extreme predictions about the prospects of future municipal defaults. Meredith Whitney, for example, forecasted in 2010 that there would be ‘hundreds of billions of dollars worth of defaults.’[3] As we pointed out in earlier work (Bergstresser and Cohen, 2011), our view is that Whitney’s and other similar predictions were extreme and reflected a poor understanding of the municipal market. Nonetheless, the security of municipal bonds in the end rests on the political will of issuers to make hard choices and repay their debt. Part of the reason why issuers have repaid their debt has been the political constituency of municipal bond owners, who form a reliable voice in favor of repaying debt. We thus view the declining ownership of municipal debt as cause for concern from a political economy perspective.

Given the declining share of households who own municipal debt, another area of potential concern is the municipal tax exemption. Tracing the economic effect of the tax exemption through the economy is a complex exercise, and economic theory shows that the net cost of a tax (or benefit of a subsidy) is not necessarily borne by the household directly paying the tax. Recent work (Galper et al, 2014) suggests that some households who don’t own municipal bonds benefit from the tax exemption through the exemption’s effect of subsidizing the provision of public sector goods and services. Even so, a declining share of households who hold municipal bonds and perceive themselves as benefiting from the tax exemption may place this exemption on a shakier political foundation.

Other recent work (Hager, 2013) has demonstrated the increasing concentration of non-municipal bonds in the hands of the top 1 percent of households, and a well-known stream of research by Piketty and Saez (see, for example, Piketty and Saez (2003)) has demonstrated the increasing concentration of income in the hands of the top 1 percent of households. One of the

[3] Meredith Whitney, interviewed on CBS’ *60 Minutes* in December 2010: ‘There’s not a doubt in my mind that you will see a spate of municipal bond defaults…You could see 50 sizeable defaults. 50 to 100 sizeable defaults. More. This will amount to hundreds of billions of dollars worth of defaults.

things that we demonstrate in this paper is that the increasing concentration of ownership in municipal bonds is particularly pronounced. In other assets (which are more often held in tax-deferred accounts) trends towards greater concentration in a small number of hands are partially offset by the increasing importance of tax-deferred retirement assets.

This paper proceeds in eight sections. The first section describes the Surveys of Consumer Finances. The second section describes patterns of municipal debt ownership; a third section breaks out debt held directly versus debt held through mutual funds. A fourth section describes the concentration of municipal bond portfolios into a small number of households. A fifth section describes the characteristics of municipal debt owners in the different waves of the survey. A sixth section describes our approach to calculating statistical confidence measures for our estimates, a seventh section fits probit models predicting household municipal ownership, and a final section concludes.

1. The Surveys of Consumer Finances

The Survey of Consumer Finances (SCF) is a survey of US households, conducted every three years by the Federal Reserve Board, in cooperation with the Internal Revenue Service. The modern incarnation of the survey began in 1983, and the questionnaire and sample design have been relatively stable since 1989, allowing comparison across surveys in different years. Since that time the survey has been constructed as a repeated cross-section rather than as a panel study following the same household across different surveys.[4] The SCF is widely used by academic and government researchers studying household portfolio choice and related decisions. SCF data

[4] An exception to this was a 2009 re-survey of 2007 survey households. This re-survey was designed to assess household assets and income across the financial crisis.

are regarded as the most reliable and extensive data on household wealth available for the United States (Dettling and Hsu, 2014).

A key feature of the SCF is the dual-frame sampling design (Kennickell, 2005). The dual-frame design means that part of the sample comes from an area-probability sample and a second part comes from what is called the 'list sample.' The area-probability sample represents about 2/3 of the total sample, and is constructed through geographically stratified sampling of a national sampling frame developed by the National Opinion Research Center (NORC) at the University of Chicago. The list sample is used to over-sample households likely to be wealthy, and is based on a sample of individual tax returns developed by the IRS' Statistics of Income (SOI) Division.

Over-sampling wealthy households is particularly important given that wealth is concentrated in a relatively small number of households. The combination of an area-probability sample with a list-sample which over-samples the wealthy means that the SCF can be used to investigate both behaviors that are widely distributed in the population (for example use of credit cards) and behavior that is more concentrated in the very wealthy (for example ownership of stock or mutual funds.) In our context, the sample design means that the same survey is useful both for investigating the share of households that have municipal debt and also the structure of municipal debt ownership among the relatively small number of households that own municipal bonds.

The SCF is distinguished by its high level of detail on the disaggregated components of wealth. This disaggregation means that the survey is particularly useful for investigating questions around household portfolio shares in different assets (Poterba and Samwick, 2003), and can be used as well to investigate household assets held both inside and outside of tax-deferred accounts such as defined contribution pension plans (Bergstresser and Poterba, 2004). For example, the SCF asks questions both about municipal bonds held directly and also about tax-exempt municipal bond mutual funds, a feature that we exploit in this work. The SCF also asks demographic questions, for example household composition, ages, educational status, and occupational and employment status.

SCF observations come with analysis weights that are intended to specify the number of households in the larger population that are similar to the survey household (see Kennickell and Woodburn, 1999). These analysis weights can be thought of as representing the inverse of the probability of selection of a household into the sample. The weights allow researchers using the survey to address questions such as the distribution of wealth ownership in the population from which the survey is drawn, which is the population of US households.

A key feature of the SCF is the use of multiple imputation for handling nonresponse in the survey. Rubin (1987) gives details on multiple imputation in surveys, and Kennickell (1999) describes the use of multiple imputation in the SCF. As with any survey, some households in the SCF decline to answer certain questions about aspects of wealth or income, or are only willing to give answers indicating a range for a given variable rather than a dollar amount. **Table 1** (based very closely on Kennickell, 1999) shows data on nonresponse and range response from the 1995 SCF. Some items have very high response rates, for example the variable capturing household payment of rent. On an unweighted basis, 23.8 percent of households reported paying rent, and no households reported being unsure whether or not they paid rent. Of the households that report paying rent, 95.1 percent gave a number for the dollar amount of rent that they paid, and 4.3 percent gave a range. No households reported paying rent and not knowing how much they paid, and 1.5 percent of the observations were coded as 'missing.' For many variables, the bulk of the missing reflects refusals by the household to give a dollar figure, but in some cases it reflects an editing decision on the part of the Federal Reserve staff (hence delivering four categories that some to more than 100 percent.)

For municipal bonds rates of refusal by survey respondents were higher. On an unweighted basis, 8.1 percent of households reported having municipal bonds. Because the survey oversamples wealthy households, this share with municipal bonds in the raw sample is higher than the rate implied for the population from which the sample was drawn. 1.2 percent of households report not knowing whether they owned municipal bonds or not, or were otherwise unable or unwilling to answer the question.[5] Of the households that were willing and able to reveal that they owned municipal bonds, almost eighty percent were able and willing to give at least a range for the value of their holdings. 1.2 percent reported not knowing the value of their holdings, and 20.1 percent were unwilling or otherwise unable to provide a value.

The SCF handles these missing observations using an imputation approach, meaning that missing observations are re-coded with values based on the sampling distribution of the variable and the characteristics of the household for which the data are missing. This approach is standard practice in use of household survey data and minimizes bias and statistical inefficiency due to survey nonresponse. It has been recognized (see Rubin (1987) and Montalto and Sung (1996)) that although single imputation, where missing observations are replaced in the dataset based on household characteristics, minimizes bias, single imputation leads to systematic underestimates of the variability in the data because the imputed values for the missing

[5] For example, one household (out of 4299) had broken off the survey by that point, but had provided enough information before breaking the survey off to be included as a participant in the survey.

observations are treated as if they were known with certainty. For this reason, the SCF uses a multiple imputation approach. From each underlying household observation the survey creates five 'implicates,' each based on that household. The imputed variables in the five implicate datasets can be given both the appropriate mean and also a variance that corrects for the uncertainty given the missing values.

This multiple imputation approach means that some care must be taken in assessing the statistical significance of econometric results when using SCF data. For example, in the 1995 survey, the 21,495 implicate observation in the dataset are based on 4,299 underlying households. This means that the statistical confidence of regressions (for example our probit regressions in this paper) is lower than naïve analysis based on the 21,495 observations would imply. We therefore follow the practice recommended by the SCF staff, based on Rubin (1987), for calculating confidence intervals for our estimates presented in this paper.[6] This approach is described in more detail in the sections that follow.

Beyond non-response to individual questions, there is an issue in the SCF (and in any survey) with non-response to the entire survey. According to Kennickell (1999), in 1995, 66 percent of the eligible area-probability sample participated in the survey, which is an astounding level of participation given the high level of detail collected by the survey. One explanation for the high participation rates is that potential participants receive a letter from the Chairman of the Federal Reserve Board describing the importance of the survey and assuring potential

[6] See discussion of sampling error in the SCF codebook at http://www.federalreserve.gov/econresdata/scf/files/codebk2013.txt. That section of the codebook has code in the SAS programming language for calculating standard errors of estimates. Our analysis was performed using the Stata programming language, and we are grateful to Kevin Moore from the Federal Reserve Board staff for providing the Stata .ado-file used to calculate confidence intervals for the analysis in this paper.

participants of the confidentiality of their responses.[7] Participation rates for the wealthier list sample are lower, with rates that varied from 44 percent in the lowest wealth stratum to 13 percent in the highest. Adjusting for non-participation involves adjustment of sampling weights, a process that is made easier in the case of the list sample by the fact that at least some information about nonparticipating households in the list sample is available from the Internal Revenue Service.[8]

Table 2 describes the observations in the 1989-2013 surveys, cutting the data by the level of financial assets.[9] The 2013 survey data include 30,075 implicate observations; these observations are based on 6,015 underlying households surveyed. Average financial assets in the entire population came to $225,136. Data in the table (as elsewhere in the paper) are reported in 2013-equivalent dollars; data from 1989, for example, are inflated to a 2013-dollar equivalent using the CPI-U levels in 1989 and 2013.[10] Average inflation-adjusted financial assets peaked in 2001, reflecting the peak of the internet bubble, at a level of $239,520 per household. Financial assets grew rapidly between 1995 and 2001, but have fluctuated between $211,000 and $226,000 between 2004 and 2013.

The total number of households in the population implied by the survey weights has grown from 93,020,000 in 1989 to 122,530,000 in 2013. The vast majority of these households have minimal financial assets. In 2013, 91 million households (74.3 percent of the total) had less

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[7] The Chairman's letter for the 2013 survey is available at http://www.federalreserve.gov/scf/bernankeletter2013.htm.

[8] See Kennickell (1997) for more detail on unit nonresponse in the SCF.

[9] Our measure of financial assets includes checking accounts, IRA accounts, CDs, savings accounts, money market accounts, savings bonds, publicly-traded stock, bonds, mutual funds, the cash value of whole life insurance, trusts, defined contribution pension plans, and a measure of 'other funds,' which according to SCF staff is mostly hedge funds. Assets excluded from our measure of financial assets include privately-held businesses, homes, and other real estate.

[10] The CPI-U in 2013 was 233.0, and the CPI-U in 1989 was 124.0. By this measure, prices have grown by 88 percent over the 24 years between 1989 and 2013, or an average compounded growth rate of 2.6 percent.

than $100,000 in financial assets, and the average level of financial assets among these households was $16,128.   At the same time, there has been rapid growth in the number of very wealthy households. In 2013, survey data imply that 806,000 households had more than $5 million in financial assets, or 0.66 percent of all households, versus 0.18 percent of households that were above this threshold in 1989. 4.2 percent of households in 2013 had financial assets totaling to over a million dollars, up from 2.0 percent in 1989.

Table 3 presents the same data but with a different way of breaking apart observations, cutting by the percentile of financial assets rather than by their absolute level. In this way the share of households in each group remains constant across the survey years. This approach demonstrates more starkly the stagnation in wealth in the bottom part of the distribution and the growth in wealth at the top. Average financial assets in the bottom 50 percent of households was $2,754 in 2013, down from $2,959 in 1989 (and $5,714 in 2001). The average among of financial assets in the top 0.5 percent of the population rose from $5.9 million in 1989 to $12.9 million in 2013. The finding that wealth has been stagnating at the bottom and rising at the top is not new, and has been documented by other researchers, including researchers using SCF data (Bricker et al, 2014).

2. Patterns of ownership of municipal debt, 1989-2013

An important feature of the municipal debt market is that political will plays an important role in assuring that debt will be repaid. In a democracy, breadth of ownership of municipal debt creates an important constituency that can be counted upon to advocate for debt repayment. In this section we investigate the patterns of ownership of municipal debt using the 1989 through 2013 Surveys of Consumer Finances and find that ownership is becoming more concentrated, with a small number of households holding a larger and larger share of the debt.

Table 4 shows patterns in household ownership of municipal debt, broken out by percentiles of total financial assets, between 1989 and 2013.[11] Panel A of the table shows the average amount of municipal debt held, by group and by year. The measure of municipal debt used in this table aggregates bonds held directly and bonds held indirectly, through tax-exempt mutual funds. The average household held $10,200 in directly-held and indirectly-held municipal bonds in 2013. Holdings per household in the survey peaked at $13,000 in 2007, and reached a low point of $8,000 in 1998. Survey responses suggest that the average household in the top 0.5 percent of the asset distribution held $859,700 worth of municipal debt in 2013, a figure that was down somewhat from a peak of $1,216,300 in 2007 but up from $436,600 in 1989.

Panel B shows the share of municipal debt that is held by groups in different levels of wealth between 1989 and 2013. The overall picture that emerges is that holdings of bonds have become increasingly concentrated at the top of the distribution: the share held by the top 0.5 percent has risen from 23.8 percent in 1989 to 42.0 percent in 2013. Closer analysis of the data shows that the change in the distribution has come in two phases. The top 0.5 percent gained share between 1989 and 1995, but took that share in part from the households between the 95th and 99th percentile of financial assets, as well as from households between the 75th and 90th percentiles. In the second part of the sample, from 1995 and 2013, the share held between the 75th and 90th percentiles continued to fall. In 1989, 11.1 percent of municipal debt was held by households between the 75th and 90th percentiles of financial assets; by 2013 that figure had fallen to 2.0 percent.

[11] The measure of financial assets used to cut the sample into groups excludes municipal bonds and tax-exempt bond funds.

Panel C of Table 4 shows the survey-implied total amounts of municipal bonds held in different parts of the wealth distribution. Total holdings implied by the survey peak at $1,505 billion in 2007, and stood at $1,245 billion in 2013. These figures are somewhat lower than figures implied by the Federal Reserve's Flow of Funds statistics. According to the Flow of Funds data, the household sector directly held $1,618.4 billion in municipal bonds in 2013. This discrepancy could have a number of sources. For one thing, the 'household sector' in the Flow of Funds data does not perfectly overlap with the sample frame of the Fed's SCF. Another consideration is that the data for the household sector in the flow of funds are calculated as a residual, based on the total known stock of municipal bonds and the amounts known to be held within other sectors that that the Flow of Funds data break out. The discrepancy could also speak to some systematic underreporting of the level of municipal bond holdings by SCF survey respondents. Antoniewicz (2000) and Henriques and Hsau (2013) describes known differences between SCF data and Flow of Funds data.

Table 5 shows two different perspectives on the importance of municipal debt for household portfolios. Panel A shows the share of households that report having any municipal bonds (either held directly or held through mutual funds) in their portfolios. The share of households reporting that they hold municipal bonds rose from 4.6 percent in 1989 to 4.8 percent in 1998, but it has since fallen sharply and as of 2013 stands at 2.4 percent. Declines have occurred at all levels of wealth, but the drops in the upper middle class are particularly large. The share of households between the 75th and 90th percentiles of financial assets who report holding municipal bonds fell has fallen from 9.6 percent in 1998 to 2.6 percent in 2013. Between the 50th and 75th percentiles of financial assets, the share has fallen from 3.8 percent to 0.9 percent over the same time.

Panel B shows municipal debt as a share of household total financial portfolios at different levels of financial assets. As a share of the total asset portfolio, municipal bonds have fallen over time from 7.9 percent to 4.5 percent, although their share rose during periods of the 2000s, largely due to fluctuation in the value of household holdings of equities. Although there is significant variation across different years of the survey, the decline in municipal bonds as a share of financial assets in the 75th to 90th percentiles is stark: it has dropped from 5.2 percent to 0.6 percent. Speaking more generally, households between the 50th and 90th percentiles of assets hold much less municipal debt (as a share of their assets) than they did in the past.

Table 6 compares the changing ownership rates of municipal debt to changing ownership rates of a variety of other assets. For stock and non-municipal bonds, the table breaks out ownership by the location of the assets – inside versus outside of tax-deferred accounts. A large literature (including Bergstresser and Poterba, 2004) investigates household asset location choices. A key result from this literature is that optimal asset location involves preferentially holding highly-taxed assets inside of tax-deferred accounts. This asset location strategy maximizes the implicit subsidy to the investor coming from the tax advantage of the tax-deferred account. For a household to hold tax-exempt municipal bonds inside of a tax-deferred account would contradict the most basic advice of the asset location literature, and such portfolio choices are unlikely to be very common.[12]

The share of households owning any stock (either inside or outside of a tax-deferred account) rose from 27.3 percent to 42.7 percent over the period since 1989. But the share of households directly (as opposed to through a mutual fund) owning shares outside of a tax-deferred account fell over the same period from 16.9 percent to 13.8 percent. The growth in

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[12] The SCF only asks about holdings of municipal debt outside of tax-deferred accounts.

equity participation is entirely a consequence of growing equity participation inside of tax-deferred accounts.

Ownership of non-municipal bonds (including savings bonds) has been more static, with rates rising from 45.3 percent to 46.8 percent over the same period. A similar pattern emerges with respect to asset location, with the share of households holding fixed income assets inside of a tax-deferred account rising from 30.7 percent to 43.6 percent over the period, and the share of households holding fixed income assets outside of a tax-deferred account falling from 28.3 percent to 12.5 percent over the same period. Over time, there appears to have been a shift in the locus of household investing activity from outside to inside of tax-deferred retirement accounts, a change that has coincided with a decline in the share of households holding municipal bonds.

3. Municipal debt held directly and held through mutual funds

Our analysis so far has aggregated bonds held directly and bonds held through tax-exempt mutual funds. In this section we break these components apart, and some interesting patterns emerge. The main theme is that the decline in the share of households owning any municipal debt is particularly pronounced when we focus on the households who hold that debt directly, as opposed to holding in indirectly through tax-exempt bond funds.

Panel A of **Table 7** shows the share of households in the various waves of the Survey of Consumer Finances that report holding municipal bonds directly. The 1989 survey data suggest that 3.5 percent of households directly held bonds, a share that appears to have fallen below 1 percent as of the 2013 survey. Direct ownership of municipal bonds has been falling across the distribution of financial assets. At the top, ownership rates are large but falling: the share of households in the top 0.5 percent holding bonds directly fell from 42.6 percent to 29.4 percent.

Ownership rates in the next 0.5 percent – households whose financial asset holdings place them in the 99th to the 99.5th percentiles – fell from 58 percent in the 1989 survey to 16.2 percent in 2013. Rates of ownership in the upper middle class have fallen as well, and have fallen from lower initial levels. The rate of ownership by households in the 90th to 95th percentiles has fallen from 13.0 percent to 2.3 percent over the same period. Direct ownership of municipal bonds used to penetrate well into the middle class: in 1989 the rate of ownership by the 50th-75th percentile households was 1.9 percent. The same figure that was only 0.3 percent as of 2013.

Panel B of Table 7 shows direct holdings of municipal debt as a share of total financial assets, again partitioned by household levels of financial assets. Note again that the measure of financial assets used to partition households excludes municipal debt. Direct ownership of municipal debt as a share of financial assets was 9.5 percent in the 99th-99.5th percentile households in 1989, and had fallen to 3 percent by 2013. For the sample as a whole, direct holdings of municipal debt fell from 5.8 percent to 2.7 percent across the nine waves of the survey that we use in this paper.

Table 8 shows ownership rates and levels for tax-exempt bond mutual funds, and a somewhat different picture emerges. Ownership rates of municipal bond funds rose between 1989 and 1998 from 1.5 percent of households to 3.5 percent of households. This expansion of ownership reflected the larger move towards mutual funds as a focus of household investing. But fund ownership rates have fallen since 1998, and now stand at 1.6 percent of all households. This pattern repeats across each of the asset level categories. For example, among the households at the 90th-95th percentiles of financial assets, ownership rates rose from 5 percent to 12.2 percent before falling back down to 5.2 percent by 2013. Municipal bond funds as a share of total financial assets (Panel B of Table 7) have been relatively stable, ranging from 1.6 percent to 2.5 percent of total financial assets. The overall picture that emerges from this disaggregated analysis is that the decline in direct ownership of municipal debt has been much more rapid than the decline of intermediated household ownership.

4. The concentration of municipal debt ownership

In this section we investigate further the degree to which municipal bond holdings are concentrated in a very small number of households, and the extent to which that concentration has changed over time. **Table 9** returns to focusing on measures of municipal debt ownership that aggregate direct and indirect holdings. The top row of the table, repeating information described earlier, shows the share of all households in the sample that report owning any municipal debt. That share has fallen to 2.4 percent as of 2013. Panel A of the table focuses just on the households owning municipal debt and shows the distribution of ownership levels within these households. Among households owning municipal debt, the median ownership level in 2013 was $70,000. The distribution is highly and increasingly skewed. The mean ownership level among households owning municipal bonds was $432,000 in 2013, up from $200,000 in 1989. As figure B shows, the vast majority of the bonds are held by the small number of households who hold municipal bonds in large amounts. The share of debt held by the top 50 percent of debt holders (among those who hold municipal bonds) rose from 95.1 percent in 1989 to 97.4 percent in 2013. Combining these numbers with the declining overall ownership rates means that in 1989 the top 2.3 percent of all households (ranking by municipal ownership) held 95.1 percent of the debt, while in 2013 the top 1.2 percent of households held more than 97 percent of the debt. Almost 90 percent of the debt was held by the top 25 percent of municipal owners. With the declining ownership rates of municipal debt, these top 25 percent of owners now represent only 0.6 percent of households in the population. Ownership of municipal debt in large quantities is becoming more and more concentrated in a very small number of households.

5. Evidence on the characteristics of municipal bond owners

In this section we present evidence on the characteristics of the municipal bond owning community. We start by focusing on their age. One hypothesis, given our earlier results on the declining share of households that own municipal bonds, would be that the set of municipal bond owners is shrinking because it is aging and not being replenished with new bond owners over time. But **Table 10** suggests that other factors are at work. Between 1989 and 2013 the age profile of municipal debt owners have been remarkably stable, with median and mean ages around 60 years. This stability contrasts with an aging overall population: the average age of the households that do not own municipal bonds has risen from 47 to 51 years over the same period, and the median age has risen from 44 years to 50 years.

Municipal debt is a particularly attractive asset for households that face high marginal tax rates on their income; this relative tax advantage to tax-exempt income is greater at higher tax rates. **Table 11** shows the distribution of marginal tax rates for households, partitioned by municipal bond ownership status. Our marginal tax rate estimate comes from linking the SCF data with the NBER's TAXSIM tax simulator (Feenberg and Coutts, 1993). This calculator, when given household characteristics and income levels, will return federal marginal tax rates. We are unable to calculate marginal state tax rates because the public-use SCF files do not have information on the geographical location of the households in the survey.[13] Effective tax rates can be negative in certain regions of the income distribution due to the phase-in of the Earned

[13] This restriction helps preserve the confidentiality of the households participating in the survey.

Income Tax Credit (EITC), which provides a subsidy for work which is based on income. Effective marginal tax rates become extremely high in regions of income where the EITC benefits are being phased out.

Not surprisingly, the SCF data suggest that the community of municipal bond owners is characterized by higher marginal tax rates than other households. The median federal marginal tax rate of municipal bond owners was 25 percent in 2013. This compares to a median marginal tax rate of households that do not own municipal bonds of 15 percent in the same survey. As illustrated in earlier sections of this paper, however, ownership of municipal debt is highly skewed. The median bond investor does not own the median dollar of municipal wealth. The median dollar of wealth is held above the 95^{th} percentile of the municipal bond owning group. **Table 12** takes a different approach, showing marginal tax rates at different points in the dollar-weighted (as opposed to household-weighted) distribution of households. The median dollar of municipal debt is held by a household with a 28 percent marginal tax rate. At least 30 percent of the debt is held by households with federal marginal tax rates above 35 percent.

6. Evidence on statistical confidence of results

The household figures presented in the previous sections represent estimates based on repeated surveys of a large number of households. The SCF is widely recognized as the best available source of evidence on aggregate household wealth and its components. But even with the large sample size of the SCF, estimates based on the survey are just that – estimates. There remains uncertainty about what these estimates mean for ownership averages and other statistics in the larger population (the population of American households) from which the SCF samples are drawn. This uncertainty about population characteristics based on survey results holds true regardless of survey or setting.

In this section we follow the approach recommended by Survey of Consumer Finances staff and calculate confidence intervals for some of the statistics in our paper. This approach to calculating confidence intervals, described in more detail in Montalto and Sung (1996), proceeds in two steps: first, calculating the variance based on the imputation of five implicates, and second, following a bootstrap procedure to estimate the sampling variance. These two estimates are then weighted and combined to find the total imputation plus sampling variance. The SCF data include replicate bootstrap weight files which facilitate the bootstrapping approach described above.

Table 13 reproduces the analysis in Table 5 panel A, but includes 95-percent confidence intervals for the point estimates in the earlier table. The table shows the share of households, by level of financial assets, who report ownership of municipal debt. The confidence intervals can be interpreted as showing the range of likely values that these variables take in the population of American households, given our estimate based on a particular specific survey. The confidence intervals shrink over time due to the increasing size of the survey, meaning that the survey is becoming an increasingly reliable indicator of the underlying population. Focusing on the main variable of interest – the share of household reporting ownership of any municipal debt – the point estimate in the 1989 sample is 4.6 percent, with a 95-percent confidence interval range of 3.6 to 5.6 percent. The point estimate for the 2013 sample is 2.4 percent, with a 95-percent confidence interval of 2.4 percent to 2.7 percent. The upshot of this is that we can be highly confident that our main result – that the share of households owning municipal bonds is declining over time – is not just an artifact of having a sample that is too small to be a statistically reliable indicator.

7. Determinants of household municipal ownership

In this section we estimate models for each of our survey years that explain ownership of municipal debt given household characteristics. The dependent variables that we include are the estimated household marginal tax rate, dummy variables for family income level (by percentile), dummy variables for household wealth[14], dummy variables for educational status and age of the household head, a dummy variable for married households and female-headed households, and a dummy variable indicating the household's risk tolerance. The risk tolerance level is based on a survey question which asks households to self-assess their willingness to take risk in exchange for a higher expected return.

In this analysis we fit probit models, and the results are presented in **Table 14**. Probit coefficient estimates for a model fit to each year's data are in the columns. Stars indicate the statistical confidence level of the coefficient, based on confidence intervals constructed according to the approach described in the earlier section. Comparing the coefficient estimates across years, a few clear patterns emerge. First, the relative weight of income versus wealth in determining municipal ownership appears to have shifted over time. In the first year, only the coefficient estimates on the income variables are statistically significant. The coefficient estimates on the wealth variables increase over time. Another result is the declining influence of the estimated marginal tax rate. Coefficient estimates are large and significant in the early samples, but smaller and statistically insignificant since 2010. The association between age and

[14] The measure of wealth excludes municipal debt.

municipal ownership also appears to have lessened by 2013. While earlier survey years saw a strong association, with older households holding more debt, in the 2013 survey there is no evidence that (controlling for other variables such as wealth) the older households are more likely to own municipal bonds.

The pattern in coefficients on the risk tolerance variable is worth noting. Households reporting that they are in the highest risk tolerance group (those who report being willing to take substantial risk for substantial reward) are less likely to own municipal bonds in most of the survey years than the omitted category, which is households that are unwilling to take risk. In general, households who rate their risk tolerance as ‘average’ are the most likely to hold municipal bonds. Early in the sample there is some evidence that households rating their risk tolerance as ‘above average’ (but lower than the highest ‘substantial’ category) are also more likely to hold municipal bonds, but that relationship appears to have disappeared (or even reversed) in the later samples.

Finally, the large coefficient on the ‘TDA share,’ or the share of household financial assets held through tax-deferred accounts such as 401(k)s, is striking. The TDA share is a strong predictor, in every survey, of the municipal ownership decision. The probit coefficient estimates can be used to calculate (at the means of the observations in the sample) a marginal effect of each variable on the probability that the household owns municipal debt. The coefficient estimate for 2013 implies a marginal effect of -0.22 percentage points on the probability of owning municipal bonds for a 10 percent change in the share of wealth held through a tax-deferred account, which is a significant effect on a population average municipal ownership rate of 2.4 percent.

Overall, households who have more assets held through tax-deferred accounts are less likely to hold municipal bonds. The mean household share of assets held in tax-deferred accounts has risen over time, rising from 19.4 percent in 1989 to 32.6 percent in the 2013 survey. This rise has coincided with a decline in the share of households owning municipal debt, particularly among the middle and upper middle classes.

8. Conclusion

The period since 1989 has seen significant changes in the structure of household ownership of municipal debt, with ownership becoming concentrated in a smaller number of households over time. The share of households holding any municipal debt fell from 4.6 percent to 2.4 percent between 1989 and 2013. The share of total debt that is held by the wealthiest 0.5 percent of households rose from 24 percent to 42 percent over the same period. The drop in direct ownership of municipal bonds has been particularly sharp, but rates of household ownership through mutual funds have fallen as well.

Ownership of debt matters because municipal debt markets depend on democratic processes. In the sovereign and sub-sovereign debt context, repayment depends on the political will of the borrower to repay. A large literature, including Bulow and Rogoff (1989), considers the mystery of sovereign debt repayment given the apparently weak tools that creditors have to enforce their claims. Recent work by Guembel and Sussman (2009) has highlighted the importance of the fact that sovereign debt is often held internally, and by voters. In the political economy equilibrium, these voter/creditors create an important constituency that can be counted on to support debt repayment. This analysis for sovereign borrowers also applies to municipal issuers in the United States – ownership of debt by voters affects the political will of borrowers to repay, and may also affect the prospects for a continued tax exemption for municipal interest. From that perspective, declining household municipal bond ownership rates may be cause for concern for this market.

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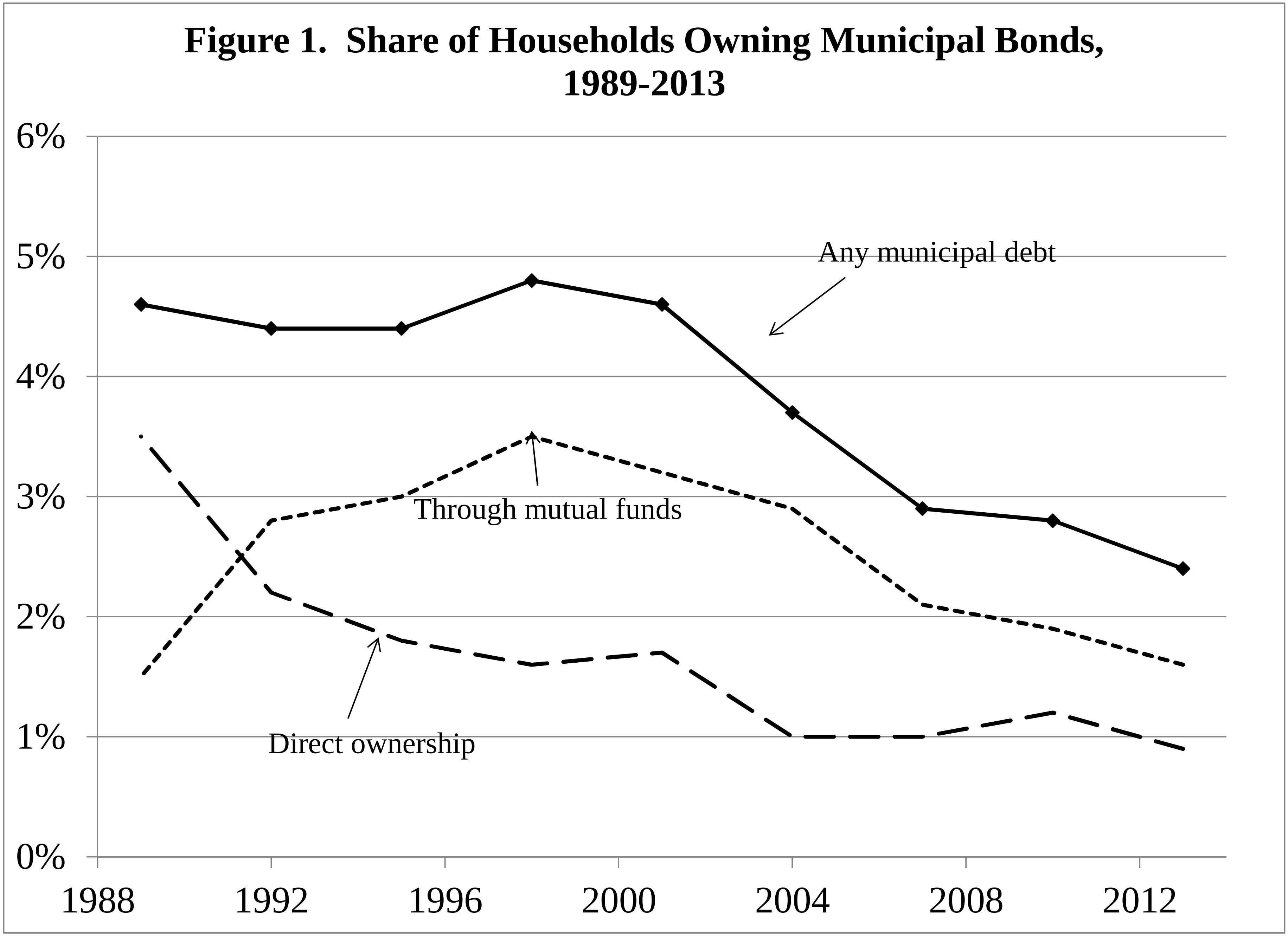
Figure 1. Share of Households Owning Municipal Bonds, 1989-2013
6%
5%
4%
3%
2%
1%
0%
1988
1992
1996
2000
2004
2008
2012
Any municipal debt
Through mutual funds
Direct ownership

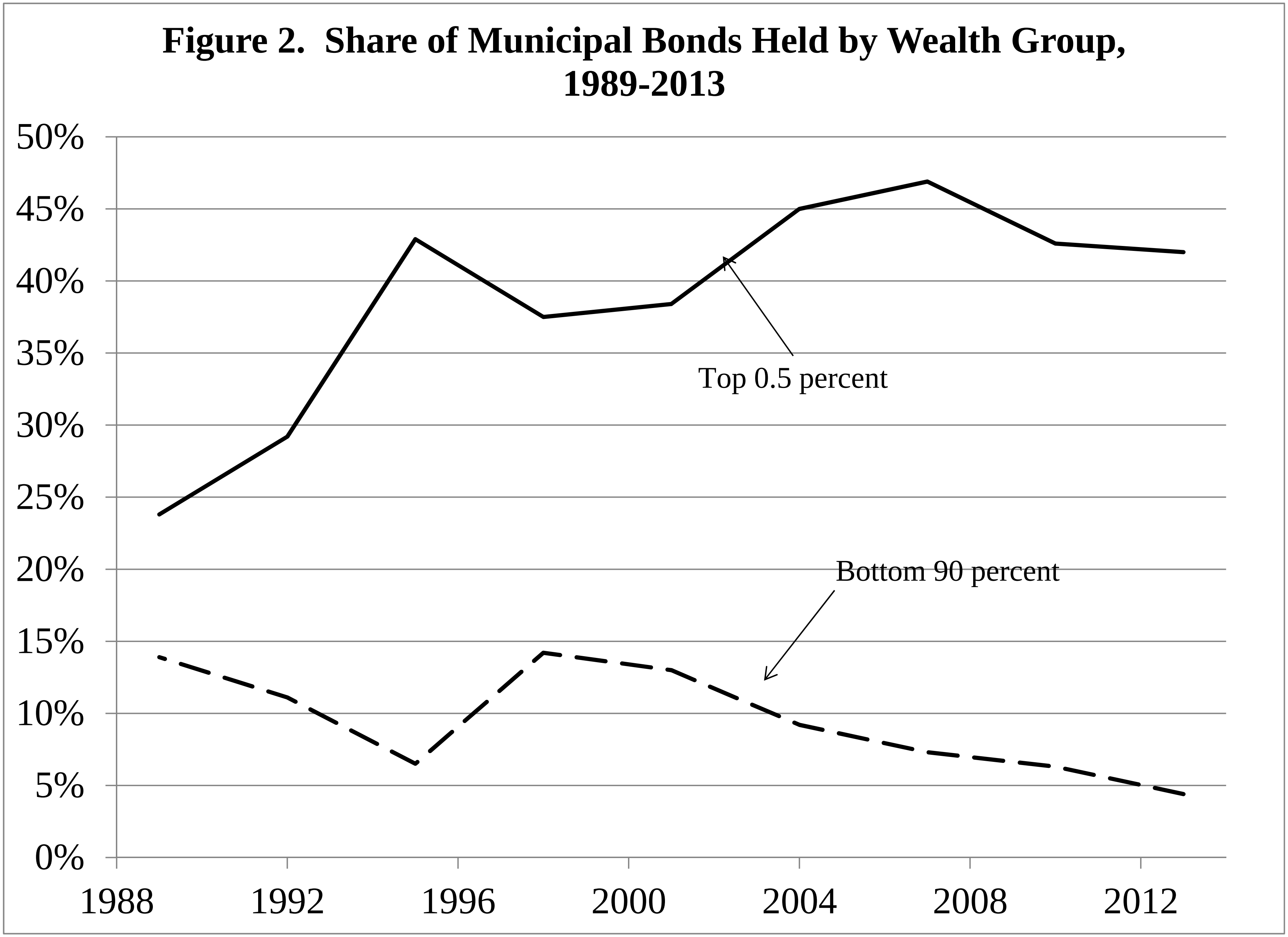
Figure 2. Share of Municipal Bonds Held by Wealth Group, 1989-2013
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
1988
1992
1996
2000
2004
2008
2012
Top 0.5 percent
Bottom 90 percent

Table 1. Reporting rates for various item, percent. Full sample for 1995 Survey of Consumer Finances, unweighted.

Table based closely on Kennickell (1999)

	Have item		Value reported by respondent, for those having the item			
Item	Yes	Un-known	Number	Range response	DK	Other missing
Credit card balance	76.0	0.4	93.6	4.7	0.1	1.7
Principal residence	67.6	0.0	88.9	9.4	0.0	1.7
Borrowed on mortgage	42.9	0.3	89.6	7.6	0.3	2.6
Owe on mortgage	42.9	0.3	86.1	10.2	0.2	3.5
Mortgage payment	42.2	0.3	92.7	4.6	0.1	2.5
Rent	23.8	0.0	95.1	4.3	0.0	1.5
Ownership of other real estate	32.4	0.6	84.0	11.9	0.4	3.7
Business	26.8	0.4	61.9	25.3	1.2	11.5
Car loan payment	23.7	0.2	93.0	4.9	0.2	1.9
Checking account	88.7	0.3	80.1	12.8	0.4	6.7
Money market account	17.3	0.7	71.7	16.7	0.9	10.6
Savings account	33.6	0.7	80.2	12.9	0.1	6.8
Certificates of deposit	17.0	1.0	69.7	14.8	0.3	15.3
IRA/Keogh	34.6	1.2	74.4	16.4	0.4	8.9
Savings bonds	24.0	0.7	76.1	16.4	0.8	6.8
Municipal bonds	8.1	1.2	59.8	19.0	1.2	20.1
Tax-free mutual funds	8.3	1.6	59.6	19.1	0.8	20.5
Stock	28.4	0.9	63.8	20.7	1.4	14.1
Trusts and annuities	7.2	0.6	65.9	20.6	0.0	13.5
Face value of whole life insurance	38.6	2.2	76.7	13.9	0.8	8.6
Cash value of whole life insurance	38.6	2.2	55.5	23.8	2.1	18.7
Wage income	73.6	1.0	72.8	18.4	0.3	8.4
Business income	20.6	1.5	68.5	15.5	0.5	15.6
Pension and Social Security income	26.5	1.2	73.3	13.0	0.4	13.3
Total income	100.0	0.0	69.1	18.4	0.5	12.1

Table 2. Summary of sample, 1989-2013 Surveys of Consumer Finances (by financial asset level)

Observation count, implied population weight, and average level of financial assets by year and by level of financial assets. Observation count is the full count of SCF replicates. In each year's survey, 5 replicates are created from each underlying household observation; see text for details. Financial assets include assets held in retirement accounts. For the 'all households' category, the 'underlying observation count' is the count of households surveyed by the SCF to obtain the total number of household replicates; it is one-fifth of the total count of observations. Weight-implied population (reported in thousands) uses household sampling weights to calculate implied number of households in the sample population, which is the sample of US households. All dollar figures adjusted to 2013 equivalents using CPI-U price index.

By level of financial assets	2013	2010	2007	2004	2001	1998	1995	1992	1989
0-100K (Count)	18,559	20,784	11,742	12,590	12,020	11,997	12,658	11,625	9,558
Weight-implied population	91,035	88,452	83,564	81,138	74,943	74,585	78,486	76,592	74,952
Average financial assets	16,128	17,036	19,043	18,118	20,235	19,853	18,695	17,854	17,715
100-250K (Count)	3,014	3,153	2,470	2,313	2,398	2,565	2,449	2,203	1,818
Weight-implied population	13,511	12,582	15,031	13,350	13,782	14,035	11,097	10,670	9,330
Average financial assets	161,074	158,803	163,118	160,392	161,140	159,936	155,783	159,678	159,604
250-500K (Count)	2,123	2,090	1,613	1,646	1,630	1,772	1,676	1,386	1,166
Weight-implied population	7,588	6,770	8,203	8,354	7,843	7,412	5,135	4,793	4,717
Average financial assets	358,208	350,725	347,515	355,109	358,878	348,300	353,256	351,057	353,546
500K-1M (Count)	1,750	1,754	1,429	1,420	1,403	1,162	1,157	1,121	857
Weight-implied population	5,202	4,919	4,986	4,796	5,294	3,296	2,346	2,180	2,187
Average financial assets	690,849	705,118	696,172	711,519	712,580	690,535	700,724	676,591	678,215
1M-2.5M (Count)	1,600	1,506	1,463	1,531	1,617	1,436	1,351	1,210	997
Weight-implied population	3,386	3,137	2,706	3,210	3,220	2,169	1,377	1,250	1,356
Average financial assets	1,520,251	1,522,359	1,534,908	1,428,840	1,480,266	1,512,767	1,522,704	1,533,234	1,532,789
2.5M-5M (Count)	832	976	898	901	885	773	737	716	557
Weight-implied population	1,002	1,161	945	692	772	658	317	311	313
Average financial assets	3,522,445	3,509,080	3,510,907	3,566,244	3,512,539	3,529,509	3,466,087	3,385,231	3,464,701
5M+ (Count)	2,197	2,147	2,475	2,194	2,257	1,820	1,467	1,269	762
Weight-implied population	806	589	688	569	641	394	252	122	166
Average financial assets	11,103,943	11,327,471	11,919,045	11,915,543	12,010,252	12,438,965	12,620,191	11,227,248	10,383,616
All households (Count)	30,075	32,410	22,090	22,595	22,210	21,525	21,495	19,530	15,715
Underlying observation count	6,015	6,482	4,418	4,519	4,442	4,305	4,299	3,906	3,143
Weight-implied population	122,530	117,609	116,122	112,109	106,496	102,549	99,010	95,918	93,020
Average financial assets	225,136	211,431	224,221	212,486	239,520	186,157	131,549	110,148	116,624

Note. Measure of financial assets includes municipal bonds.

Table 3. Summary of sample, 1989-2013 Surveys of Consumer Finances (by financial asset percentile)

Observation count, implied population weight, and average level of financial assets by year and by level of financial assets. Observation count is the full count of SCF replicates. In each year's survey, 5 replicates are created from each underlying household observation; see text for details. Financial assets include assets held in retirement accounts. For the 'all households' category, the 'underlying observation count' is the count of households surveyed by the SCF to obtain the total number of household replicates; it is one-fifth of the total count of observations. Weight-implied population (reported in thousands) uses household sampling weights to calculate implied number of households in the sample population, which is the sample of US households. All dollar figures adjusted to 2013 equivalents using CPI-U price index.

By percentiles of fin. assets	2013	2010	2007	2004	2001	1998	1995	1992	1989
0-50 (Count)	12,540	14,122	8,099	8,654	8,550	8,240	7,737	7,117	5,506
Weight-implied population	61,336	58,818	58,063	56,060	53,336	51,300	49,508	47,961	46,582
Average financial assets	2,754	3,055	4,593	4,114	5,714	5,051	3,291	2,909	2,959
50-75 (Count)	6,195	6,600	4,177	4,460	4,337	4,137	4,138	3,701	3,179
Weight-implied population	30,566	29,391	29,040	28,029	26,537	25,629	24,759	23,982	23,203
Average financial assets	45,399	44,336	59,179	55,963	67,389	57,545	37,764	34,649	33,422
75-90 (Count)	4,406	4,686	3,028	3,015	2,999	2,996	3,115	2,776	2,578
Weight-implied population	18,378	17,642	17,413	16,842	15,975	15,368	14,844	14,385	13,946
Average financial assets	215,428	200,009	223,783	231,561	257,276	199,104	133,606	130,658	127,061
90-95 (Count)	1,893	1,973	1,431	1,450	1,375	1,401	1,529	1,342	1,106
Weight-implied population	6,124	5,879	5,806	5,597	5,327	5,127	4,951	4,793	4,642
Average financial assets	586,550	583,738	551,644	587,322	651,019	447,594	326,492	307,399	323,107
95-99 (Count)	2,484	2,327	2,387	2,080	2,143	2,185	2,234	1,998	1,626
Weight-implied population	4,901	4,707	4,641	4,460	4,258	4,102	3,959	3,841	3,729
Average financial assets	1,582,240	1,568,563	1,472,613	1,338,254	1,512,125	1,182,391	808,849	731,103	795,853
99-99.5 (Count)	545	557	629	761	732	597	706	567	448
Weight-implied population	612	586	582	572	533	512	495	476	454
Average financial assets	4,591,827	4,066,683	4,289,873	3,829,225	4,310,749	3,333,848	2,117,024	1,890,892	2,044,463
99.5-100 (Count)	2,012	2,145	2,339	2,175	2,074	1,969	2,036	2,029	1,272
Weight-implied population	612	587	578	549	530	511	495	479	465
Average financial assets	12,919,722	11,351,066	13,177,553	12,158,576	13,391,043	10,653,386	8,242,118	5,286,961	5,952,553
All households (Count)	30,075	32,410	22,090	22,595	22,210	21,525	21,495	19,530	15,715
Underlying observation count	6,015	6,482	4,418	4,519	4,442	4,305	4,299	3,906	3,143
Weight-implied population	122,530	117,609	116,122	112,109	106,496	102,549	99,010	95,918	93,020
Average financial assets	225,136	211,431	224,221	212,486	239,520	186,157	131,549	110,148	116,624

Note. Measure of financial assets includes municipal bonds.

Table 4. Household holdings of municipal bonds (direct and indirect), 1989-2013 Surveys of Consumer Finances

Tables based on 1989 through 2013 Surveys of Consumer Finances, conducted by Federal Reserve Board. Measure of financial assets used to group households includes all financial assets, including retirement accounts, but does not include municipal bonds. Municipal bond values in this table include both bonds held directly and bonds held indirectly through mutual funds. Dollar values are in 2013-equivalent dollars, calculated using CPI-U

Panel A: Average holdings of municipal bonds (direct and indirect), by percentiles of financial assets (2013-equivalent dollars, in thousands)

Financial asset percentile	2013	2010	2007	2004	2001	1998	1995	1992	1989
0-50	-	-	-	0.3	-	0.1	0.1	0.1	-
50-75	0.9	0.7	0.8	0.3	0.8	1.4	0.6	1.5	1.0
76-90	1.4	4.2	4.9	5.6	9.1	5.0	2.4	3.3	6.8
90-95	18.1	15.9	12.5	15.0	22.5	23.5	13.0	22.1	16.7
95-99	76.4	107.0	96.4	66.9	75.7	43.7	47.9	72.6	76.8
99-99.5	294.8	304.7	294.3	357.1	329.1	187.2	321.6	195.6	364.2
99.5-100	859.7	1,105.0	1,216.3	1,025.6	921.3	600.6	706.3	491.7	436.6
All	10.2	12.9	13.0	11.4	12.0	8.0	8.2	8.3	9.2

Panel B: Share held by group (divided by financial asset levels) as percent of total household holdings

Financial asset percentile	2013	2010	2007	2004	2001	1998	1995	1992	1989
0-50	0.1%	0.2%	0.1%	1.1%	0.1%	0.5%	0.4%	0.5%	0.1%
50-75	2.3%	1.3%	1.6%	0.7%	1.6%	4.4%	1.8%	4.6%	2.7%
76-90	2.0%	4.8%	5.6%	7.4%	11.3%	9.3%	4.3%	6.0%	11.1%
90-95	8.9%	6.1%	4.9%	6.6%	9.4%	14.6%	7.9%	13.2%	9.1%
95-99	30.1%	33.1%	29.6%	23.5%	25.3%	21.9%	23.2%	34.8%	33.4%
99-100	14.6%	11.8%	11.3%	15.7%	13.8%	11.7%	19.5%	11.8%	19.8%
99.5-100	42.0%	42.6%	46.9%	45.0%	38.4%	37.5%	42.9%	29.2%	23.8%
all	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Panel C: Total implied amount held, by percentiles of financial assets (2013-equivalent dollars, in billions)

Financial asset percentile	2013	2010	2007	2004	2001	1998	1995	1992	1989
0-50	1.1	2.8	2.2	14.6	1.9	4.5	2.9	3.8	0.6
50-75	28.3	19.3	24.0	8.5	20.4	35.9	14.7	36.9	22.8
76-90	25.2	73.6	84.7	93.8	144.7	76.4	35.4	48.0	95.0
90-95	111.0	93.2	73.1	83.8	119.9	119.8	64.4	105.4	77.5
95-99	374.5	503.0	445.7	300.0	322.6	179.2	189.4	278.4	285.5
99-99.5	181.9	179.6	169.6	200.4	175.4	96.0	159.1	94.2	169.2
99.5-100	522.7	647.2	705.7	573.4	489.9	307.4	349.6	234.0	203.0
all	1,244.6	1,518.8	1,504.9	1,274.5	1,274.9	819.2	815.6	800.7	853.5

Table 5. Household holdings of municipal bonds (direct and indirect), 1989-2013 Surveys of Consumer Finances

Tables based on 1989 through 2013 Surveys of Consumer Finances, conducted by Federal Reserve Board. Measure of financial assets used to group households includes all financial assets, including retirement accounts, but does not include municipal bonds. Municipal bond values in this table include both bonds held directly and bonds held indirectly through mutual funds. Dollar values are in 2013-equivalent dollars, calculated using CPI-U

Panel A: Percent of households reporting positive holdings of municipal debt (direct and indirect)

Financial asset percentile	2013	2010	2007	2004	2001	1998	1995	1992	1989
0-50	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.2%	0.1%	0.1%
50-75	0.9%	0.7%	1.2%	2.3%	2.8%	3.8%	1.8%	2.2%	2.4%
75-90	2.6%	2.6%	3.5%	5.9%	8.9%	9.6%	7.5%	6.7%	7.0%
90-95	7.3%	14.6%	9.5%	12.5%	16.1%	12.9%	18.3%	19.4%	17.1%
95-99	21.4%	24.1%	23.1%	24.4%	27.4%	25.8%	31.3%	32.2%	35.9%
99-100	46.4%	38.4%	55.4%	47.3%	37.8%	41.1%	47.3%	47.0%	64.6%
99.5-100	46.6%	56.4%	58.0%	41.3%	51.9%	51.8%	55.0%	61.7%	55.2%
all	2.4%	2.8%	2.9%	3.7%	4.6%	4.8%	4.4%	4.4%	4.6%

Panel B: Household holding of municipal debt (direct and indirect) as a share of total financial assets

Financial asset percentile	2013	2010	2007	2004	2001	1998	1995	1992	1989
0-50	0.6%	1.5%	0.8%	5.9%	0.6%	1.7%	1.7%	2.7%	0.4%
50-75	2.0%	1.5%	1.4%	0.5%	1.1%	2.4%	1.5%	4.3%	2.9%
75-90	0.6%	2.1%	2.2%	2.4%	3.5%	2.5%	1.8%	2.5%	5.2%
90-95	3.0%	2.7%	2.3%	2.5%	3.5%	5.1%	3.9%	7.0%	5.1%
95-99	4.8%	6.7%	6.4%	5.0%	5.0%	3.7%	5.9%	9.9%	9.7%
99-100	6.5%	7.5%	7.1%	9.3%	7.7%	5.7%	14.4%	10.4%	16.9%
99.5-100	6.7%	10.0%	9.4%	8.7%	7.0%	5.7%	8.8%	9.5%	7.7%
all	4.5%	6.1%	5.8%	5.4%	5.0%	4.3%	6.3%	7.6%	7.9%

Table 6. Percentages of households holding different assets, 1989-2013 Surveys of Consumer Finances

Tables based on 1989 through 2013 Surveys of Consumer Finances, conducted by Federal Reserve Board.

	2013	2010	2007	2004	2001	1998	1995	1992	1989
Municipal bonds	2.4%	2.8%	2.9%	3.7%	4.6%	4.8%	4.4%	4.4%	4.6%
Municipal bonds - direct ownership	0.9%	1.2%	1.0%	1.0%	1.7%	1.6%	1.8%	2.2%	3.5%
Municipal bonds - through mutual funds	1.6%	1.9%	2.1%	2.9%	3.2%	3.5%	3.0%	2.8%	1.5%
Any stock	42.7%	43.6%	35.3%	36.3%	49.4%	45.8%	36.6%	32.4%	27.3%
Stock (inside tax-deferred accounts)	38.4%	38.8%	26.2%	27.3%	44.1%	40.3%	30.1%	24.4%	17.0%
Stock - direct shares (outside tax-deferred)	13.8%	15.1%	17.9%	20.7%	21.3%	19.2%	15.2%	16.9%	16.9%
Stock - equity in mutual funds (outside)	7.7%	8.1%	10.6%	14.1%	16.7%	15.2%	11.3%	8.3%	6.0%
Stock - own-company shares	4.4%	5.4%	6.5%	7.7%	8.1%	7.4%	6.1%	7.0%	7.0%
IRA/Keogh accounts	28.1%	28.0%	30.6%	29.0%	31.3%	28.3%	25.9%	26.0%	24.5%
Checking accounts	87.1%	85.1%	83.7%	82.5%	80.8%	80.9%	80.5%	77.0%	75.2%
Certificates of Deposit (CDs)	7.8%	12.2%	16.1%	12.7%	15.7%	15.3%	14.3%	16.7%	19.9%
Other bonds (inside and outside tax-deferred)	46.8%	48.0%	52.0%	51.8%	40.6%	42.8%	44.6%	45.0%	45.3%
Other bonds (inside tax-deferred accounts)	43.6%	44.3%	47.1%	45.4%	28.9%	29.5%	30.7%	30.3%	30.7%
Other bonds (outside tax-deferred accounts)	12.5%	14.7%	17.8%	21.6%	21.0%	23.9%	26.2%	27.2%	28.3%
Own home	65.1%	67.2%	68.6%	69.1%	67.7%	66.3%	64.7%	63.9%	63.9%
Other real estate	17.0%	18.2%	18.7%	17.7%	16.4%	18.2%	17.2%	18.0%	19.2%
Private business	9.9%	11.9%	11.6%	11.2%	11.6%	11.2%	10.9%	11.3%	11.4%

Table 7. Household holdings of municipal bonds (direct holdings of bonds only), 1989-2013 Surveys of Consumer Finances

Tables based on 1989 through 2013 Surveys of Consumer Finances, conducted by Federal Reserve Board. Measure of financial assets used to group households includes all financial assets, including retirement accounts, but does not include municipal bonds. Municipal bond values in this table include only bonds held directly, and do not include bonds held through mutual funds. Dollar values are in 2013-equivalent dollars, calculated using CPI-U

Panel A: Percent of households reporting positive holdings of municipal debt (direct holdings only)

Financial asset percentile	2013	2010	2007	2004	2001	1998	1995	1992	1989
0-50	0.1%	0.1%	0.0%	0.1%	0.1%	0.2%	0.1%	0.1%	0.0%
50-75	0.3%	0.2%	0.2%	0.2%	0.9%	1.0%	0.8%	0.8%	1.9%
75-90	0.8%	1.0%	0.8%	0.6%	3.1%	2.9%	2.5%	1.7%	5.2%
90-95	2.3%	6.0%	3.2%	3.6%	4.7%	3.2%	7.6%	10.4%	13.0%
95-99	9.1%	10.6%	10.1%	9.4%	12.1%	9.9%	11.1%	19.9%	27.1%
99-99.5	16.2%	20.7%	25.8%	27.9%	21.1%	25.5%	30.1%	34.1%	58.0%
99.5-100	29.4%	24.3%	26.3%	29.2%	37.2%	31.0%	32.9%	45.7%	42.6%
all	0.9%	1.2%	1.0%	1.0%	1.7%	1.6%	1.8%	2.2%	3.5%

Panel B: Household holding of municipal debt (direct holdings only) as a share of total financial assets

Financial asset percentile	2013	2010	2007	2004	2001	1998	1995	1992	1989
0-50	0.4%	1.4%	0.0%	0.3%	0.2%	0.3%	0.2%	0.6%	0.0%
50-75	0.3%	0.4%	0.2%	0.0%	0.4%	0.8%	1.0%	2.7%	2.7%
75-90	0.2%	0.9%	0.8%	1.5%	2.1%	1.1%	0.9%	1.5%	4.0%
90-95	2.3%	1.8%	1.4%	1.1%	1.5%	2.9%	2.3%	4.5%	4.1%
95-99	3.3%	4.1%	4.0%	3.2%	2.7%	1.7%	3.4%	7.1%	6.5%
99-99.5	3.0%	5.0%	3.8%	7.4%	3.7%	3.1%	10.1%	8.5%	9.5%
99.5-100	3.8%	5.6%	5.3%	6.9%	5.4%	4.2%	5.9%	7.6%	7.0%
all	2.7%	3.6%	3.3%	3.8%	3.1%	2.5%	4.0%	5.6%	5.8%

Table 8. Household holdings of municipal bonds (indirect holdings of bonds only), 1989-2013 Surveys of Consumer Finances

Tables based on 1989 through 2013 Surveys of Consumer Finances, conducted by Federal Reserve Board. Measure of financial assets used to group households includes all financial assets, including retirement accounts, but does not include municipal bonds. Municipal bond values in this table include only bonds held through mutual funds and do not include bonds held directly. Dollar values are in 2013-equivalent dollars, calculated using CPI-U

Panel A: Percent of households reporting positive holdings of municipal debt (indirect holdings only)

Financial asset percentile	2013	2010	2007	2004	2001	1998	1995	1992	1989
0-50	0.1%	0.1%	0.3%	0.4%	0.5%	0.4%	0.2%	0.1%	0.1%
51-75	0.6%	0.5%	1.0%	2.2%	2.1%	2.8%	1.0%	1.7%	0.5%
76-90	1.9%	1.9%	2.7%	5.3%	5.9%	6.7%	5.4%	5.4%	2.3%
90-95	5.2%	10.3%	6.9%	9.8%	12.2%	9.9%	12.1%	11.7%	5.0%
95-99	13.9%	16.9%	14.2%	16.4%	18.7%	19.3%	24.7%	18.3%	14.2%
99-100	34.7%	20.3%	34.6%	28.2%	22.1%	26.0%	23.3%	23.8%	13.3%
99.5-100	27.9%	37.2%	37.0%	17.9%	22.5%	28.4%	35.5%	27.4%	20.1%
all	1.6%	1.9%	2.1%	2.9%	3.2%	3.5%	3.0%	2.8%	1.5%

Panel B: Household holding of municipal debt (indirect holdings only) as a share of total financial assets

Financial asset percentile	2013	2010	2007	2004	2001	1998	1995	1992	1989
0-50	0.2%	0.2%	0.8%	5.6%	0.4%	1.4%	1.6%	2.1%	0.4%
51-75	1.7%	1.1%	1.2%	0.5%	0.7%	1.6%	0.6%	1.6%	0.2%
76-90	0.4%	1.1%	1.3%	0.9%	1.4%	1.3%	0.9%	1.0%	1.2%
90-95	0.7%	0.9%	0.9%	1.4%	1.9%	2.2%	1.7%	2.5%	1.1%
95-99	1.5%	2.6%	2.4%	1.8%	2.3%	2.1%	2.5%	2.8%	3.2%
99-100	3.5%	2.6%	3.2%	1.8%	4.0%	2.5%	4.3%	1.9%	7.4%
99.5-100	2.9%	4.4%	4.1%	1.8%	1.6%	1.5%	2.9%	1.9%	0.7%
all	1.9%	2.5%	2.5%	1.6%	1.9%	1.8%	2.3%	2.0%	2.1%

Table 9. Concentration of holdings of municipal bonds (both direct and indirect holdings), 1989-2013 Surveys of Consumer Finances

Tables based on 1989 through 2013 Surveys of Consumer Finances, conducted by Federal Reserve Board. Municipal bond values in this table include both bonds held directly and bonds held through mutual funds. Dollar values are in 2013-equivalent dollars, calculated using CPI-U.

	2013	2010	2007	2004	2001	1998	1995	1992	1989
Share positive	2.4%	2.8%	2.9%	3.7%	4.6%	4.8%	4.4%	4.4%	4.6%
Panel A: Percentiles (among households with positive holdings, dollar figures in 2013 dollars)									
	2013	2010	2007	2004	2001	1998	1995	1992	1989
5th	3,000	2,671	2,023	1,233	2,631	2,430	1,452	4,982	3,758
10th	5,000	7,478	5,058	2,467	4,736	4,431	3,058	8,304	3,758
25th	15,000	25,640	22,479	10,484	13,156	11,150	10,702	18,268	18,790
50th	70,000	106,832	89,918	37,004	49,994	28,589	29,049	49,822	46,976
75th	241,000	320,495	284,366	123,346	131,564	121,503	88,675	166,073	176,629
90th	900,000	801,238	921,659	493,383	527,572	285,890	304,245	431,789	422,782
95th	1,800,000	1,602,476	1,989,436	992,933	1,052,513	714,724	672,703	780,542	751,613
Mean	432,054	459,694	442,203	305,487	258,500	165,538	188,592	189,029	199,967
Panel B: Share of total bonds held above each percentile (percentiles calculated based on households with positive holdings)									
	2013	2010	2007	2004	2001	1998	1995	1992	1989
5th	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
10th	99.9%	99.9%	99.9%	100.0%	99.9%	99.8%	99.9%	99.6%	99.8%
25th	99.6%	99.4%	99.5%	99.6%	99.3%	99.2%	99.4%	98.7%	98.5%
50th	97.4%	95.6%	96.8%	97.6%	96.5%	96.1%	97.0%	94.4%	95.1%
75th	89.4%	86.1%	87.6%	91.4%	87.7%	86.1%	90.1%	80.3%	83.1%
90th	70.2%	69.4%	71.0%	78.3%	72.1%	69.1%	77.9%	61.3%	62.9%
95th	55.0%	56.2%	56.0%	67.4%	57.8%	57.0%	66.2%	46.7%	49.8%

Table 10. Age distribution of households, by municipal bond ownership status (both direct and indirect holdings), 1989-2013 Surveys of Consumer Finances

Tables based on 1989 through 2013 Surveys of Consumer Finances, conducted by Federal Reserve Board. Municipal bond values in this table include both bonds held directly and bonds held through mutual funds.

Panel A: Age distribution among households that own municipal bonds.

	2013	2010	2007	2004	2001	1998	1995	1992	1989
5th	35	39	33	36	32	32	31	36	35
10th	42	42	38	41	36	36	36	41	38
25th	52	52	47	49	47	47	46	51	51
50th	62	62	59	60	58	61	57	60	62
75th	71	73	70	72	71	72	70	72	69
90th	79	83	82	81	79	80	77	78	76
95th	85	87	87	84	82	84	81	81	79
Mean	61	62	59	60	58	59	58	60	59

Panel B: Age distribution among households that do not own municipal bonds.

	2013	2010	2007	2004	2001	1998	1995	1992	1989
5th	24	24	24	24	24	24	24	24	24
10th	28	28	28	27	27	27	27	27	26
25th	37	37	36	36	35	35	34	34	33
50th	50	49	48	47	46	45	45	45	44
75th	63	62	61	61	61	60	62	62	61
90th	75	75	75	75	74	74	74	74	73
95th	81	80	81	80	79	80	79	79	79
Mean	51	50	50	49	49	48	48	48	47

Table 11. Marginal Tax Rate (MTR) distribution of households, by municipal bond ownership status (both direct and indirect holdings), 1989-2013 Surveys of Consumer Finances

Tables based on 1989 through 2013 Surveys of Consumer Finances, conducted by Federal Reserve Board. Municipal bond values in this table include both bonds held directly and bonds held through mutual funds. Marginal Tax Rate (MTR) constructed based on households' SCF data through merge to National Bureau of Economic Research TAXSIM calculation engine.

Panel A: MTR distribution among households that own municipal bonds.

	2013	2010	2007	2004	2001	1998	1995	1992	1989
5th	0	-6	0	-8	0	0	-8	0	0
10th	0	0	0	0	0	0	0	0	0
25th	0	0	5	0	15	15	15	15	15
50th	25	25	25	19	28	23	28	28	28
75th	28	33	33	28	31	28	29	29	28
90th	35	35	36	35	40	37	36	32	33
95th	35	35	36	36	41	40	41	35	33
Mean	18	18	20	17	22	20	22	19	20

Panel B: MTR distribution among households that do not own municipal bonds.

	2013	2010	2007	2004	2001	1998	1995	1992	1989
5th	-34	-40	-34	-8	-34	-40	-30	-17	-14
10th	-8	-14	-8	-8	-8	-8	-26	-17	0
25th	0	0	0	0	0	0	0	0	0
50th	15	15	15	15	15	15	15	15	15
75th	25	25	25	25	28	28	28	23	28
90th	28	28	28	28	31	28	28	28	28
95th	31	31	31	31	36	32	31	28	28
Mean	10	9	12	12	14	10	9	9	13

Table 12. Distribution of Marginal Tax Rates (MTR), weighted by municipal bond holdings. Holdings based on both indirect and direct holdings. 1989-2013 Surveys of Consumer Finances (with link to NBER TAXSIM for estimated marginal tax rates).

Tables based on 1989 through 2013 Surveys of Consumer Finances, conducted by Federal Reserve Board. Municipal bond values in this table include both bonds held directly and bonds held through mutual funds. Marginal Tax Rate (MTR) constructed based on households' SCF data through merge to National Bureau of Economic Research TAXSIM calculation engine.

	2013	2010	2007	2004	2001	1998	1995	1992	1989
Bottom	-45.0	-51.2	-40.0	-40.0	-40.0	-40.0	-30.0	-17.0	-14.0
5th	0.0	-6.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10th	0.0	0.0	0.0	7.5	0.0	0.0	15.0	0.0	0.0
15th	0.0	0.0	10.0	10.0	10.0	15.0	15.0	0.0	15.0
20th	0.0	15.0	20.0	15.0	15.0	15.0	15.0	15.0	15.0
25th	15.0	18.5	25.0	18.5	15.0	15.0	15.0	15.0	22.5
30th	15.0	18.8	25.9	25.0	22.5	22.5	27.8	22.5	28.0
35th	15.0	25.3	26.0	25.0	25.0	25.0	28.0	22.5	28.0
40th	25.0	27.0	28.0	25.0	28.0	28.0	28.0	28.0	28.0
45th	26.0	27.8	29.1	25.6	28.0	28.0	28.0	28.0	28.0
50th	28.0	28.8	32.5	27.8	28.0	28.0	28.0	28.0	28.0
55th	28.0	30.0	35.0	28.0	31.9	28.0	31.0	28.0	28.0
60th	30.0	33.0	35.0	28.0	32.5	31.0	31.0	31.0	28.0
65th	30.0	34.9	35.0	32.5	36.0	31.9	36.0	31.0	28.0
70th	35.0	35.0	35.0	34.0	37.6	36.0	37.1	31.0	28.0
75th	35.0	35.0	35.0	35.0	39.6	37.5	39.6	31.0	33.0
80th	35.0	35.0	35.7	35.0	39.6	39.1	39.6	31.0	33.0
85th	35.0	35.0	35.7	35.4	39.6	39.6	39.6	31.1	33.0
90th	35.0	35.4	35.7	36.4	39.6	39.6	39.6	31.9	33.0
95th	35.0	41.0	36.0	46.3	51.8	39.6	40.8	35.1	42.0
Top	61.1	64.8	66.1	65.9	73.3	68.0	78.8	55.9	49.5

Table 13. Probability of owning municipal bonds (direct and indirect), 1989-2013 Surveys of Consumer Finances

Tables based on 1989 through 2013 Surveys of Consumer Finances, conducted by Federal Reserve Board. Municipal bond values in this table include both bonds held directly and bonds held through mutual funds. Households grouped by percentiles of financial assets. Measure of financial assets used to group households excludes municipal debt. For each group and survey year, the first number is the point estimate of the share of households that own municipal debt, and the second and third represent the top and bottom of the 95-percent confidence interval calculated using the bootstrapping approach described in the text.

	2013	2010	2007	2004	2001	1998	1995	1992	1989
0-50	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.2%	0.1%	0.1%
(bottom)	0.0%	0.0%	0.1%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%
(top)	0.2%	0.3%	0.5%	0.9%	0.8%	0.9%	0.4%	0.3%	0.3%
51-75	0.9%	0.7%	1.2%	2.3%	2.8%	3.8%	1.8%	2.2%	2.4%
(bottom)	0.5%	0.2%	0.4%	1.2%	2.0%	2.7%	0.9%	1.0%	1.1%
(top)	1.2%	1.1%	1.9%	3.4%	3.5%	4.8%	2.7%	3.4%	3.7%
76-90	2.6%	2.6%	3.5%	5.9%	8.9%	9.6%	7.5%	6.7%	7.0%
(bottom)	1.6%	1.5%	2.0%	4.2%	6.2%	7.5%	5.5%	4.2%	5.0%
(top)	3.6%	3.7%	5.1%	7.6%	11.6%	11.8%	9.5%	9.1%	9.0%
90-95	7.3%	14.6%	9.5%	12.5%	16.1%	12.9%	18.3%	19.4%	17.1%
(bottom)	4.2%	10.7%	5.9%	8.6%	11.3%	6.1%	13.7%	12.5%	11.1%
(top)	10.5%	18.6%	13.1%	16.4%	20.8%	19.8%	22.9%	26.2%	23.1%
95-99	21.4%	24.1%	23.1%	24.4%	27.4%	25.8%	31.3%	32.2%	35.9%
(bottom)	17.0%	18.8%	17.8%	17.8%	21.6%	18.8%	25.8%	25.6%	26.9%
(top)	25.8%	29.5%	28.4%	31.0%	33.1%	32.7%	36.8%	38.9%	44.7%
99-99.5	46.4%	38.4%	55.4%	47.3%	37.8%	41.1%	47.3%	47.0%	64.6%
(bottom)	32.8%	21.8%	40.2%	39.1%	21.7%	24.2%	30.8%	32.0%	36.8%
(top)	60.2%	54.8%	71.1%	55.9%	53.7%	58.0%	63.4%	62.2%	92.9%
99.5-100	46.6%	56.4%	58.0%	41.3%	51.9%	51.8%	55.0%	61.7%	55.2%
(bottom)	33.3%	43.7%	48.0%	29.6%	39.4%	39.4%	42.2%	46.4%	35.8%
(top)	59.8%	69.1%	68.2%	53.0%	64.3%	63.9%	68.3%	77.2%	74.4%
all	2.4%	2.8%	2.9%	3.7%	4.6%	4.8%	4.4%	4.4%	4.6%
(bottom)	2.0%	2.4%	2.5%	3.2%	4.1%	4.3%	3.9%	3.8%	3.6%
(top)	2.7%	3.2%	3.4%	4.2%	5.2%	5.4%	4.9%	5.0%	5.6%

Table 14. Determinants of municipal bond holding status. 1989-2013 Surveys of Consumer Finances.

Figure shows results of probit regressions. Dependent variable is set to one for households that have municipal bonds, either held directly or held indirectly through a mutual fund. Independent variable 'TDA share' is share of financial assets held in tax-deferred accounts. Statistical significance indicated with stars: *** for signficant at 1% confidence level, ** for 5%, * for 10%. Statistical confidence calculated using bootstrapping approach described in text.

Variable	2013	2010	2007	2004	2001	1998	1995	1992	1989
Marginal Tax Rate	0.277	0.293	0.568 *	0.366	0.846 ***	0.948 ***	0.776 ***	1.093 ***	0.691 **
Family income percentile (0-50th omitted)									
50-75	-0.289 **	0.239 *	-0.081	0.197	0.163	0.326 ***	0.257 *	0.390 **	0.390 **
75-90	-0.255 **	0.253 *	0.104	0.251 *	0.232	0.234	0.564 ***	0.517 ***	0.488 **
90-95	-0.181	0.191	0.254	0.437 **	0.441 **	0.509 ***	0.557 **	0.626 ***	0.695 ***
95-99	-0.110	0.296 *	0.390 *	0.322 *	0.367 **	0.476 ***	0.608 ***	0.881 ***	0.975 ***
99-99.5	-0.042	0.383 **	0.669 ***	0.422 *	0.521 ***	0.848 ***	0.661 ***	1.041 ***	1.278 ***
99.5-100	0.029	0.300 *	0.821 ***	0.629 ***	0.661 ***	0.976 ***	0.844 ***	1.063 ***	1.285 ***
Net worth percentile (0-50th omitted)									
50-75	1.868	0.396 **	0.767	0.408 **	0.299 **	0.486 ***	0.323 *	0.682	0.436
75-90	2.385	1.043 ***	1.325	0.836 ***	0.789 ***	0.929 ***	0.691 ***	1.099 ***	0.949
90-95	2.841	1.626 ***	1.520	1.102 ***	1.158 ***	1.050 ***	1.080 ***	1.339 ***	1.321
95-99	3.220	2.019 ***	2.001 **	1.606 ***	1.301 ***	1.328 ***	1.304 ***	1.642 ***	1.411
99-99.5	3.187	2.368 ***	1.986 **	1.712 ***	1.252 ***	1.412 ***	1.346 ***	1.640 ***	1.605
99.5-100	3.501	2.471 ***	1.960 **	1.590 ***	1.320 ***	1.356 ***	1.386 ***	1.615 ***	1.273
TDA shr	-0.986 ***	-1.139 ***	-0.909 ***	-1.000 ***	-1.018 ***	-0.808 ***	-0.947 ***	-1.089 ***	-0.626 ***
Education (No HS omitted)									
HS	0.122	0.026	-0.212	-0.004	0.261	0.057	0.545 ***	0.216	0.322 **
Some col	0.009	0.201	0.017	0.306	0.406 *	0.193	0.674 ***	0.282 **	0.449 ***
College	0.315 *	0.493 **	0.183	0.326 *	0.456 **	0.164	0.878 ***	0.356 ***	0.795 ***
Postgrad	0.500 ***	0.503 **	0.338 *	0.417 **	0.572 **	0.344 **	1.053 ***	0.505 ***	0.678 ***
Age category (<35 omitted)									
35-44	-0.057	0.364 *	-0.055	0.158	-0.047	-0.103	0.044	0.079	-0.037
45-64	0.145	0.400 **	-0.049	0.405	0.276	-0.098	0.132	0.307 **	0.264 **
65+	0.209	0.576 ***	0.211	0.534 ***	0.413 **	0.386 ***	0.599 ***	0.710 ***	0.639 ***
Married	0.191 *	-0.102	0.119	0.092	-0.048	-0.130	0.035	-0.237 **	-0.211 *
Female	0.223	-0.002	0.316	0.145	0.083	0.245 **	0.333 **	-0.069	0.138
Risk tolerance group (Low tolerance omitted)									
Highest	-0.402 ***	-0.328 **	-0.386 **	-0.085	-0.133	-0.029	-0.107	-0.296 **	-0.430 **
High	0.160	0.079	-0.129	0.085	0.112	0.129	0.483 ***	0.206 *	0.237 **
Average	0.278 ***	0.190 **	-0.015	0.191 **	0.219 **	0.288 ***	0.378 ***	0.432 ***	0.317 ***
Constant	-4.444 ***	-3.457 ***	-3.066 ***	-3.180 ***	-3.011 ***	-2.807 ***	-3.724 ***	-3.560 ***	-3.570 ***
PseudoR2	0.409	0.462	0.392	0.362	0.331	0.334	0.381	0.391	0.374
Mean TDA shr	32.6%	33.9%	34.0%	31.8%	28.8%	27.4%	25.6%	21.7%	19.4%

Municipal Borrowing Costs and State Policies for Distressed Municipalities*

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This Draft: June 9, 2016

Abstract

Policies on financially distressed municipalities differ significantly across states in the U.S. Some states unconditionally allow municipalities to file for Chapter 9 bankruptcy ("Chapter 9 states"), while others have strong policies in place to deal with distressed municipalities ("Proactive states"). Such policy differences significantly affect local municipal borrowing costs. Local municipal bond yields in Chapter 9 states are higher and more cyclical than those in Proactive states. Moreover, following a default event in Chapter 9 states, the average yield of defaulted bonds increases more than those in Proactive states. Default events have a contagion effect among no-default bonds in Chapter 9 states, but not in Proactive states. Lower borrowing costs for local governments come at the expense of higher borrowing costs for the state government through a channel of higher intergovernmental revenue transfers when economic conditions are weak. Proactive states bear more local credit risk than Chapter 9 states and as a result, their yields on state-issued general obligation bonds are higher.

*We thank Robert Battalio, Kevin Crotty, Tim Loughran, Steve Peterson, Paul Schultz, Jim Spiotto, Charles Trzcinka, and seminar participants at DePaul University, Northwestern University, University of Illinois at Chicago, and University of Notre Dame for helpful comments. We also thank Karl Kraus for excellent research assistance. All errors are our own.

1 Introduction

Sovereign credit risk-sharing between countries in Europe has become more prominent since the global financial crisis of 2008. Following the crisis, for example, the European Central Bank (ECB) administered assistance packages that provided elements of ex-post cross-country risk-sharing to Greece, Ireland, and Portugal. In March 2015, the ECB implemented a quantitative easing program in which the ECB and the European national central banks would purchase and hold sovereign bonds of distressed Eurozone states, sharing the risks of sovereign debt defaults (VoxEU (2015)). Given the brief history of these governmental risk sharing programs, the long-term implications of these risk reallocations on sovereign borrowing costs are still unclear.

The purpose of this paper is to examine the interactions between intergovernmental risk sharing and government borrowing costs. The U.S. municipal bond market provides an ideal setting for this investigation, as there is significant cross-sectional variation in U.S. state policies for distressed municipalities. Some states have policies that induce risk-sharing between the state and its local municipalities, while other states have policies that underscore the independence of their municipalities from the state. Studying the cross-state variation in risk-sharing policies at the U.S. state government level contributes to an understanding of the tradeoff of intergovernmental risk-sharing.

The risk-sharing policies of the ECB in many ways parallel those of U.S. states. One of the goals of the ECB is to promote financial stability by protecting the creditworthiness of its member countries. In 2012, the ECB promised to do "whatever it takes" to preserve the euro in the face of the sovereign debt crisis (ECB (2012)), which included emergency fund provisions for its distressed member countries. Similarly, U.S. states have policies in place to protect the creditworthiness of the state and its municipalities. For example, when Harrisburg, Pennsylvania was financially distressed in 2010, the state advanced $4 million in loans so that Harrisburg could avoid default. Then-Governor Edward Rendell stated that missing a bond payment "would devastate not only the city, but the school district, the county, and central Pennsylvania" (Singer (2010)). In addition, both policies are similar in that they require compliance with austerity measures as a condition for this assistance, with the ECB often requiring fiscal reforms and states requiring restructuring of taxes and pension obligations.

When a municipality is financially distressed and unable to meet its debt obligations, it may file for Chapter 9 bankruptcy in a federal court. Due to the constitutional protection of state sovereignty, Chapter 9 functions advantageously to debtors (Frost (2014)). For example, once a municipality files for Chapter 9 bankruptcy protection, creditors cannot enforce any collection efforts to the debtor. Moreover, only the municipality has the right to submit debt adjustment plans to the court, and the creditors can only approve or disapprove the plans submitted by the municipality. As a result, creditor protections are much weaker under Chapter 9 than Chapters 7 and 11, the bankruptcy codes for corporations.

Each state has sovereignty over its municipalities and thus can determine whether a Chapter 9 bankruptcy filing is allowed. Some states unconditionally allow municipalities to file for Chapter 9 bankruptcy ("Chapter 9 states"), preferring to leave the municipalities to manage their own affairs. This policy of unconditional access to Chapter 9 underscores the independence of the municipalities from the state, and implies weaker creditor protections for those states.

In contrast, other states allow Chapter 9 access only as a last resort, preferring to deal with financially distressed municipalities directly via state assistance programs ("Proactive states"). These programs allow the state to restructure local finances of the distressed municipality and often feature emergency loan provisions and direct revenue transfers. This results in a higher degree of risk transfer from the local governments to the state government and stronger creditor protections in Proactive states compared to Chapter 9 states. Typically, these programs are motivated by a desire to preserve the state's ability to borrow, and a concern that a default could create a ripple effect beyond the individual municipality (Frost (2014)). That is, the programs are in place to minimize the negative externalities associated with a municipal default.[1]

We exploit these differences in state policies to examine how intergovernmental risk-sharing and the resulting creditor protections affect municipal borrowing costs at the local and state levels. In the too-big-to-fail literature, implicit government guarantees in the form of taxpayer bailouts to banks that are "too big to fail" indirectly lead to a lower cost of debt for these banks, but also to a higher burden on taxpayers that are indirectly financing these bailouts (see Admati and Hellwig (2013)). The assistance provided by state governments to distressed municipalities can similarly be seen as a "bailout" that must be financed by state taxpayer dollars. Motivated by this, we hypothesize that a higher degree of risk-sharing between the state and local governments will lead to lower borrowing costs for local municipalities, but at the cost of higher borrowing costs for bonds issued by the state.

We first examine yield increases following default events of local municipal bonds and find that

[1] Many of these Proactive state programs were put in place in response to a within-state crisis. For example, New York state originally implemented its proactive measures in response to the New York City fiscal crisis of 1975. Ohio's measures were introduced in response to the Cleveland crisis of 1978. Similarly, North Carolina originally developed many of its proactive programs in response to a slew of local township defaults during the Great Depression (Spiotto, Acker, and Appleby (2012)).

they are much higher in Chapter 9 states. In particular, when a local municipal bond experiences a default event, we find that the yield spread increases by 6.7 percentage points in Chapter 9 states.[2] On the other hand, the municipal bond yield only increases by 4.2 percentage points following a default event in Proactive states, for a difference of 2.5 percentage points (p-value=0.004). This indicates that the expected loss to municipal bond investors is higher following a default in a Chapter 9 state than a Proactive state. This is consistent with the interpretation that creditors under Chapter 9 receive weak creditor protections compared to creditors under the Proactive state programs.

State policies also have a significant ex-ante effect on yields—local municipal bond yields in Chapter 9 states are 3.9 basis points higher than those in Proactive states. That is, investors prefer to purchase local municipal bonds from states that proactively assist municipalities that exhibit signs of fiscal distress, all else being equal. If we restrict our attention to newly issued bonds, we find that offering yields are 1.4 basis points higher in Chapter 9 states than Proactive states. To put this perspective, in 2007, local governments issued an average of \$4.5 billion in long-term municipal bonds (par value) per state. Given that long-term municipal bonds have an average maturity of about 14 years, this implies that borrowing costs in Chapter 9 states are approximately \$4.5 billion $\times$ 14 years $\times$ 1.4 basis points = \$8.8 million higher per year. Over the course of our 12 year sample, this implies that aggregate local borrowing costs are approximately \$105 million higher for a Chapter 9 state compared to a Proactive state. This difference in offering yields is even higher for uninsured and unrated bonds with higher credit risk.

A potential concern in our analysis is that our results capture differences in unobserved state characteristics rather than differences in distress-related state policies, particularly because of the large geographic dispersions between many of these states. Holmes (1998) addresses a similar identification concern by comparing bordering counties in states with different right-to-work laws, and shows that counties in states with a right-to-work law are associated with higher manufacturing activity. Using a similar identification strategy, we examine municipal bonds issued in counties on the border of North Carolina and South Carolina. North Carolina is a Proactive state and South Carolina is a Chapter 9 state; because of the geographic proximity of these counties, any differences in yields can be more readily attributed to differences in these state policies.[3] We find that secondary yields in the South Carolina border counties are 7.65 basis points higher than those in the North Carolina border counties, while offering yields are 9.19 basis points higher. This supports our

[2]The municipal bond yield spread is defined as the difference between the municipal bond yield and the duration-matched U.S. Treasury bond yield. We will henceforth refer to the municipal bond yield spread as the yield.

[3]These are the only Proactive and Chapter 9 states that share a border and similar municipal bond taxation policies.

argument that the lower borrowing costs for municipalities in Proactive states are driven by their distress-related policies, and not by other unobserved state characteristics.

The divergence in borrowing costs between Proactive and Chapter 9 states becomes even more pronounced when local economic conditions worsen. Creditor protections are particularly important during these times due to the increased probability of municipal default. When state economic conditions are weak, we find that yields on municipal bonds in Chapter 9 states are 6.4 basis points higher than those in Proactive states. When state economic conditions are strong, however, there is no significant difference between those state types.

Another major concern in municipal bond markets is the contagion effect, in which a default event in one municipal bond causes investors to change their risk perceptions of other municipal bonds in that state, leading to higher yields for those bonds. Risk perceptions change because information is often limited for individual municipalities due to minimal disclosure requirements and infrequent trading, and a default event provides new information about local economic conditions (Kidwell and Trzcinka (1982)). However, we suspect that risk perceptions of municipal bonds in Proactive states following a default would remain largely unchanged because of the implicit insurance provided by the state.[4] There is no implicit insurance in Chapter 9 states, however, implying that a municipal bond default is more likely to affect risk perceptions about other bonds located in that state, leading to a contagion effect.

We examine whether a contagion effect exists, and if so, whether it is more pronounced in Chapter 9 or Proactive states and for what duration. First, within each state, we calculate the total par value of defaulted bonds in the previous quarter as a percentage of the total par value of municipal bonds outstanding. We then examine how this relates to municipal bond yields in that state. In Chapter 9 states, we find that a 0.1 percentage point increase in the percentage of defaulted bonds (by par value) in the previous quarter implies a 1.3 basis point increase in yields for other municipal bonds in that state. This contagion effect remains positive and significant for one year. However, there is no significant contagion effect in Proactive states at any horizon.

U.S. Census data suggest that Proactive states play an active role in assisting its municipalities, especially in times of distress. When state economic conditions are strong, the state-to-local intergovernmental revenue transfer as a percentage of total local government revenue is 2.2 percentage points higher in Proactive states compared to Chapter 9 states. However, when economic conditions are weak, this difference increases to 3.5 percentage points. This is consistent with our

[4]For example, during the New York City financial crisis of 1975, the governor stepped in to provide aid to the city, citing concerns that without this aid, borrowing costs would increase in surrounding municipalities.

evidence that local municipal bond yields in Proactive states are lower and less cyclical than those in Chapter 9 states.

The advantages that accrue to local municipalities in Proactive states come at a cost to their state governments. By providing assistance to a municipality when it is financially distressed, the Proactive state government bears some of the local credit risk. Reflecting this higher risk, we find that yields on state-issued general obligation bonds in the Proactive states are approximately 3.5 basis points higher than those in Chapter 9 states. For new issuances, offering yields in Proactive states are 11.4 basis points higher than those in Chapter 9 states.

Finally, we provide suggestive evidence that the risk-sharing mechanism in Proactive states also generates a moral hazard problem. Using the total local debt level as a proxy for the severity of this problem, we find that the ratio of total local debt to total local revenue is 11.9 percentage points higher in Proactive states than Chapter 9 states. This suggests that the downside protection provided by the state induces local municipalities to take on more risk in the form of higher levels of debt.

To the best of our knowledge, our study is the first to take a comprehensive look at borrowing costs under different regimes of intergovernmental risk sharing. Poterba (1994) finds that adjustment within a state to a fiscal crisis is faster when states have more restrictive fiscal rules and when state party control is not divided. The Proactive states identified in our sample have lower average local municipal bond yields, which ties into this story since Proactive states have mechanisms in place for dealing with municipalities that exhibit signs of fiscal distress. Kidwell and Trzcinka (1982) find that the New York fiscal crisis in 1975 was not associated with a contagion effect, in that other municipal bonds within the state of New York did not have significantly higher yields following the crisis. In a follow-up paper, Kidwell and Trzcinka (1983) find that yields on new issuances in New York state were also not affected by the New York City fiscal crisis. Our results are consistent with these findings, as New York is classified as a Proactive state based on the programs they implemented during the New York City fiscal crisis.

In addition, our paper contributes to the recent literature about the potential costs of sovereign bailouts. Using an event study approach, Kilponen, Laakkonen, and Vilmunen (2015) provide evidence that ECB announcements of financial assistance programs reduced government bond yields in recipient countries and increased government bond yields in guaranteeing countries during the European sovereign crisis. Ardagna and Caselli (2014) suggest that the potential moral hazard problem brought about by ECB sovereign bailouts would not be severe because the bailouts are funded with a combination of assistance from the ECB and austerity measures, and hence still very costly for the recipient country. Using a rich cross-section of distress-related state policies over a long time period that contains a large sample of default events, we provide further evidence that financial assistance programs protect yields following default events, reduce cyclicality in yields, and prevent contagion, and we also document the tradeoffs of such programs.

This paper also relates to recent work that investigates the effect of creditor protections and rights on the terms and costs of private sector debt. Bae and Goyal (2009) examine how creditor rights and contract enforceability affect loan contracts in 48 countries and find that strong creditor rights and enforceability reduce loan spreads. Similarly, Qian and Strahan (2007) show that loans made in a country with strong creditor protections have more concentrated ownership, longer maturities, and lower interest rates. Davydenko and Franks (2008) show that bankruptcy codes in France, Germany, and the United Kingdom provide different creditor protections and induce banks to adjust their lending and reorganization practices accordingly. Our study extends the literature on creditor protections to the public sector, which provides novel implications about the tradeoffs between borrowing costs at the local and state level in the presence of creditor protections provided by state programs.

The importance of state policy is also stressed in the law and public economics literature. Spiotto (2014) emphasizes that Chapter 9 debt adjustments should be a last resort after all alternatives for remedying local fiscal distress have been exhausted. Frost (2014) proposes that states authorize Chapter 9 bankruptcy on a conditional basis, stating that the increased use of Chapter 9 could have a negative impact on municipal economics which can extend beyond the individual distressed municipality. Finally, Pew Charitable Trusts (2013) reviews state intervention programs for distressed municipalities and recommends a proactive, rather than reactive, approach to dealing with municipalities exhibiting signs of distress.

The rest of this paper is organized as follows. Section 2 outlines the methodology for classifying each state as Proactive, Chapter 9, or neither. Section 3 describes the data used in this paper, and the filters that we apply to the data. Section 4 presents summary statistics related to municipal bond defaults. Section 5 examines local municipal bond yields conditional on the type of state (Proactive, Chapter 9, Neither) that issued the bond. Section 6 examines potential contagion effects around municipal bond defaults. Section 7 examines the potential costs of being a Proactive state. Finally, Section 8 concludes.

2 State Policies for Distressed Municipalities

States have different mechanisms in place to deal with financially distressed municipalities. In this section, we categorize states into three mutually exclusive groups according to their policies for dealing with local distress. The three groups are Chapter 9 states, Proactive states, and Neither states.

Chapter 9 States

When a municipality is financially distressed and unable to meet its debt obligations, it may file for bankruptcy in a federal court under Chapter 9. State policies regarding Chapter 9 access can be classified into one of three types; blanket authorization, de-authorization, and conditional authorization (Frost (2014)). We denote the first group of states as Chapter 9 states, as those are the states that have the most lenient authorization policies.

Chapter 9 states allow financially distressed municipalities to file under Chapter 9 without further restriction. In contrast, de-authorization states prohibit access to Chapter 9 and conditional authorization states grant access to Chapter 9 only under certain conditions. In our sample period of 1999 to 2010, there are 13 Chapter 9 states: Alabama, Arkansas, Arizona, California, Idaho, Minnesota, Missouri, Montana, Nebraska, Oklahoma, South Carolina, Texas, and Washington (Spiotto, Acker, and Appleby (2012)).[5] These states have statutes in place that affirm unconditional Chapter 9 authorization for any qualifying governmental unit. For example, South Carolina statute reads "... all appropriate powers are hereby conferred upon any county, municipal corporation, township, school district, drainage district or other taxing or governmental unit ... to institute any appropriate action and in any other respect to proceed under ... any existing act of the Congress of the United States ... relating to bankruptcy ..."[6]

In these states, the policy of unconditional Chapter 9 authorization represents a relatively decentralized approach to local financial problems. Chapter 9 states typically do not have laws allowing states to intervene in municipal finances. By specifying unconditional authorization in their statutes, these states expressly leave it up to local governments to fix local financial problems.

Because Chapter 9 functions advantageously to debtors, the decentralized approach of blanket Chapter 9 authorization can be viewed unfavorably by bondholders. Specifically, once a municipality files for Chapter 9 bankruptcy protection, creditors cannot enforce any collection efforts to

[5]For further details on municipal bankruptcy authorization, see Appendix A.
[6]S.C. CODE ANN. §6-1-10.

the debtor. Moreover, only the municipality has the right to submit debt adjustment plans to the court, and the creditors can only approve or disapprove the plans submitted by the municipality. Therefore, the creditors' negotiation powers are much weaker under Chapter 9. The court's powers are also much more limited under Chapter 9. For example, the court cannot change the plan submitted by the municipality, nor can it instruct an order that interferes with local governmental matters, such as an increase in local taxes (Kimhi (2008)).

Proactive States

The second group of states we consider are Proactive states. Some states have statutes allowing them to provide assistance to a municipality and intervene in its finances in the event of local financial distress. This assistance can take the form of emergency loan provisions, revenue transfers, and technical support. In addition, the state will typically appoint a person or board that assesses the problem and makes recommendations to address the problem. Depending on the state, the appointee even has the authority to control municipal finances (Pew Charitable Trusts (2013)). For example, when Pittsburgh was facing serious financial problems as a result of decade-long budget deficits in 2003, it entered the state's Municipalities Financial Recovery Program, also known as Act 47 (City of Pittsburgh (2012)). The state appointed a coordinator who, after consulting with the city's creditors, came up with a multi-year financial recovery plan that was adopted by the city council in 2004. The state also charged the Intergovernmental Cooperation Authority (ICA), a state agency, with overseeing the city's finances to ensure that the city meets its financial obligations and improves spending practices. Later in 2004, the state approved tax revisions led by the ICA and based on the Act 47 recovery plan. As a result of the intervention, Pittsburgh achieved positive operating balances in 2005.

Some states have more systematic and aggressive programs than other states. Out of the twenty-two states which have some form of state program, we identify eight states whose municipal distress-related programs are stronger from the point of view of bondholders. By examining statutes on state policies regarding distressed municipalities, we determine a state to be "Proactive" if debt default triggers state intervention and if the state appointee has the authority to restructure municipal finances (Pew Charitable Trusts (2013) and Spiotto, Acker, and Appleby (2012)). The states classified as Proactive are Maine, Michigan, Nevada, New Jersey, New York, North Carolina, Ohio, and Pennsylvania. Table 1 summarizes the procedure for identifying the Proactive states. Because our sample period ends in 2010, changes in state programs after 2010 are not reflected in this table. For example, Rhode Island adopted a strong intervention program in June 2010 but is not identified as a Proactive state in our sample. For convenience, Appendix A provides a table of statutes related to state policies about distressed municipalities.[7]

Proactive state policies represent a relatively centralized approach to local financial distress. Therefore, restructuring processes via state programs reflect not only the concerns of the local government but also of the state. In particular, one common motivation for state intervention is to preserve the creditworthiness of the overall state (Pew Charitable Trusts (2013)). As such, bondholders are likely to be better protected under these proactive programs than under Chapter 9. For example, when Harrisburg was on the verge of missing its $3.3 million in bond payments in 2010, Pennsylvania provided the city with state aid to avoid default.[8]

It is worth noting that the programs in Proactive states do not directly prevent defaults and bankruptcies. For example, Michigan, New Jersey, New York, North Carolina, Ohio, and Pennsylvania authorize Chapter 9 as a last resort if the state appointee determines that bankruptcy is unavoidable. As such, past intervention episodes indicate how much loss the state is willing to force on bondholders to resolve local insolvency.[9]

Neither States

The third group of states consists of twenty-nine states that are neither Chapter 9 states nor Proactive states. We call these states Neither states. This group does not have explicit state policies regarding local financial distress.

Comparison of the Three Groups

For convenience, Figure 1 provides a map of the United States that indicates the Chapter 9 states, Proactive states, and Neither states. Interestingly, Proactive states tend to be clustered in the northeast, which tends to be more Democratic, while Chapter 9 states are mostly clustered in the southern and western states, which tend to be more Republican. California and Washington are

[7] Interestingly, Proactive states tend to coincide with states that monitor local finances effectively. Kloha (2005) report that of the fifteen states which use indicators to monitor local financial conditions, only eight have indicators that are effective in detecting local distress. These eight states include Maryland, Nevada, New Hampshire, New Jersey, New York, North Carolina, Ohio, and Pennsylvania. Six of the eight states that are considered Proactive are also considered by Kloha (2005) as effective in detecting local distress.

[8] Harrisburg, Pennsylvania, Bond default averted with state aid, September 12, 2010, Bloomberg.

[9] "It remains to be seen whether the decision of Detroit's state-appointed emergency manager to file for bankruptcy, default on debt and propose deep losses to bondholders is because of Detroit's unique weaknesses or a harbinger of a policy change that will weaken its oversight program for other cities as well", September 16, 2013, Reuters.

exceptions to Chapter 9 states that are Republican; we suspect this is because these are "Frontier" states, in which the municipalities were established before becoming states and have a history of operating more independently from the state government.[10]

An examination of local government finances relative to state government finances further suggests that local governments in Chapter 9 states operate more independently from the state than Proactive states.[11] Figure 3 shows the average share of local government revenue that is made up of intergovernmental transfers from the state. This share is highest among Proactive states, suggesting that these local governments are more dependent on their state governments.

3 Data

We study yields around municipal bond default events by utilizing several data sources. Information on daily municipal bond prices and yields is provided by the Municipal Securities Rulemaking Board (MSRB), which is a self-regulatory organization that writes rules regulating broker-dealers and banks in the U.S. municipal securities market. The data consist of all broker-dealer municipal bond trades for the period 1999 to 2010. Each observation includes the bond price, yield, par value traded, and whether the trade was a customer purchase from a broker-dealer, customer sale to a broker-dealer, or an interdealer trade.

Our second source of data is the Mergent Municipal Bond Securities Database. This database is used to identify attributes of each bond contained in MSRB database. Specifically, for each bond, the Mergent database provides its issuer, state of issuance, issuance date, maturity date, coupon rate, issue size, sector, and bond ratings from Moody's and Standard & Poor's (conditional on the bond being rated). It also provides information about whether the bond is general obligation, insured, callable, and puttable.

We also collect municipal bond default information from the Bloomberg Default Event Calendar for the period 1999 to 2010, which includes both monetary and technical defaults. For each bond that experienced a default, we obtain information on the date of the default event. Altogether, there are 2,063 municipal bonds that experienced at least one default event, where these bonds

[10] U.S. territories, including Puerto Rico, are excluded from our analysis, as Chapter 9 bankruptcy protection is not applicable to U.S. territories. Puerto Rico is currently experiencing a municipal debt crisis due to excessive issuance of municipal bonds. These bonds were popular among municipal bond investors because of their triple tax-exempt status (federal, state, and local). Congress is currently debating whether to extend Chapter 9 bankruptcy protection to U.S. territories.

[11] State and local government financial information for the Census years 1997 to 2012 was obtained from the U.S. Census Bureau website.

originated from 679 different issuers. This information is merged with the MSRB and Mergent databases.

We study municipal bond yields around default events at the monthly level. The MSRB database consists of intraday municipal bond transactions. To convert this database to a monthly frequency, we calculate the average yield of all "customer buy" transactions within each bond-month, weighted by the par value traded. We only use customer buy transactions, as this mitigates time series variation in municipal bond yields due to bid-ask bounce. In addition, the municipal bond market is often considered a buyers' market, meaning that the majority of transactions are customer purchases from broker-dealers. The exclusion of customer sell and interdealer transactions does not significantly reduce our sample.

If a municipal bond is contained in the MSRB database but not the Mergent database, it is excluded. We also exclude municipal bonds with fewer than ten transactions, a maturity of at least one hundred years, a variable coupon rate, or bonds that are federal taxable. We only include bonds that are issued in states, and not those issued in U.S. territories, as state-issued bonds are more likely to be subject to Proactive or Chapter 9 policies. To mitigate the effect of outliers, we exclude any transactions from the MSRB database that have non-positive yields or yields greater than 50 percentage points. We also exclude state-issued general obligation bonds from our main analysis, as state policies generally apply to municipal bonds issued at the local level. After applying these filters and aggregating trades into bond-month observations, we are left with a final sample of 5,307,584 bond-month observations.

4 Summary Statistics

Panel A of Table 2 contains summary statistics for the municipal bonds in our sample. There are 416,643 bonds (about 99.5 percent of all municipal bonds) that did not experience a default event; we will call these "non-default bonds." Within these bonds, there are 25,554 issuers. The average par value of these municipal bonds is $6.69 million, with an average maturity of 13.82 years. About 10 percent of these bonds are considered "conduit" bonds, which are bonds sold by the local government on behalf of a non-governmental third party, where the funds generated by the third party are used to repay the bond.[12] 61 percent of non-default bonds are insured. 80 percent of these bonds are classified as investment grade and the remaining 20 percent are unrated.

[12]We collect issuer and ultimate borrower information from Bloomberg to identify conduit bonds. A bond is classified as conduit if its ultimate borrower is different from its issuer.

42 percent of these bonds are general obligation, meaning they are backed by the full faith and credit of the issuing municipality. Finally, 62 percent of these bonds are callable, meaning the municipality has the right to repurchase the bonds it issued at a pre-specified price, starting at a pre-specified date.

For comparison purposes, Panel A also reports summary statistics for municipal bonds that experienced at least one default event, which we will call "default bonds." Altogether, there are 2,063 default bonds, which comprises approximately 0.5 percent of all municipal bonds in our sample. Within these bonds, there are 679 issuers. In addition, the average par value of these bonds is $9.82 million, which is about 47 percent higher than the average par value for non-default municipal bonds ($6.69 million). That is, issuers of default bonds tend to issuer fewer bonds at higher par values. This is likely because these bonds have a higher tendency to be unrated (69 percent, versus 20 percent for non-default bonds), which implies that it is more difficult to attract many investors on a per-bond basis. Default bonds have a longer average time to maturity (18.98 years) and have a higher tendency to be callable (78 percent).

In addition, a higher percentage of these bonds are conduit (59 percent), meaning that conduit bonds default more often. This is unsurprising, as conduit bonds are backed by cash flows from a non-governmental third party entity, and not a municipality with a typically reliable tax base. 27 percent of default bonds are insured, 22 percent are investment grade, and 4 percent are general obligation. All of these numbers reflect the increased riskiness of these bonds, even before a default occurs. In our tests later in the paper, we make sure to control for these characteristics.

We also break down non-default and default municipal bonds by bond type. Altogether, there are nine bond type categories: Education, Healthcare, Housing, Improvement/Development, Public Service, Recreation, Transportation, Water/Sewer, and Other. Panel B of Table 2 reports statistics related to bond type. For non-default bonds, the three most frequently observed bond type categories are Education (31.8 percent), Improvement/Development (30.3 percent), and Water/Sewer (14.3 percent). In contrast, for default bonds, they are Improvement/Development (25.5 percent), Healthcare (19.8 percent), and Housing (18.7 percent).

Why are defaults more prevalent in these latter three categories? It is likely because bonds from these categories tend to be more speculative investments, backed by cash flows that have greater uncertainty. Improvement/Development bonds are typically used to develop residential and commercial zones in that municipality, where the cash flows are backed by tax revenues from residents and businesses that are expected to occupy those zones. Housing bonds are typically used to develop housing projects in lower-income areas, and these cash flows are subject to local economic conditions, highly variable revenues and costs, and potential mismanagement. Similarly, healthcare bonds are used to develop local hospitals and assisted living facilities, which are also subject to the same uncertainties.

A potential selection bias concern is that municipal bond attributes will differ by state type. To address this concern, we report municipal bond summary statistics by state type in Table 3. For the most part, the differences in municipal bond attributes between Chapter 9 and Proactive states are minimal. Both states have a similar proportion of investment grade, unrated, and insured bonds, and the mean bond par value and maturity are also similar. The main differences are that Proactive states tend to have more bonds per issuer and a slightly higher proportion of general obligation bonds (51 percent in Proactive states versus 40 percent in Chapter 9 states). These results suggest different bond types will not be self-selected into different state types in equilibrium in a way that significantly affects our analysis.

The main purpose of our paper is to examine municipal bond yield spread changes around default events, and how these changes differ depending on whether the bond is located in a Proactive state, Chapter 9 state, or neither. Panel A of Table 4 contains information about the number of municipal bond defaults within each of these three state types. We separate municipal bonds into two categories: non-conduit and conduit. Non-conduit bonds, which are backed by their respective municipalities, are more likely to have the option to declare Chapter 9 bankruptcy and be subject to state intervention policies. On the other hand, conduit bonds, which are backed by non-governmental third parties, do not have the option to declare Chapter 9 bankruptcy and are unlikely to be subject to state intervention policies. Within Chapter 9 states, there are 443 non-conduit default events, while for Proactive states, there are 123 default events. On a default-per-state basis, this implies there are about 34 non-conduit default events per state for Chapter 9 states (443 default events divided by 13 states) and 15 default events per state for Proactive states (123 default events divided by 8 states). Panel B of Table 4 reports the average fraction of bonds that experienced a default event within each state type. In Chapter 9 states, 0.38 percent of bonds experienced a default event, while in Proactive states, only 0.16 percent of bonds experienced a default event. On a per-state basis, these numbers imply that defaults are less likely to occur in Proactive states, which makes sense, given that Proactive states are designed to intervene and assist a municipality when it is exhibiting signs of distress.

5 Municipal Bond Yields and State Policies

We first examine how a default event affects the yield of local municipal bonds, and condition this event on whether this bond was issued in a Chapter 9 state, Proactive state, or neither. The independent variable of interest is $Default$, which is an indicator variable that equals one if the bond previously experienced a default event and zero otherwise. The dependent variable we use throughout our analyses is the duration-matched yield spread (y), which is defined as the difference between the municipal bond yield and the same-duration U.S. treasury yield. We obtain U.S. treasury yields from the Federal Reserve Board website. Specifically, the Federal Reserve Board provides daily parameters with which to calculate the entire U.S. treasury yield curve, where the functional form for the curve, based on Nelson and Siegel (1987) and Svensson (1994), is as follows:

$$TYield(D) = \beta_0 + \beta_1\left(\frac{1-e^{-D/\tau_1}}{D/\tau_1}\right) + \beta_2\left(\frac{1-e^{-D/\tau_1}}{D/\tau_1} - e^{D/\tau_1}\right) + \beta_3\left(\frac{1-e^{-D/\tau_2}}{D/\tau_2} - e^{D/\tau_2}\right).$$

In this equation, $TYield(D)$ is the yield on a treasury bond with duration D and $(\beta_0, \beta_1, \beta_2, \beta_3, \tau_1, \tau_2)$ is the daily set of parameters provided by the Federal Reserve Board. For more details about the functional form and daily parameters, see Gürkaynak, Sack, and Wright (2007).

In addition to default indicators and state type indicators, we also control for bond characteristics and state economic conditions. Specifically, we include controls for whether the bond is general obligation, callable, puttable, rated (Rated), and the rating number conditional on being rated (Rated $\times$ Rating). Following Butler, Fauver, and Mortal (2009), the rating number is on a scale from one to twenty-two, with one being the highest rating from Moody's (we use the S&P rating when the Moody's rating is not available). We also include time to maturity and inverse time to maturity (Inverse TTM). Similar control variables are employed in Butler, Fauver, and Mortal (2009), Bergstresser, Cohen, and Shenai (2011), and Gao and Qi (2013). Based on Schultz (2013), we also control for states that tax in and out-of-state municipal bonds equally (Equal Tax). Finally, we include three-month growth in the state coincident index (Coincident Index), which is meant to control for economic conditions in that state. The state coincident index encompasses payroll employment, hours worked in manufacturing, unemployment, and wage and salary disbursements in that state.

To determine how default events affect municipal bond yields, we run the following regression:

$$\begin{aligned} y_{it} = \; & \beta_0 + \beta_1 \cdot Default_{it} + \beta_2 \cdot (Default_{it} \times Ch.9_i) + \\ & \beta_3 \cdot (Default_{it} \times Proactive_i) + \beta_4 \cdot (Default_{it} \times Insured_i) + \\ & \beta_5 \cdot Ch.9_i + \beta_6 \cdot Proactive_i + \beta_7 \cdot Insured_i + \\ & \gamma' Y_{it} + \delta_t + \varepsilon_{it}, \end{aligned} \tag{1}$$

where i denotes the municipal bond, t denotes the year-month, and δ_t denotes year-month fixed-effects. We also double-cluster standard errors by issuer and year-month. β_2 and β_3 are meant to capture the incremental effect a municipal bond default has on the yield if the bond was issued in a Chapter 9 and Proactive state, respectively. β_5 and β_6 are meant to capture ex-ante effects on the yield, due to being located in one of these state types.

The results are reported in Table 5. According to the first column, a default event increases the municipal bond yield by 5.9 percentage points, unconditional on the state type. In the second column, we condition on state type. We find that, following a default event in a Chapter 9 state, the municipal bond yield increases by 6.7 percentage points, implying that investors expect higher losses due to the relative ease of declaring Chapter 9 bankruptcy in that state. In a Proactive state, however, a default event only increases the yield by 4.2 percentage points, which represents a statistically significant difference of about 2.5 percentage points between those two state types. Finally, if the bond is insured, the yield increases by 0.95 percentage points following a default event.

Our results also indicate that investors ex-ante prefer municipal bonds issued in Proactive states to those in Chapter 9 states, all else equal. According to the second column, municipal bond yields in Chapter 9 states are 3.9 basis points higher than those in Proactive states. That is, an investor requires a higher yield when purchasing a municipal bond in a state in which the borrower can unconditionally file for Chapter 9 bankruptcy. Proactive states, in contrast, have mechanisms in place to ensure its municipalities do not default on their debt obligations, and will typically only allow Chapter 9 filing as an absolute last resort.

The control variable coefficients are as expected. Callable bonds have higher yields to compensate for the valuable option embedded in the bond for the seller. Similarly, puttable bonds, which give the holder the right to sell his bond back to the issuer before the maturity date, have lower yields because of valuable option embedded in the bond for the buyer. High-rated bonds have lower yields than low-rated bonds. Bonds with a longer time to maturity have higher yields because they are subject to higher interest rate risk and inflation risk. Yields are lower for general obligation bonds because they are backed by the full faith and credit of the issuing municipality; shortfalls can be covered, for example, by raising local taxes. Yields are 9.6 basis points lower for bonds that have insurance, indicating that bonds which issuers choose to insure benefit from having insurance.[13] Bonds in Equal Tax states have higher yields, which is consistent with Schultz (2013). Bonds with a larger issue sizes have lower yields. Finally, we include past three-month growth in the state coincident index and find that when it is one percentage point higher (lower), municipal bonds in that state have yields that are 4.6 basis points lower (higher).

As a falsification exercise, we run the same regressions for conduit municipal bonds only. These bonds are sold by the local government on behalf of a non-governmental third party, where the funds generated by the third party are used to repay the bond. Typically, in the event of default, the government is not held responsible. For example, K-Mart, a massive retail franchise, built approximately 96 stores in various locations and funded these by having the local government issue conduit bonds on their behalf. These bonds would be backed by revenues generated from those stores. When K-Mart filed for bankruptcy protection in 2002, it defaulted on many of these bonds. The local governments were not responsible for these defaults, although might have indirectly suffered negative consequences from being associated with the defaults. Therefore, while we anticipate a Chapter 9 or Proactive effect for non-conduit bonds, we do not anticipate any effect for conduit municipal bonds.

The results are reported in the last two columns of Table 5. The first of these two columns indicates that if a conduit bond experiences a default event and we do not condition on state type, then its yield spread increases by 4.2 percentage points. The last column conditions on state type and provides evidence that there is no significant incremental effect following default if the conduit bond is located in a Chapter 9 or Proactive state, which makes sense given that conduit bonds cannot file for Chapter 9 bankruptcy protection, and it is likely that intervention policies do not affect yields ex-post. Ex-ante, there is also no difference in yields for Chapter 9 states versus Proactive states. Therefore, we find that conduit bonds issued in any state do not have significantly different yields, unlike non-conduit bonds which do have higher yields in Chapter 9 states.

Next, we examine whether offering yields of newly issued municipal bonds are affected by being located in a Chapter 9 or Proactive states. To do this, we test the same regression model as above, except that we exclude the Default indicator and y_{it} is now defined as the difference between the offering yield and duration-matched Treasury bond yield for bond i in issuance month t. Table 6

[13]For related results on municipal bond insurance, see Nanda and Singh (2004) and Wilkoff (2013).

reports the results. The first column reports that offering yields in Chapter 9 states are 1.4 basis points higher than those in Proactive states. We also expect that newly-issued bonds with higher credit risk will have especially higher yields in Chapter 9 states than Proactive states because higher credit risk means a higher probability of default, and being located in a Chapter 9 state increases the probability of declaring Chapter 9 bankruptcy following default. The second column in Table 6 reports the results for unrated bonds, while the last column reports the results for uninsured bonds. We find that the offering yields of unrated bonds are 3.2 basis points higher in Chapter 9 states than Proactive states, while for uninsured bonds, offering yields are 10.4 basis points higher.

To further strengthen our identification, we examine yield differences between counties on the border of North Carolina and South Carolina. North Carolina is a Proactive state and South Carolina is a Chapter 9 state. Because of the close geographic proximity of these counties, any differences in yields between counties north and south of this border can be more readily attributed to their differences in policies regarding distressed municipalities.[14] Figure 2 provides a map of the North Carolina and South Carolina counties, with the border counties in South Carolina and North Carolina highlighted in orange and blue, respectively.

We test a similar regression model as before, except that we only include municipal bonds from these border counties. The results are report in Table 7. Column (2) reports results for secondary market yields and also includes county-level controls (population growth and real per capita income) and column (4) reports similar results for offering yields (columns (1) and (3) exclude county-level controls). The evidence suggests that secondary market yields in the border counties within South Carolina are 7.65 basis points higher than the yields in the border counties within North Carolina. Similarly, offering yields in the South Carolina border counties are 9.19 basis points higher.

We also expect that municipal bond yields in Chapter 9 states will vary more with local economic conditions. In general, if economic conditions are poor, then the likelihood of a municipal bond default in that state will be higher. In a Chapter 9 state, a municipal bond default is more likely to lead to Chapter 9 bankruptcy, since those states unconditionally allow a distressed municipality to file for Chapter 9 bankruptcy. Therefore, the yield reaction to economic conditions will be stronger in Chapter 9 states than in Proactive states due to the increased likelihood that a distressed municipality will file for Chapter 9 bankruptcy.

To examine whether yields are more sensitive to local economic conditions in Chapter 9 states, we regress municipal bond yields on the following interaction terms: $Coincident\ Index \times Ch.9$ and $Coincident\ Index \times Proactive$ (along with the control variables from before). If yields vary more

[14]Holmes (1998) implements a similar methodology when examining differences in right-to-work laws across states.

with local economic conditions in Chapter 9 states, then we should expect a negative and significant coefficient on the former interaction term.

The results are reported in Table 8. According to the first column, a one percentage point decrease in coincident index growth is associated with a 3.1 basis point increase in municipal bond yields in Proactive states. However, if the municipal bond was issued in a Chapter 9 state, then a one percentage point decrease in coincident index growth is associated with a 9.1 basis point increase in municipal bond yields in that state.

This increased sensitivity to economic conditions in Chapter 9 states primarily manifests in "bad times", which we define as an indicator variable that equals one if the coincident index is less than 0.5 percentage points and zero otherwise.[15] Similarly, "good times" is defined as indicator variable that equals one if the coincident index is greater than or equal to 0.5 percentage points and zero otherwise. According to the second column in Table 8, yields are 6.4 basis points higher in bad times in Chapter 9 states compared to Proactive states, but are not significantly different in good times. This evidence indicates that yields in Chapter 9 states are more sensitive to local economic conditions, particularly in bad times.

6 Contagion Effects

A major concern in municipal bond markets is the contagion effect, in which a default event in one municipality causes investors to change their risk perceptions of other municipalities in that state, leading to higher yields in those municipalities. Risk perceptions change because information is often limited for individual municipalities due to minimal disclosure requirements and infrequent trading, and a default event provides new information about local economic conditions (Kidwell and Trzcinka (1982)). While a default event in a Proactive state will lead to a change in the risk perceptions regarding the fundamentals of the local economy, the Proactive state measures mitigate creditors' concerns that these weak fundamentals will affect their repayments from other municipalities in that state.[16] No such measures exist in Chapter 9 states, however, increasing the likelihood of contagion.

Several high profile cases of municipal distress suggest that state policy can be influenced by contagion concerns. Harrisburg, PA was financially distressed in 2010, and the state advanced

[15] 0.5 percent represents the median coincident index growth across the entire sample.

[16] For example, during the New York City financial crisis of 1975, the governor stepped in to provide aid to the city, citing concerns that without this aid, borrowing costs would increase in surrounding municipalities.

$4 million in loans so that Harrisburg could avoid default. Then-Governor Edward Rendell cited contagion concerns, stating that missing a bond payment "would devastate not only the city, but the school district, the county, and central Pennsylvania" (Singer (2010)). During the New York City fiscal crisis of 1975, the governor stepped in to provide aid to the city, citing concerns that without this aid, borrowing costs would increase in surrounding municipalities. Yields in New Jersey municipalities increased in 2014 after Governor Chris Christie appointed Kevyn Orr as the emergency manager to Atlantic City, which was in economic distress and had $344 million in municipal debt outstanding. Previously, Orr was appointed as emergency manager to Detroit and ultimately filed for Chapter 9 bankruptcy. Moody's downgraded Atlantic City debt to "Caa1" in 2014, citing the appointment of Orr, and this in turn adversely affected yields in New Jersey's 565 municipalities. The precedent in New Jersey that the state was now more open to Chapter 9 bankruptcy filings was now set.

The purpose of this section is to examine whether a contagion effect exists in municipal markets and, if it does, to determine: (1) the duration of the contagion effect, and (2) whether it is more pronounced in Chapter 9 or Proactive states.

To examine potential contagion effects, we first calculate the total par value of defaulted bonds within each state-quarter, and divide this by the total par value of all bonds within that state-quarter. We denote this variable as $PCTDEF_{q-k}$ (percentage default), where $q-k$ denotes the lagged three-month period relative to the yield in month t. Bonds that have previously defaulted are excluded from this analysis. Then, for bonds within each state type (Chapter 9, Proactive, Neither), we run the following regression:

$$y_{it} = \beta_0 + \sum_{k=1}^{4} \beta_k \cdot PCTDEF_{i,q-k} + \gamma' Y_{it} + \delta_t + \varepsilon_{it},$$

where all other variables are defined as before.

The results are reported in Table 9. For each state type, we run the regression using only $PCTDEF$ from the previous quarter, and then again for the previous four quarters. We do find evidence of a contagion effect in Chapter 9 states, but not for Proactive states. Specifically, in Chapter 9 states, we find that a 0.1 percentage point increase in $PCTDEF$ in the previous quarter is associated with a 1.2 basis point increase in yields for other bonds in that state. According to column (2), this effect persists for one year. Neither states have a similar, but milder, contagion effect. Proactive states, in contrast, do not experience any contagion effect at any lag. Therefore, our evidence indicates that contagion is significant in Chapter 9 states, but not necessarily in Proactive states.

Our finding is consistent with Kidwell and Trzcinka (1982), who examine potential contagion effects in the New York municipal bond market following the fiscal crisis in New York City in 1975. They show that there were no significant increases in yields in New York municipal bonds following this crisis. At best, they find that if there was an effect, it was small and of short duration. Our evidence corroborates this finding, as New York is considered a Proactive state, and we find no evidence of a contagion effect in these states.

7 The Cost of Being a Proactive State

Proactive states implement measures to protect the creditworthiness of the state when its local municipalities are exhibiting signs of distress. As a result, local municipal bonds in these states have lower yields, both in the secondary market and at issuance, than those in Chapter 9 states. In addition, municipal bond yields in Proactive states are less sensitive to economic conditions and are not susceptible to contagion, unlike those in Chapter 9 states. However, we suspect that these benefits come at a cost. When a municipality in a Proactive state is distressed, the state government can provide emergency loans (at zero or low interest rates), grants, credit guarantees, and professional and technical assistance. By aiding local governments in times of distress, the state government bears some of the local credit risk. Ex-ante, Proactive states also have to allocate resources toward monitoring its municipalities for signs of distress.

Therefore, we expect that state-issued general obligation bonds in Proactive states will have higher yields than those issued in Chapter 9 states. To test this hypothesis, we examine yield spreads for state-issued general obligation bonds[17] in Proactive and Chapter 9 states, controlling for the same bond characteristics as before. The results are reported in Table 10. According to the first column, secondary market yields on state-issued general obligation bonds in Proactive states are approximately 3.5 basis points higher than those in Chapter 9 states. The second column reports the results for offering yields. We find offering yields in Proactive states are approximately 11.4 basis points higher than those in Chapter 9 states. These results confirm that the benefits local governments receive from being in a Proactive state come at a cost to the state itself.

Local government finance data from the U.S. Census are also consistent with this result. One way in which state governments support their municipalities is through intergovernmental revenue transfers. Distress-related policies in Proactive states are reflective of their overall willingness to aid their municipalities, particularly in bad times. Therefore, we expect that intergovernmental

[17] MSRB provides information regarding whether the issuer is a state or local government.

transfers in Proactive states will be higher than those in Chapter 9 states, and will be even higher when state economic conditions are poor.

To test this, we calculate state-to-local intergovernmental transfers as a percentage of total local government revenue for each state-year ($Transfer_{it}$) for the fiscal years 2000 to 2012 (excluding 2001 and 2003, when state-level census data were not available). Then, we examine how these transfers vary with state economic conditions in Proactive and Chapter 9 states. Specifically, we run the following regression:

$$\begin{aligned} Transfer_{it} &= \beta_0 + \beta_1 \cdot Proactive_i + \beta_2 \cdot Proactive_i \times \Delta GSP_{it} + \\ &\quad \beta_3 \cdot Ch.9_i + \beta_4 \cdot Ch.9_i \times \Delta GSP_{it} + \beta_5 \cdot \Delta GSP_{it} + \\ &\quad \gamma' Z_{it} + \delta_t + \varepsilon_{it}, \end{aligned} \tag{2}$$

where ΔGSP is the annual log growth of real state GDP per capita. Z is a vector of control variables that includes federal-to-local intergovernmental transfers as a percentage of total local government revenue, the maximum state income tax rate, the percentage of the state population that is over the age of sixty-five, the state S&P credit rating (which is on a numerical scale from one to twenty-two, which one being the highest rating), and the log of state income per capita. These control variables are similar to the ones used in Matsusaka (2000) and Butler, Fauver, and Mortal (2009).

The results are reported in Table 11. According to the second regression column, the proportion of total local government revenue that comes from the state government in Proactive states is 2.5 percentage points higher than Chapter 9 states. In addition, the transfer in Proactive states is more countercyclical than in Chapter 9 states, as indicated by the significantly negative coefficient term on the interaction between state GDP growth and the Proactive state indicator variable.

According to regression column (3) in Table 11, intergovernmental revenue transfers in Proactive states are more countercyclical than transfers in Chapter 9 states because revenue transfers in Proactive states are particularly high when economic conditions are weak. In this regression, "bad times" ("good times") is defined as an indicator variable that equals one if State GDP growth is less than (greater than or equal to) 2.0 percentage points and zero otherwise.[18] We find that revenue transfers in Proactive states are 3.5 percentage points higher than transfers in Chapter 9 states during bad times and 2.2 percentage points higher during good times. This suggests that Proactive state governments play an active role in assisting its municipalities in times of distress, and is consistent with our evidence that local municipal bond yields are lower at the cost of higher

[18] 2.0 percentage points is the median of State GDP growth in the full sample.

yields for state-issued municipal bonds.

The risk-sharing mechanism in Proactive states potentially generates a moral hazard problem (Persson and Tabellini (1996)), in that it discourages fiscal discipline of local governments because of the downside protection provided by the state. To deter local officials from exploiting this downside protection ex-ante, the Proactive state policies often give the state government authority to control local finances in times of distress, although this is likely to be ineffective because of the short-term incentives of local politicians.

Using U.S. Census data, we calculate the ratio of total local debt outstanding to total local government revenue for each state-year ($Localdebt_{it}$) for the fiscal years 2000 to 2012 (again excluding 2001 and 2003, when state-level census data were not available). If there is a moral hazard problem in the Proactive states, then we expect this variable to be higher in Proactive states compared to Chapter 9 states. We test the same regression model as above, except that we use *Localdebt* as the dependent variable.

The results are reported in Table 12. According to the second regression column, *Localdebt* in Proactive states is 11.9 percentage points higher than in Chapter 9 states, indicating that local governments in Proactive states take on higher levels of debt. In addition, while we find that there is cyclicality in the debt level in the unconditional case, there is no significant difference in this cyclicality between Proactive and Chapter 9 states. Therefore, our evidence suggests a moral hazard problem in Proactive states. However, its severity does not vary with state economic conditions, likely because debt levels are slow to adjust in the short term.

8 Conclusion

Following the European sovereign debt crisis, the ECB enacted policies that promoted intergovernmental risk sharing between its member countries. Motivated by this, we examine the implications of intergovernmental risk sharing on government borrowing costs using U.S. municipal bond markets. We find that intergovernmental risk sharing between local governments and the state government reduces borrowing costs for local municipalities and promotes economic stability. On the other hand, this leads to higher borrowing costs for the state government and presents a moral hazard problem.

Proactive states have programs that allow the state to restructure local finances of the distressed municipality and provide emergency loans and revenue transfers, while Chapter 9 states unconditionally allow their distressed municipalities to file for Chapter 9 bankruptcy. This state policy difference leads to increased risk sharing between the state and local governments and stronger creditor protections in Proactive states. We find that yield changes of local municipal bonds following default events are lower in Proactive states. Specifically, in Proactive states, municipal bond yield spreads increase by 4.2 percentage points, while in Chapter 9 states, they increase by 6.7 percentage points.

This difference in state policies also affects local municipal bond yields in general; average yields in Chapter 9 states are 3.9 basis points higher than yields in Proactive states. That is, investors anticipate that if a bond were to default, it could follow through with a Chapter 9 bankruptcy declaration in a Chapter 9 state. Within Proactive states, investors anticipate that the state will step in when a municipality is exhibiting signs of financial distress, and thus are willing to pay a higher price for bonds with this implicit state insurance.

Additional results emphasize the advantages that local municipalities have in Proactive states compared to those in Chapter 9 states. For example, municipal bond yields in Chapter 9 states are more sensitive to state economic conditions, especially when those conditions are poor. In particular, during these times, the yields on local municipal bonds in Chapter 9 states are 6.4 basis points higher than those in Proactive states. We also find evidence of a contagion effect in Chapter 9 states, but not in Proactive states. Specifically, a 0.1 percentage point increase in the percentage of defaulted bonds (by par value) within a Chapter 9 state leads to a 1.3 basis point increase in other municipal bonds within that state. This contagion effect lasts about one year.

However, these advantages that accrue to local municipalities in Proactive states come at a cost to their state governments. By providing emergency assistance to a municipality when it is distressed, the Proactive state government bears some of the local credit risk. Reflecting this higher risk, we find that yields on state-issued general obligation bonds in these states are approximately 3.5 basis points higher than those in Chapter 9 states. U.S. Census data also suggest that Proactive states play an active role in assisting its municipalities in times of distress; we find that state governments transfers are always higher in Proactive states compared to other states, and are even higher when state economic conditions are weak. In addition, we also provide evidence of a moral hazard problem in Proactive states because of the downside protection provided by the state.

In the context of the European sovereign debt crisis, our results suggest that the implementation of ECB policies promoting cross-country risk sharing decreased the borrowing costs of the peripheral countries and increased the borrowing costs of the core countries in the European Monetary Union, all else equal. Furthermore, our results suggest that these policies would reduce the cyclicality of borrowing costs in the peripheral countries and also minimize contagion effects in which fiscal distress in one country has negative effects on the borrowing costs of other countries in the European Monetary Union. A tradeoff is that the risk-sharing mechanism will induce a moral hazard problem, encouraging peripheral countries to take on more debt.

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Appendix A

The following table summarizes statutes in each state related to Chapter 9 authorization and intervention policies for distressed municipalities. Empty cells in the “Bankruptcy Authorization” or “Intervention Statute” columns indicate that no statute exists for that category. Empty cells in the “Intervention Strength” column indicate no explicit intervention statutes.

State	Bankruptcy Authorization	Intervention Statute	Intervention Strength
Alabama	Blanket		
Alaska			
Arizona	Blanket		
Arkansas	Blanket		
California	Blanket		
Colorado	Limited to Special Districts		
Connecticut	Conditional	The state deals with fiscal distress in an ad hoc manner. See LCO 4532 (Waterbury); SA 92-5 (West Haven); SA 88-80, 89-23, 89-47, 90-31, 91-40 (Bridgeport); and SA 93-4 (Jewett City).	Weak
Delaware			
Florida	Conditional	See F.S.A. 163.05, 163.055, and 218.50-218.504	Weak
Georgia	Prohibited		
Hawaii			
Idaho	Blanket	IDAHO CODE ANN. 43-2101 et seq.	Weak
Illinois	Limited to Illinois Power Agency	See 65 ILCS 5/8-12-1 through 65 ILCS 5/8-12-24 (Financially Distressed City Law) and 50 ILCS 320/1 through 50 ILCS 320/14 (Local Government Financial Planning and Supervision Act)	Weak
Indiana		See IC 6-1.1-20.3-1 through 6-1.1-20.3-13 (Distressed Unit Appeal Board)	Weak
Iowa	No Statute with Exceptions		
Kansas			
Kentucky	Conditional	See KY. REV. STAT. ANN. 66.320	Weak

State	Bankruptcy Authorization	Intervention Statute	Intervention Strength
Louisiana	Conditional		
Maine		See 30-A M.R.S.A. 6101-6113 (Municipal Finance Board)	Strong
Maryland			
Massachusetts		The state deals with fiscal distress in an ad hoc manner. See MA Session Laws: Chapter 58 of the Acts of 2010 and Chapter 169 of the Acts of 2004.	Weak
Michigan	Conditional	See M.C.L.A. 141.1541 et al. (Local Financial Stability and Choice Act). Act 436 of 2012 took effect on March 28, 2013	Strong
Minnesota	Blanket		
Mississippi			
Missouri	Blanket		
Montana	Blanket, Except Counties		
Nebraska	Blanket		
Nevada		See N.R.S. 354.655 through 354.725	Strong
New Hampshire		See N.H. Rev. Stat. 13:1 through 13:7	Weak
New Jersey	Conditional	See Special Municipal Aid Act N.J.S.A. 52:27D-118.24 to 118.31; Local Government Supervision Act N.J.S.A. 52:27BB- 1 et seq.; Municipal Finance Commission R.S. 52:27-1 to R.S. 52:27-66; Municipal Rehabilitation and Economic Recovery Act N.J.S.A. 52:27BBB-1 et seq., and 18A:7A et seq.	Strong
New Mexico		See N.M.S.A. 1978, 12-6-1 through 12-6-14 (Audit Act), N.M.S.A. 1978, 6-1-1 through 6-1-13, 10-5-2, and 10-5-8.	Weak
New York	Conditional	The state deals with fiscal distress in an ad hoc manner. New legislation is passed for each municipality.	Strong

State	Bankruptcy Authorization	Intervention Statute	Intervention Strength
North Carolina	Conditional	See N.C.G.S.A. 159-1 through 159-180; N.C.G.S.A. 63A; and 159D.	Strong
North Dakota			
Ohio	Conditional	See Ohios R.C. 118, 133.34, and 3735.49.	Strong
Oklahoma	Blanket		
Oregon	Limited to Irrigation and Drainage Districts	See O.R.S. 203.095-100 and 287A.630.	Weak
Pennsylvania	Conditional	See PA ST 53 P.S. 11701.101-712 (Municipalities Financial Recovery Act and Intergovernmental Cooperation Authority Act)	Strong
Rhode Island	Conditional	See RI GEN LAWS 45-9-1 through 45-9-14, enacted in June 2010	None during the sample period
South Carolina	Blanket		
South Dakota			
Tennessee		See T.C.A. 9-13-201 to 212 (Emergency Financial Aid to Local Government Law of 1995), T.C.A. 9-13-301 to 302 (Financially Distressed Municipalities, Counties, Utility Districts and Education Agencies Act of 1993), and T.C.A. 9-21-403 (Local Government Public Obligations Act).	Weak
Texas	Blanket	See T.C.A., Local Government Code 101.006.	Weak
Utah			
Vermont			
Virginia			
Washington	Blanket		
West Virginia			
Wisconsin			
Wyoming			

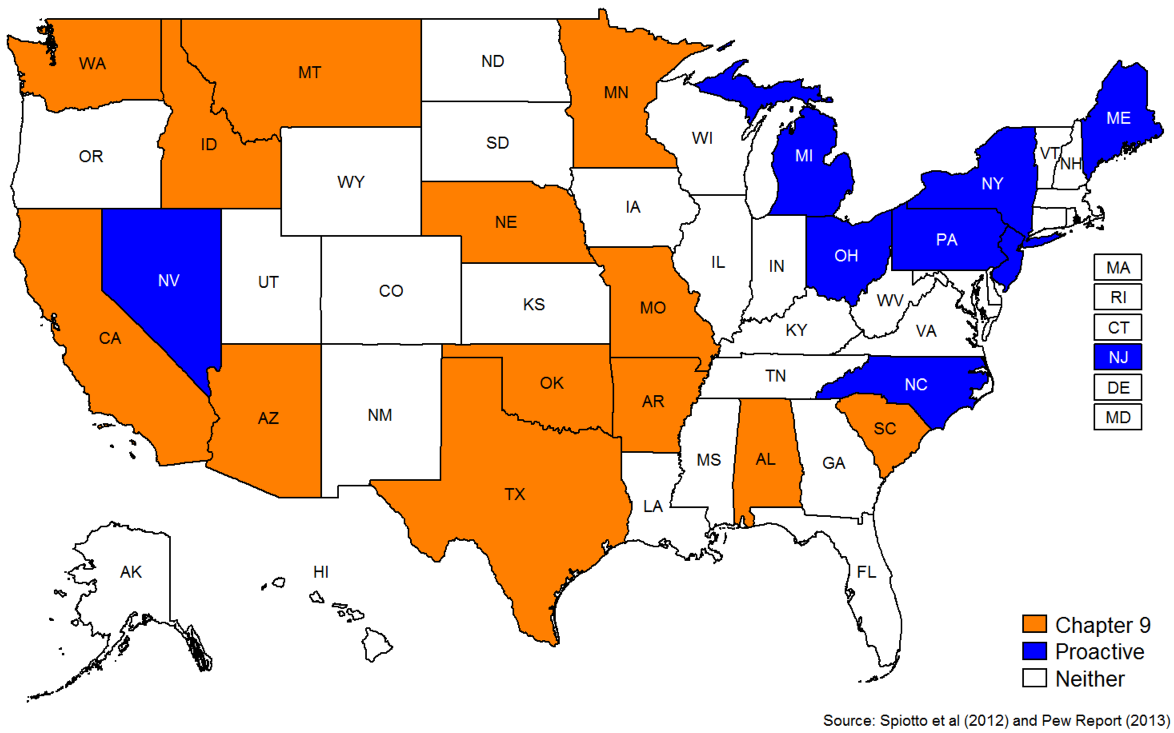

Figure 1: **Map of United States with State Type.** This map of the United States indicates state type: Proactive (blue), Chapter 9 (red), or Neither (white).

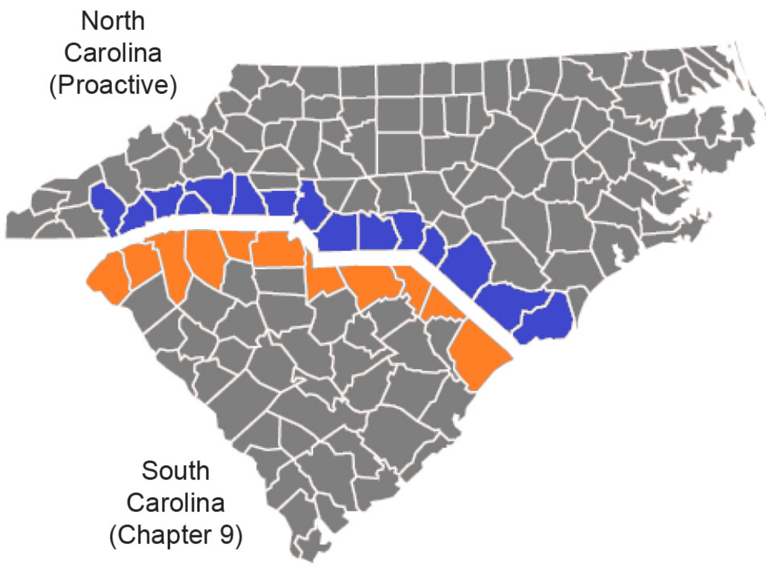

Figure 2: **County Map of North Carolina and South Carolina.** North Carolina is a Proactive state and South Carolina is a Chapter 9 state. The counties highlighted blue are those from North Carolina that border South Carolina. The counties highlighted orange are those from South Carolina that border North Carolina.

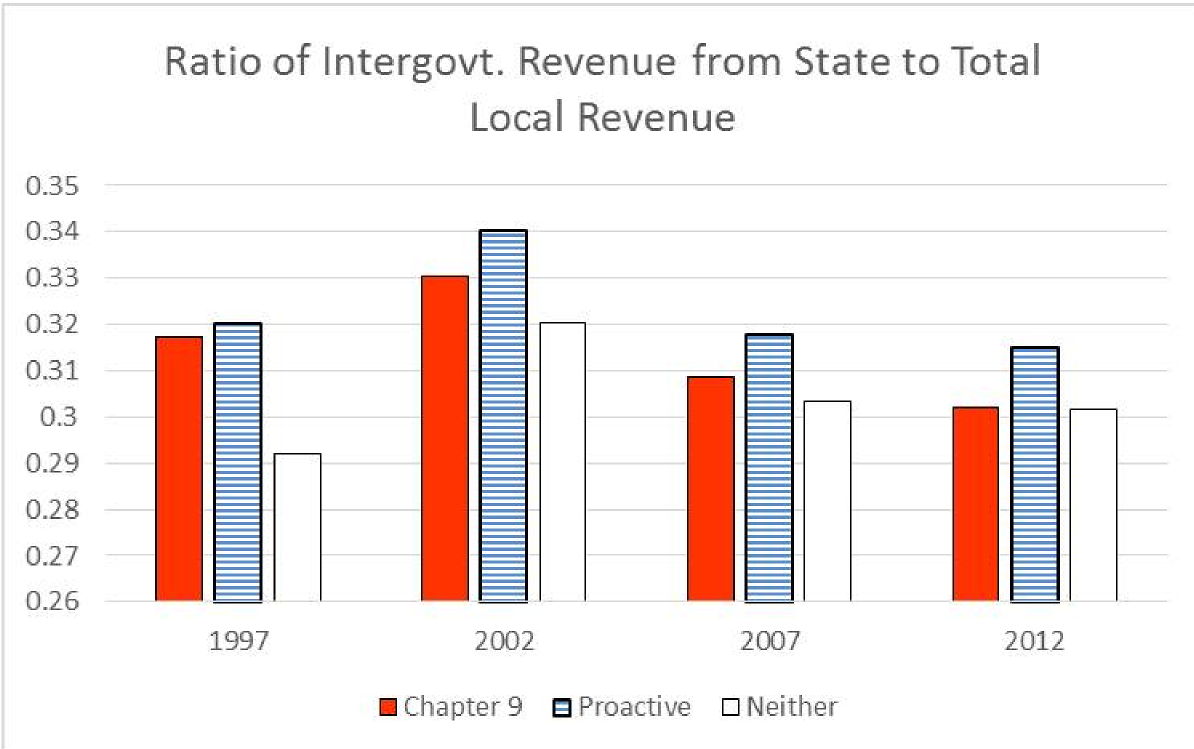

Figure 3: **Ratio of Local Revenue from State to Total Local Revenue.** Graph of cross-sectional average ratio of local revenue from state to total local revenue. Averages are separated by those in Chapter 9 states, Proactive states, and those in neither of these state types.

Table 1: Conditions for Proactive State Classification. Conditions are as follows. C1: state program triggered by debt default. C2: state can restructure the debt contract. C3: state can restructure labor contracts. C4: state can restructure taxes and fees. A state is defined as a Proactive state if C1 holds and at least one of C2, C3, or C4 holds. Eight states are classified as Proactive states. The states missing from this table are those that do not satisfy any of these four conditions.

	State can restructure:				
	C1	C2	C3	C4	Proactive?
CT	0	1	1	1	
DC	1	0	0	0	
FL	1	0	0	0	
ID	1	0	0	0	
IL	0	1	1	1	
IN	0	0	1	0	
KY	0	1	0	0	
ME	1	1	0	1	Yes
MA	0	1	0	1	
MI	1	1	1	0	Yes
NV	1	1	1	1	Yes
NH	0	0	0	0	
NJ	1	1	0	1	Yes
NM	0	0	0	0	
NY	1	1	1	0	Yes
NC	1	1	0	1	Yes
OH	1	1	0	0	Yes
OR	0	1	0	0	
PA	1	1	1	1	Yes
RI	0	1	0	1	
TN	0	1	0	1	

Table 2: Municipal Bond Attributes. Panel A reports summary statistics for municipal bonds that have never experienced a default event and those that have experienced at least one default event. Panel B reports the breakdown of municipal bonds by sector.

Panel A: Bond Sample Statistics		
	Non-Defaulted	**Defaulted**
N(bonds)	416,643	2,063
N(issuers)	25,554	679
Avg. Bond Par Value ($M)	6.69	9.82
Avg. Bond Maturity (years)	13.82	18.98
Conduit (%)	10	59
Insured (%)	61	27
Inv. Grade (%)	80	22
Non-Inv. Grade (%)	0	9
Unrated (%)	20	69
Gen. Obligation (%)	42	4
Callable (%)	62	78
Puttable (%)	0	1

Panel B: Sector Breakdown (%)		
	Non-Defaulted	**Defaulted**
Education	31.8	8.2
Healthcare	6.4	19.8
Housing	2.5	18.7
Improvement/Development	30.3	25.5
Public Service	4.2	1.3
Recreation	2.5	3.9
Transportation	5.4	3.5
Water-Sewer	14.3	6.3
Others	2.6	12.9

Table 3: Summary Statistics by State Type. This table reports summary statistics for municipal bonds by the following state types: Chapter 9, Proactive, and Neither.

	Chapter 9	Proactive	Neither
N(bonds)	143364	124691	150651
N(issuers)	10064	6317	9568
Avg. Bond Par Value ($M)	7.1	7.1	6.1
Avg. Bond Maturity (years)	14.5	13.5	13.5
Conduit (%)	8	12	12
Insured (%)	61	64	59
Inv. Grade (%)	79	81	79
Non-Inv. Grade (%)	0	1	0
Unrated (%)	21	19	21
Gen. Obligation (%)	40	51	37
Callable (%)	66	60	59

Table 4: Default Policies by State. Panel A reports the number of defaulted bonds and total par value of defaulted bonds within three state types: Chapter 9, Proactive, and Neither. Panel B reports the number of defaulted bonds as a percentage of all bonds in that state type and the total par value of defaulted bonds as a percentage of total par value of all bonds in that state type. "Chapter 9" states are those that allow for unconditional Chapter 9 bankruptcy authorization. "Proactive" states are those that have proactive measures in place for municipal bonds that show signs of distress. "Neither" defines the remaining states. Bonds are also separated into non-conduit and conduit.

		N(Defaulted Bonds)		Off. Amt. Defaulted ($M)	
Panel A		Non-conduit	Conduit	Non-conduit	Conduit
Chapter 9	AL, AR, AZ, CA, ID, MN, MO, MT, NE, OK, SC, TX, WA	443	415	2658.2	3121.39
Proactive	ME, MI, NC, NJ, NV, NY, OH, PA	123	250	2158.82	2548.65
Neither	The Rest	275	557	4100.26	4723.58

		Defaulted Bonds (%)		Off. Amt. Defaulted (%)	
Panel B		Non-conduit	Conduit	Non-conduit	Conduit
Chapter 9	AL, AR, AZ, CA, ID, MN, MO, MT, NE, OK, SC, TX, WA	0.379%	3.491%	0.710%	2.747%
Proactive	ME, MI, NC, NJ, NV, NY, OH, PA	0.164%	1.778%	0.331%	4.570%
Neither	The Rest	0.173%	2.727%	0.436%	2.581%

Table 5: Local Municipal Bond Yield Spreads and Default. Regression of monthly municipal bond yields on default indicator and indicator variables that interact with default indicator, including whether the state allows for unconditional Chapter 9 bankruptcy (Chapter 9), whether the state has proactive measures in place in the event that the municipality becomes distressed (Proactive), and whether the bond is insured (Insured). The first two columns report results for local municipal bonds. The last two columns are a falsification exercise that report results for conduit municipal bonds. Standard errors are double-clustered by issuer and year-month. t-statistics are reported below the regression coefficients.

	Regular		Conduit	
Default	5.861***	5.437***	4.206***	4.285***
	(8.83)	(6.50)	(10.13)	(8.90)
Default x Chapter 9		1.295		-0.511
		(1.42)		(-0.73)
Chapter 9		0.0189*		0.0298
		(1.68)		(0.83)
Default x Proactive		-1.267		0.604
		(-1.13)		(0.65)
Proactive		-0.0199**		-0.0278
		(-2.30)		(-0.82)
Default x Insured	-4.663***	-4.486***	-3.169***	-3.375***
	(-6.34)	(-5.57)	(-5.73)	(-5.17)
Insured	-0.109***	-0.109***	-0.613***	-0.610***
	(-12.27)	(-12.37)	(-16.70)	(-16.56)
General Obligation	-0.0832***	-0.0790***		
	(-7.69)	(-7.72)		
Callable	0.00616	0.00581	0.192***	0.190***
	(0.71)	(0.67)	(8.66)	(8.57)
Puttable	-0.803***	-0.799***	-0.730***	-0.733***
	(-6.33)	(-6.30)	(-7.57)	(-7.76)
Time to Maturity	0.0187***	0.0184***	0.00596**	0.00590**
	(11.33)	(10.94)	(2.34)	(2.30)
Inverse TTM	0.0935***	0.0934***	0.133***	0.133***
	(7.47)	(7.47)	(10.63)	(10.62)
Rated	-0.304***	-0.301***	-1.107***	-1.107***
	(-7.26)	(-7.32)	(-12.75)	(-12.78)

Rated x Rating	0.0470***	0.0471***	0.0963***	0.0961***
	(6.83)	(6.86)	(10.06)	(10.04)
Equal Tax	0.0544***	0.0440***	0.248***	0.237***
	(5.98)	(3.93)	(5.71)	(5.32)
Coincident Index	-0.0390***	-0.0435***	-0.0585***	-0.0606***
	(-7.12)	(-8.03)	(-2.71)	(-2.77)
Log(Size)	-0.0317***	-0.0304***	-0.0334***	-0.0336***
	(-8.86)	(-8.74)	(-2.85)	(-2.88)
Intercept	-0.220***	-0.221***	0.728***	0.734***
	(-6.13)	(-6.37)	(13.14)	(12.47)
Ch. 9 - Proactive		0.0388***		0.0576
p-value		0.006		0.133
Def x Ch. 9 - Def x Pro		2.562***		-1.115
p-value		0.004		0.261
SE Clustering	Issuer-YM	Issuer-YM	Issuer-YM	Issuer-YM
Fixed Effects	YM	YM	YM	YM
N	5080589	5080589	827987	827987
R-Squared	0.487	0.488	0.389	0.390

Table 6: Offering Yields on Newly Issued Municipal Bonds. Regression of municipal bond offering yields on Chapter 9 and Proactive state indicators. Standard errors are double-clustered by issuer and year-month. Columns two and three report results for unrated and uninsured bonds, respectively, which represent a higher credit risk for the municipality. *t*-statistics are reported in parentheses below the regression coefficients.

	All	Unrated	Uninsured
Chapter 9	0.0457***	0.0836***	0.140***
	(6.55)	(5.88)	(10.39)
Proactive	0.0320***	0.0521***	0.0359***
	(4.74)	(3.74)	(2.64)
Insured	-0.112***	-0.290***	
	(-14.31)	(-20.32)	
General Obligation	-0.0636***	-0.151***	-0.137***
	(-10.92)	(-14.27)	(-13.38)
Callable	0.113***	0.237***	0.155***
	(17.22)	(12.17)	(12.40)
Puttable	-0.928***	-1.019**	-1.012***
	(-6.56)	(-2.40)	(-5.56)
Time to Maturity	0.0248***	0.0386***	0.0296***
	(23.96)	(20.93)	(20.56)
Inverse TTM	0.0484	-0.191***	0.0497
	(0.56)	(-3.59)	(0.59)
Rated	-0.200***		-0.468***
	(-14.61)		(-18.88)
Rated x Rating	0.0227***		0.0679***
	(8.42)		(10.96)
Equal Tax	0.0867***	0.0864***	0.0651***
	(13.75)	(6.21)	(4.63)
Coincident Index	-0.0332***	-0.00273	-0.0137
	(-5.93)	(-0.18)	(-1.55)
Log(Size)	0.0117***	0.00407	0.0107**
	(3.92)	(0.90)	(2.14)
Intercept	-0.598***	-0.690***	-0.488***
	(-23.58)	(-25.39)	(-14.74)
Ch. 9 - Proactive	0.0137*	0.0315**	0.1041***
p-value	0.054	0.049	0.000
SE Clustering	Issuer-YM	Issuer-YM	Issuer-YM
Fixed Effects	YM	YM	YM
N	244258	35559	80314
R-Squared	0.651	0.661	0.669

Table 7: Carolina Border County Regression. Regression of municipal bond secondary market yields (columns (1) and (2)) and offering yields (columns (3) and (4)) on bond and county characteristics using municipal bonds from the counties on the border of North Carolina and South Carolina. North Carolina is a Proactive state and South Carolina is a Chapter 9 state. "Pop. Growth" is the annual population growth from the previous year for the county in which the municipal bond was issued. "Per Capita Income" is the real per capita income from the previous year from the county in which the municipal bond was issued. All other variables are defined as before. t-statistics are reported in parentheses below the regression coefficients.

	Regular		New Issue	
	(1)	(2)	(3)	(4)
Chapter 9 (SC)	0.0867***	0.0765***	0.0914**	0.0919**
	(2.94)	(3.30)	(2.02)	(2.29)
Insured	-0.0210	-0.0311	0.00224	-0.00105
	(-0.44)	(-0.40)	(0.06)	(-0.02)
General Obligation	-0.0239	-0.0261	-0.106***	-0.113***
	(-0.74)	(-0.66)	(-4.44)	(-3.78)
Callable	0.0727***	0.0739***	0.0885***	0.0879***
	(2.67)	(2.64)	(3.47)	(3.50)
Time to Maturity	0.0109**	0.0109**	0.0125***	0.0126***
	(2.17)	(2.16)	(2.80)	(2.83)
Inverse TTM	0.128***	0.128***	-0.346	-0.336
	(8.22)	(8.28)	(-1.63)	(-1.64)
Rated	-0.0164	-0.0164	0.0253	0.0241
	(-0.31)	(-0.31)	(0.96)	(0.95)
Rated x Rating	0.0373***	0.0368***	0.00913	0.00949
	(2.82)	(2.76)	(1.14)	(1.20)
Log(Size)	-0.0309	-0.0301	0.0286**	0.0288**
	(-1.08)	(-1.01)	(2.17)	(2.17)
Pop. Growth		-0.184		0.886
		(-0.35)		(0.46)
Log(Per Capita Income)		-0.0512		-0.0392
		(-0.29)		(-0.48)
Intercept	-0.601***	-0.0489	-0.675***	-0.283
	(-10.45)	(-0.03)	(-8.18)	(-0.33)
SE Clustering	County	County	County	County
Fixed Effects	YM	YM	YM	YM
N	39069	39069	1905	1905
R-Squared	0.541	0.541	0.828	0.828

Table 8: Municipal Bond Yield Spreads and State Economic Conditions. This table examines municipal bond yield spreads, conditional on local economic conditions in that state, and conditional on whether the bond is located in a Chapter 9 state or Proactive state. Bad Times (Good Times) is an indicator variable that equals one if Coincident Index is less than (greater than or equal to) 0.5 percent and zero otherwise; this cutoff represents the median Coincident Index. Standard errors are double-clustered by issuer and year-month.

	(1)		(2)
Coincident Index	-0.0359***	Bad Times	0.0142*
	(-5.93)		(1.86)
Coincident Index x Chapter 9	-0.0546***	Bad Times x Chapter 9	0.0377**
	(-5.52)		(2.36)
Coincident Index x Proactive	0.00468	Bad Times x Proactive	-0.0261**
	(0.79)		(-2.44)
Chapter 9	0.0306***	Good Times x Chapter 9	-0.00998
	(2.91)		(-0.98)
Intervention	-0.0218**	Good Times x Proactive	-0.0117
	(-2.46)		(-1.36)
Insured	-0.124***	Insured	-0.123***
	(-13.33)		(-13.10)
Intercept	-0.199***	Intercept	-0.211***
	(-5.46)		(-5.73)
Index x Ch. 9 - Index x Pro	-0.0593***	Bad x Ch. 9 - Bad x Pro	0.0638***
	0.000		0.001
		Good x Ch. 9 - Good x Pro	0.0017
			0.892
SE Clustering	Issuer-YM	SE Clustering	Issuer-YM
Fixed Effects	YM	Fixed Effects	YM
Controls	Yes	Controls	Yes
N	5080589	N	5080589
R-Squared	0.467	R-Squared	0.467

Table 9: Contagion Effects. This table examines whether recent defaults affect yields of other bonds in that state. The dependent variable is the bond-month yield spread. Pctdef_{q-k} is the total par value of defaulted bonds in a state, as a percentage of the total par value of all bonds within that state, in quarter $q-k$. Standard errors are double-clustered by issuer and year-month.

	Chapter 9		Proactive		Neither	
Pctdef_{q-1}	0.123***	0.131***	0.0008	0.0007	0.0233**	0.0238**
	(4.51)	(4.51)	(0.09)	(0.08)	(2.05)	(2.07)
Pctdef_{q-2}		0.123***		-0.0102		0.0252**
		(4.17)		(-1.48)		(2.15)
Pctdef_{q-3}		0.140***		-0.0106		0.0262***
		(3.93)		(-1.39)		(2.59)
Pctdef_{q-4}		0.132***		0.0008		0.0199**
		(5.06)		(0.12)		(2.03)
SE Clustering	Issuer-YM	Issuer-YM	Issuer-YM	Issuer-YM	Issuer-YM	Issuer-YM
Fixed Effects	YM	YM	YM	YM	YM	YM
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	1718422	1688362	1374025	1346899	1689350	1655254
R-Squared	0.484	0.479	0.509	0.504	0.495	0.489

Table 10: State-Issued General Obligation Bonds. This table compares the yields of state-issued general obligation bonds in Proactive states to those in Chapter 9 states.

	Regular	New Issue
Chapter 9	0.0218	0.0298
	(0.79)	(1.28)
Proactive	0.0572**	0.144***
	(2.00)	(3.01)
Insured	0.00495	-0.0207
	(0.25)	(-1.08)
Callable	0.0129	0.123***
	(0.84)	(8.54)
Puttable	-0.863*	
	(-1.75)	
Time to Maturity	0.0162***	0.0254***
	(5.28)	(10.01)
Inverse TTM	0.0844***	0.187*
	(8.75)	(1.65)
Rated	-0.108***	-0.0797***
	(-3.78)	(-2.74)
Rated x Rating	0.0424***	0.0349***
	(6.47)	(3.53)
Equal Tax	0.0457**	0.0569***
	(2.09)	(2.84)
Coincident Index	0.00530	-0.0451**
	(0.29)	(-2.44)
Log(Size)	-0.0169***	0.0241***
	(-2.96)	(3.18)
Intercept	-0.561***	-1.002***
	(-15.15)	(-24.81)
Ch. 9 - Proactive	-0.0354**	-0.1142**
p-value	0.035	0.012
SE Clustering	State-YM	State-YM
Fixed Effects	YM	YM
N	508305	18153
R-Squared	0.602	0.807

Table 11: State-to-Local Transfers and Economic Conditions. The dependent variable is the annual total dollars transferred from the state to its municipalities as a percentage of total municipality revenue. ΔGSP is the annual growth in gross state product. % Fed Revenue is the annual total dollars transferred from the federal government to the municipalities as a percentage of total municipality revenue in that state. State Tax Rate is the top marginal state tax rate. % Pop $>$ 65 is the percentage of the population for that state-year that is greater than 65 years of age. State Rating is the state-year S&P rating, where State Rating can take on a value from one to twenty-two (where a value of one corresponds to the highest credit rating. Bad (Good) is an indicator variable that equals one is ΔGSP is at least (less than) 2 percent for that state-year. Standard errors are clustered by year-month.

	(1)	(2)	(3)
Proactive	0.0192***	0.0251***	
	(13.44)	(10.96)	
Chapter 9	-0.0102***	-0.00788**	
	(-8.05)	(-2.79)	
Proactive x Delta GSP		-0.552**	
		(-2.67)	
Chapter 9 x Delta GSP		-0.222	
		(-0.90)	
Delta GSP		0.498**	
		(2.99)	
Proactive x Good			0.0130
			(1.52)
Chapter 9 x Good			-0.00906
			(-0.81)
Proactive x Bad			0.0239***
			(4.93)
Chapter 9 x Bad			-0.0111
			(-1.54)
Bad			-0.0134
			(-1.23)
% Fed Revenue	-1.079***	-1.160***	-1.087***
	(-7.49)	(-8.05)	(-7.68)
State Tax Rate	0.00638***	0.00629***	0.00638***
	(14.64)	(11.42)	(13.66)

% Population > 65	-0.0499	-0.0576	-0.0589
	(-1.33)	(-1.13)	(-1.13)
State Rating	-0.00228	-0.00230	-0.00239
	(-1.78)	(-1.78)	(-1.72)
Log(Per Capita Income)	-0.165***	-0.169***	-0.166***
	(-17.99)	(-15.40)	(-18.20)
Intercept	2.071***	2.118***	2.092***
	(21.55)	(18.34)	(22.29)
Proactive - Ch. 9	0.0294***	0.0330***	
p-value	0.000	0.000	
Pro x Good - Ch. 9 x Good			0.0221*
p-value			0.061
Pro x Bad - Ch. 9 x Bad			0.0350***
p-value			0.000
SE Clustering	Year	Year	Year
Fixed Effects	Year	Year	Year
N	521	521	521
R-Squared	0.145	0.152	0.145

Table 12: Moral Hazard. The dependent variable is total local debt divided by total local revenue by state-year. ΔGSP is the annual growth in gross state product. % Fed Revenue is the annual total dollars transferred from the federal government to the municipalities as a percentage of total municipality revenue in that state. State Tax Rate is the top marginal state tax rate. % Pop > 65 is the percentage of the population for that state-year that is greater than 65 years of age. State Rating is the state-year S&P rating, where State Rating can take on a value from one to twenty-two (where a value of one corresponds to the highest credit rating. Bad (Good) is an indicator variable that equals one is ΔGSP is at least (less than) 2 percent for that state-year. Standard errors are clustered by year-month.

	(1)	(2)	(3)
Proactive	0.189***	0.175***	
	(14.16)	(9.42)	
Chapter 9	0.0593***	0.0559***	
	(7.74)	(4.47)	
Proactive x Delta GSP		0.0470	
		(0.05)	
Chapter 9 x Delta GSP		0.354	
		(0.48)	
Delta GSP		-1.861*	
		(-1.99)	
Proactive x Good			0.174***
			(6.13)
Chapter 9 x Good			0.0724
			(1.81)
Proactive x Bad			0.181***
			(5.78)
Chapter 9 x Bad			0.0518*
			(1.83)
Bad			0.0716
			(1.29)
% Fed Revenue	3.210***	3.540***	3.258***
	(5.96)	(6.41)	(6.40)
State Tax Rate	-0.0188***	-0.0181***	-0.0188***
	(-8.26)	(-7.60)	(-8.01)
% Population > 65	-3.542***	-3.449***	-3.515***

	(-10.18)	(-8.99)	(-9.19)
State Rating	0.0226***	0.0222***	0.0228***
	(6.06)	(4.92)	(5.12)
Log(Per Capita Income)	-0.267***	-0.235***	-0.258***
	(-5.62)	(-4.46)	(-5.17)
Intercept	4.042***	3.706***	3.903***
	(7.58)	(6.40)	(6.89)
Proactive - Ch. 9	0.130***	0.119***	
p-value	0.000	0.000	
Pro x Good - Ch. 9 x Good			0.102***
p-value			0.001
Pro x Bad - Ch. 9 x Bad			0.129**
p-value			0.024
SE Clustering	Year	Year	Year
Fixed Effects	Year	Year	Year
N	521	521	521
R-Squared	0.099	0.105	0.101

MUNICIPAL CAPITAL STRUCTURE AND CHAPTER 9 CREDITOR PRIORITIES

Juliet M. Moringiello[*]

I. INTRODUCTION

In the spring of 2016 amidst cries from many sectors to "do something" about Puerto Rico's staggering debt load, the House Committee on Natural Resources introduced a bill dubbed PROMESA, the Puerto Rico Oversight, Management, and Economic Stability Act.[1] Its sponsors quickly promoted the bill as "not Chapter 9" and indeed, with its oversight provisions, it contains a lot more than Chapter 9 of the Bankruptcy Code, the bankruptcy chapter used to adjust the debt of struggling public entities. Yet the attempts to distinguish PROMESA from Chapter 9 ring hollow – PROMESA incorporates by reference most of Chapter 9, which itself incorporates by reference a wide swath of Chapter 11.

Municipal distress in cities nationwide has revived scholarly interest in Chapter 9. Its efficacy has been debated widely with several authors lamenting the lack of operational restructuring anticipated by Chapter 9.[2] PROMESA aims to remedy this deficiency by mandating federal oversight for Puerto Rico.[3] Legislative realities aside, Congress missed a chance. Puerto Rico's unique political status made a Bankruptcy Code based process unnecessary. One aspect of PROMESA that supports the claim that it is "not bankruptcy" is its intended placement in Title 48 of the United States Code, the federal law governing territories and insular possessions.[4] Congress therefore could have designed a bespoke procedure for debt resolution for the Commonwealth and the other jurisdictions governed by the act[5] that is not rooted in bankruptcy values and policies.

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[1] H.R. 5278, 114th Congress, 2nd Sess. President Obama signed PROMESA on June 30, 2016.

[2] *See, e.g.* Clayton P. Gillette & David A. Skeel, Jr., *Governance Reform and the Judicial Role in Municipal Bankruptcy,* 125 YALE L. J. 1140 (2016); Michael W. McConnell & Randal C. Picker, *When Cities Go Broke: A Conceptual Introduction to Municipal Bankruptcy,* 60 U. CHI. L. REV. 425 (1993).

[3] PROMESA § 101 (b)(2).

[4] PROMESA § 6.

[55] Although the title of PROMESA implies that it applies only to Puerto Rico, it includes all "territories," defined as Puerto Rico, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, and the U.S. Virgin Islands. *See*

The (admittedly time-consuming) process of designing a true "non-bankruptcy" financial distress resolution procedure for Puerto Rico might have helped policy makers think through the necessary and appropriate elements of a federal process for resolving municipal financial distress. Those who have studied Chapter 9 have criticized it for borrowing plan confirmation standards from Chapter 11, the chapter of the Bankruptcy Code designed for business reorganizations.[6] Although its political status and some of the reasons for its staggering debt loads are unique, Puerto Rico and its public entities borrow in the same way that United States municipalities borrow, primarily by making promises described in terms of the efforts used to make good on them, not by pledging property to support those promises.

There is a good argument that municipal debt adjustment should not be part of a system called bankruptcy. The Bankruptcy Clause of the Constitution grants Congress the power to enact "uniform Laws on the subject of Bankruptcies."[7] Yet soon after Congress passed the predecessor to Chapter 9, some wondered whether the purview of the Bankruptcy Clause could include a law that did not contemplate the surrender of a debtor's assets in satisfaction of creditor claims.[8] Although the scope of bankruptcy legislation has expanded beyond liquidation, the goal of the bankruptcy system is to satisfy competing claims of creditors when the debtor has insufficient assets to satisfy all claims.

The foundational goal of bankruptcy does not apply to municipal entities. Public debtors are unique in that their assets are not available to creditors, thus limiting creditor remedies against municipalities.[9] The

PROMESA §§ 5 (20) (defining "territory"); 101 (explaining that the purpose of the oversight title of the act is to provide a method for a territory to "achieve fiscal responsibility and access to the capital markets").

[6] *See* Juliet M. Moringiello, *Chapter 9 Plan Confirmation Standards and the Role of State Choices*, 37 CAMPBELL L. REV. 71, 91-105 (2015) (discussing the poor fit between the Chapter 11 confirmation standards and the goals of Chapter 9).

[7] U.S. CONST. art. 1, § 8, cl. 4.

[8] Harold Gill Reuschlein, *Municipal Debt Readjustment: Present Relief and Future Policy*, 23 CORNELL L.Q. 365, 371 n. 35 (1938).

[9] Michael W. McConnell & Randal C. Picker, *When Cities Go Broke: A Conceptual Introduction to Municipal Bankruptcy*, 60 U. CHI. L. REV. 425, 429-34 (1993) (explaining that municipal assets are immune from creditor process). Municipal debtors do, however, voluntarily sell or otherwise monetize assets to satisfy creditor claims. *See In re* City of Detroit, 524 B.R. 147, 177-179 (explaining Detroit's "Grand Bargain" in which several foundations and the state of Michigan contributed money to transfer Detroit's valuable art collection to a non-city entity), 194-197 (explaining how Detroit transferred real estate to

security that supports public promises to repay is not security in the form of access to property, it is security based on trust in various types of promises. Indeed, American states and some foreign countries[10] have processes to resolve municipal debt that are not bankruptcy-based, but such processes in the United States cannot include the bankruptcy benefit of forced contract impairment on non-consenting creditors.[11]

This paper has a modest goal. Imagining a Congress unbound from the requirements of expediency and from the existing structure of Chapter 9, this paper proposes a priority scheme based not on property principles, which are largely absent in public finance law, but on contractual, legal, and social promises that form the basis of public capital structures. I do not propose an entirely new debt adjustment process. Others have already done so,[12] and in earlier work, I have advocated for a bankruptcy process combined with higher-level oversight, something that the Puerto Rico legislation does admirably but controversially.[13]

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satisfy creditor claims); HARRISBURG STRONG PLAN, August 26, 2013 at 13-21 http://www.newpa.com/download/harrisburg-strong-plan-pdf/#.V2v0aatf2Ul (explaining how the City of Harrisburg monetized its parking assets outside of bankruptcy).

[10] *See, e.g.* 52 P.S. §11701.101 *et seq.* (Pennsylvania's Municipalities Financial Recovery Act, also known as "Act 47"); Lili Liu & Michael Waibel, *Subnational Insolvency: Cross-Country Experiences and Lessons*, The World Bank, Policy Research Working Paper 4496, January 2008 8-12 (explaining the municipal insolvency schemes in South Africa and Hungary, both of which specifically tailored to public entities); Frank Shafroth, *Why Cities Can't Go Bankrupt in Canada or Germany*, GOVERNING, May, 2014, at http://www.governing.com/columns/public-money/gov-municipal-debt-traps-nein.html (discussing German Haushaltssicherungskonzept).

[11] 11 U.S.C. § 903. The United States Supreme Court reinforced the scope of this section in *Commonwealth of Puerto Rico v. Franklin California Tax-Free Trust*, No. 15-233, June 16, 2016.

[12] I join a small group of others who have proposed an insolvency scheme tailored specifically to municipal governments. *See, e.g.,* Steven L. Schwarcz, *Global Decentralization and the Subnational Debt Problem*, 51 DUKE L.J. 1179 (2002) (proposing a model law, for use by countries worldwide, that adopts fundamental United States principles of bankruptcy reorganization); Samir D. Parikh, *A New Fulcrum Point for City Survival*, 57 WM. & MARY L. REV. 221 (2015) (arguing that municipal restructuring can and should be done only at the state level). *See also* Anna Gelpern, *Bankruptcy, Backwards: The Problem of Quasi-Sovereign Debt*, 121 YALE L.J. 188 (2012) (explaining that it is unhelpful to discuss the debt problems of U.S. states using a bankruptcy-based framework).

[13] *See* Juliet M. Moringiello, *Goals and Governance in Municipal Bankruptcy,* 71 WASH. & LEE L. REV. 403 (2014). Receiverships and other forms of oversight are always controversial but often provide the political will to make hard decisions that elected officials may lack. *See* Clayton P. Gillette, *Dictatorships for Democracy: Takeovers of Financially-Failed Cities*, 114 COLUM. L. REV. 1473 (2014) (exploring the justification for state takeovers and evaluating their efficacy); Michelle Wilde Anderson, *Democratic*

To propose a different way of thinking about creditor priorities, this article proceeds as follows. In Part I, I will explain the types of promises and security that support public borrowing promises. Part II will explain public borrowing. Part III will discuss the policies and values behind bankruptcy priorities as applied to individuals and business entities. In Part IV, this article will explore and question the values of municipal insolvency law and pose some questions about how those values can inform municipal bankruptcy priorities. The article concludes by calling for more discussion.

II. PUBLIC ENTITY BORROWING: THE WHY, THE HOW, AND THE COMPETING INTERESTS

Municipalities make several different types of promises when they borrow money, and state laws attempt to enhance those promises in a variety of ways. In this section, I will discuss traditional promises and protections and the more recent innovations in municipal finance.

A. The Why

The feature that distinguishes municipal finance from other types of finance is its public purpose. The role of a municipality in providing goods and services is distinct from that of a private actor. Public entities step in to provide goods and services when private markets cannot do so.[14] Public entities are better situated to provide public goods and services than are private entities. An example is a paved road or a street light system – because everyone in the geographical area of the improvement will benefit from it, no private actor has incentive to provide it.[15] Ideally, when a public entity provides public goods and services, it does so in furtherance of its "cardinal civic responsibilities" to protect the health, welfare, and safety of its citizens.[16]

The rules governing municipal debt are based in its public purpose. State constitutions permit a municipality to incur debt only for a public

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Dissolution: Radical Experimentation in State Takeovers of Local Governments, 39 FORDHAM URB. L.J. 577 (2012) (criticizing state receivership laws in Michigan and Rhode Island as failing to address the root causes of municipal financial distress).

[14] ROBERT AMDURSKY, ET AL., MUNICIPAL DEBT FINANCE LAW: THEORY AND PRACTICE (2ND ED. 2015 CUM. SUPP.) § 1.1.1.

[15] ROBERT AMDURSKY, ET AL., MUNICIPAL DEBT FINANCE LAW: THEORY AND PRACTICE (2ND ED. 2015 CUM. SUPP.) § 1.1.1.

[16] Dep't of Revenue v. Davis, 553 U.S. 328, 342 (2008).

purpose.[17] Because a municipality may increase taxes to make bond payments, it would be considered unjust to make the public at large pay for a project for which it gains no benefit.[18] States limit the amount of debt that a municipality may incur in order to insulate future taxpayers from decisions in which they played no part.[19] Municipalities fund their public obligations by collecting taxes. A municipality's power to collect taxes is restricted by its local boundaries.[20] Municipal debt receives favorable tax treatment because of its public purpose. The funded improvements further the entity's social obligations, and as a result, municipal bonds are generally tax-exempt. Because of this exemption, the federal government and states forgo revenue in furtherance of a social good.[21]

The public purpose of municipal debt not only drives limitations on public debt but also limits the remedies to which municipal creditors can resort. Creditors of private entities have recourse to the entity's property in the event of non-payment. Creditors of public entities do not because the law considers municipal property to be held in trust for the public.[22] Access to property is a key feature in the design of creditors' rights laws, but municipal creditors have no rights to their debtors' assets. Municipal debt resolution schemes are thus fundamentally different from methods of resolving the debts of individuals and private entities.

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[17] 1 GELFAND, STATE AND LOCAL GOVERNMENT DEBT FINANCING § 1.4 (database update 2015 James A. Coniglio).

[18] ROBERT AMDURSKY, ET AL., MUNICIPAL DEBT FINANCE LAW: THEORY AND PRACTICE (2[ND] ED. 2015 CUM. SUPP.) § 3.1.

[19] *See* Lonegan v. State, 819 A. 2d 395, 402-03 (N.J. 2003) (explaining that New Jersey adopted its debt limitation in 1844 to protect future generations of taxpayers and to rein in unchecked speculation by the state); ROBERT AMDURSKY, ET AL., MUNICIPAL DEBT FINANCE LAW: THEORY AND PRACTICE (2[ND] ED. 2015 CUM. SUPP.) § 4.1.1; Stewart E. Sterk & Elizabeth S. Goldman, *Controlling Legislative Shortsightedness: The Effectiveness of Constitutional Debt Limitations*, 1991 WIS. L. REV. 1301, 1315-16 (surveying different types of debt limitations).

[20] *See* Richard Briffault, *The Local Government Boundary Problem in Metropolitan Areas*, 48 STAN. L. REV. 1115, 1129 (1996) (explaining that local governments receive most of their revenue from taxes rather than from higher levels of government).

[21] *See* Fox v. U.S., 397 F.2d 119, 122 (8[th] Cir. 1968) (explaining that the federal tax exemption for public debt reflects "a fundamental long-standing policy of Congress that the federal government shall not impose any restraint on the borrowing power of the states or their political subdivisions for public use and benefit").

[22] *See*, *e.g.* Meriwether v. Garrett, 102 U.S. 472, 513 (1880); Little River Bank & Trust Co. v. Johnson, 141 So. 141, 143 (defining protected public property as that property "absolutely essential to the to the existence of the public corporation, or necessary and useful to the exercise and performance of governmental powers, or the performance of governmental duties").

B. *Public Borrowing: Promises not Property*

Bankruptcy law's distinctions among creditors are rooted in the non-bankruptcy borrowing and lending practices of individuals and business entities. In the private realm, bankruptcy respects the choice to partition property in such a way as to elevate one creditor over another, but does not provide the same protection to contractual promises that do not include the grant of a property interest.[23]

"Debt," as defined in municipal finance rules, is not debt as commonly understood in the commercial world. Commercial parties understand debt to mean any obligation to pay. The municipal finance definition of debt is rooted in the effect of municipal debt on the public. Debts subject to constitutional or statutory debt restrictions are those that may result in a tax increase. Other obligations, such as those payable from specific revenues and those payable from annual budget appropriations, are not considered "debt" for the purpose of debt limitation clauses. To the commercial lawyer's eye, all such obligations appear to be unsecured. Municipal finance, makes a distinction between promises that provide high assurance of payment, like the full faith and credit promise, and promises that provide less certainty, like the appropriations promise.[24]

1. The General Obligation Promise

The markets have long considered general obligation bonds to be fail-safe. Municipal finance participants describe general obligation bonds as being backed by a *pledge* of the issuer's full faith and credit, its taxing power, or both.[25] Both the grant and the promised security are not security as commonly understood by commercial lawyers. In the commercial world, a grant of security carries with it a remedy against the property interest pledged. A full faith and credit pledge, on the other hand, does not grant the recipient a lien on any municipal property.[26] Instead, the full faith and credit

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[23] For example, a debtor may give a "negative pledge" promise to a creditor, whereby it promises not to grant security interests in its property to other lenders. Although this is a binding contractual obligation, the law does not consider it to be the same as a security interest in the debtor's property. *See* Carl S. Bjerre, *Secured Transactions Inside Out: Negative Pledge Covenants, Property, and Perfection,* 84 CORNELL L. REV. 305, 306-07 (1999)

[24] Lonegan v. State, 819 A. 2d 395, 406 (N.J. 2003) (acknowledging that the payment of appropriations debt was "highly likely" if only to protect the state in the bond market).

[25] National Association of Bond Lawyers, *General Obligation Bonds: State Law, Bankruptcy, and Disclosure Considerations*, August, 2014.

[26] State *ex rel.* Babson v. Sebring, 115 Fla. 176, 182 (1934).

pledge is couched in the contract language of obligation. According to one court, a full faith and credit provision "does no more than express an understanding and appreciation of the legal obligation to pay the bond according to its terms."[27] Moreover, this pledge is limited by governing law. Although the issuer may pledge (promise) to levy additional taxes, the bondholders cannot collect the taxes themselves. In other words, an issuer cannot be forced to raise taxes above statutory limits. In the municipal finance world, the pledge of full faith and credit and/or taxing power is a promise that can be enforced only by a mandamus action.

General obligation bonds are thus supported by promises protected by the Contracts Clause of the Constitution. Courts have made clear the difference between a full faith and credit pledge and a mortgage granted by an individual or business.[28] The remedies available against a non-paying municipal entity reinforce the distance between property concepts and municipal finance. Even an unsecured creditor of a private actor eventually has recourse against that entity's property if any such property is available and unencumbered. These property remedies do not exist against public entities. The best a general obligation bondholder can do is to pursue a mandamus action to force the performance of the municipal issuer's contractual promise. A municipality's primary asset is its taxing power,[29] but such power is not an asset that creditors can seize. Because public borrowing does not incorporate the property concepts embedded in private borrowing, the remedies for non-payment differ. Mandamus is a typical remedy in the public context.[30] Although mandamus is available, it is rarely used and somewhat ineffective. The goal of a mandamus action is to force a public official to apply the first funds received to pay creditors. Many state courts are unwilling to force a public official to do so if the result would be to pay a financial market creditor before a provider of essential services. Ordinary creditors of a public entity are even worse off. Even when a statute creates a lien against a debtor's property, such statute is inoperable against

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[27] State *ex rel.* Babson v. Sebring, 115 Fla. 176, 183 (1934). The bonds in the cited case pledged the city's full faith, credit and resources. Even the pledge of resources did not create a lien on the municipality's property.

[28] State *ex rel.* Dos Amigos v. Lehman, 100 Fla. 1313, 1325 (1930). Courts in other states have reinforced the principle that a faith and credit pledge creates a contractual pledge unsupported by any property interest. *See* Flushing Nat'l Bank v. Municipal Assistance Corp., 40 N.Y. 2d 731, 735 (1976) (holding that the state's Emergency Moratorium Act, which suspended the right of certain bondholders to enforce their debts, violated the New York Constitution.

[29] *See e.g.* Faitoute Iron & Steel Co. v. City of Asbury Park, 316 U.S. 502, 509 (1942).

[30] *See* Samuel L. Bray, *The System of Equitable Remedies*, 63 U.C.L.A. L. REV. 530 (2016).

public property.[31]

The concept of a general obligation bond is not a monolithic one. Variations include the unlimited tax general obligation (UTGO) bond, the limited tax general obligation bond (LTGO) and the general fund general obligation bond (GFGO). The nature and effect of these designations vary from state to state. Although voter approval is often required for UTGO bonds, it is often not required for LTGO and GFGO bonds. This is an important distinction – voter approval is usually needed when payment of the bonds can result in risk to the taxpayers.[32] In the Detroit bankruptcy, bondholders and the city fought over whether the UTGO and LTGO obligations were "secured" or not, mapping commercial lending terms onto public finance instruments whose safety is not based on a property grant but rather on the types and amounts of taxes that can be used to pay the obligation.[33]

2. Revenue Bonds Distinguished

Reading Chapter 9 of the Bankruptcy Code, one would think that there are only two types of municipal debt: special revenue debt and other. This binary distinction mirrors the secured/unsecured distinction in other types of bankruptcy. Although on the one hand this distinction is not the crucial one in municipal financing, the fairly detailed (in Chapter 9 terms) treatment of special revenue bonds emerged from a concern that the Bankruptcy Code did not take the realities of municipal finance into account. The Code treats revenue bonds as secured debt, and when Congress revised the Bankruptcy Code in 1988, it took the needs of the municipal market into account in protecting the security interest created by revenue bonds. A security interest in special revenues extends to such revenues generated after the commencement of the bankruptcy case.[34] This rule is contrary to the rule that applies in all other types of bankruptcies – the floating lien does not float and property received by the debtor post-petition is free from pre-petition liens. This reflects the realities of municipal finance practice:

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[31] *See* City of Westminster v. Brannan Sand & Gravel Co., 940 P. 2d 393 (Colo. 1997) (holding that a mechanics' lien does not attach to municipal property, noting that the "rationale for the common law's exemption of public property from mechanics' liens is to preserve essential public services and functions while protecting those who benefit from public services and facilities").

[32] National Association of Bond Lawyers, *General Obligation Bonds: State Law, Bankruptcy, and Disclosure Considerations*, August, 2014.

[33] *See* Lawrence A. Larose, *Restoring Confidence in California General Obligation Bonds*, LAW360, November 4, 2015.

[34] 11 U.S.C. § 928.

holders of special revenue bonds look to only one source of payment. That source is the revenue stream generated by the project financed. The bondholders have no recourse whatsoever against the municipal entity if the funds turn out to be insufficient. Congress also protected special revenue obligations from the automatic stay and made clear that bankruptcy law could not transform a special revenue obligation into a general obligation of the municipality.[35]

Special revenue bonds are secured in the traditional conception of the term "secured debt." The commercial definition of secured debt assumes that there is a defined property interest that is pledged to a creditor to secure the payment of an obligation.[36] The definition of security interest includes the sale of accounts receivable, which is probably the best analogy to a special revenue pledge. Just as in a sale of accounts, the security pledge in a special revenue bond is non-recourse. When a loan to a municipality is made secured by a special revenue pledge, the municipality commits to pay all of the revenues generated by a specific project in excess of amounts needed to operate the project. If the municipality fails to remit the revenues to the bondholders, the bondholders have remedies with respect to those revenues.

In its pure form, the revenue bond does not put a municipality's taxpayers at risk because payment is made solely from revenues generated from a specific project. For this reason, revenue bonds are exempt from constitutional debt limits.[37] This is a key point to keep in mind as parties argue over whether various types of general obligation bonds should be treated as secured by a tax pledge. Revenue bonds are protected as secured precisely because their risk is directly related to the financed project.

By statute, custom, and common law, municipalities are restricted in their ability to grant security interests in other property. All three of these mechanisms prohibit creditors from seizing municipal assets to satisfy claims against the municipality. As a result, municipal finance does not rest on the same property-based concepts that exist in commercial lending. Even revenue bonds are secured only by a stream of income from a project, not

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[35] *See* 11 U.S.C. §§ 922 (excepting the application of pledged special revenues from the operation of the automatic stay); 927 (denying the holders of special revenue obligations the ability to be treated as holders of recourse obligations under § 1111 (b) of the Bankruptcy Code).

[36] UNIF. COMM. CODE. § 1-102 (b)(35) (defining security interest as "[a]n interest in personal property or fixtures which secures payment or performance of an obligation").

[37] ROBERT AMDURSKY, ET AL., MUNICIPAL DEBT FINANCE LAW: THEORY AND PRACTICE (2ND ED. 2015 CUM. SUPP.) § 1.3.

by the physical project itself.

3. Beyond General Obligation and Revenue Bonds

A comparison of general obligation and revenue bonds illustrates how market expectations in the municipal context are sometimes the reverse of those in the commercial context. Market participants consider general obligation bonds to be safe because there are numerous payment sources available for their repayment.[38] Revenue bonds are considered less safe because they are payable out of a distinct set of funds. Yet revenue bonds are secured by a property right in the form of a dedicated source of funds. They are non-recourse, however, so unsatisfied creditors may not proceed against other funds of the municipality.

Increasingly, or most notably in the recent distress cases of Detroit and Harrisburg, local governments have been engaging in the sorts of practices that marked the subprime lending crisis. Just as homeowners could buy a previously unaffordable house by deferring the obligation to pay as long as possible, municipalities engaged in a number of lending practices that deferred the obligation to pay as long as possible. One example of a debt obligation that provides no new value to the municipality is the "scoop and toss" refunding. Such a refunding allows an issuing municipality to defer imminent debt service and add it to the back end of the debt service schedule. Municipalities in distress tend to engage in a series of such refundings, resulting in a very large debt over time.[39] Other financing arrangements that may ultimately harm municipalities include swaptions and capital appreciation bonds.[40]

C. The Competing Interests

Priorities matter only when a municipality falls into distress. It is only at that point when we see questions about whether a bondholder will be paid before firefighters or police. Local governments exist for several reasons: they provide services, they hold land in the public interest, and they regulate for public health, safety, and welfare.[41] The obligations of local

[38] ROBERT AMDURSKY, ET AL., MUNICIPAL DEBT FINANCE LAW: THEORY AND PRACTICE (2ND ED. 2015 CUM. SUPP.) § 1.3.3.

[39] David Unkovic, *Municipal Financial Distress: Causes and Solutions, The Bond Buyer's* Second Symposium on Municipal Financial Distress, March 2013.

[40] For an explanation of a variety of potentially abusive financing arrangements, *see* Tom Sgouros, *Predatory Public Finance*, 17 J.L. SOC'Y 91 (2015).

[41] Commissioners of Albany County v. Laramie County, 92 U.S. 307, 308 (1875) ("[c]counties, cities and towns . . . are usually invested with certain subordinate legislative

governments are labor-intensive, therefore they will have large obligations for salaries, pensions, and health benefits. Like general obligation bonds, all of these service claims on municipal resources are unsecured in the commercial or property sense.

In the next section of this paper, I discuss bankruptcy rules and values to illustrate how Congress assigned priorities in the Bankruptcy Code. This discussion will lay the foundation for a discussion of the values that can inform the assignment of priority treatment in any federal procedure for municipal debt resolution.

III. BANKRUPTCY POLICIES AND PRIORITIES (OR THE VALUES OF BANKRUPTCY)

Creditors of individuals and private entities have a number of methods by which they can ensure that their claims are paid before others outside of bankruptcy. The first is to ensure that the debtor's assets are partitioned in such a way that no other creditors can have a plausible claim to them.[42] Another is to obtain a property interest in the debtor's assets. Last is to be a beneficiary of a statutory or constitutional priority. This last category includes statutes that grant property interests in the debtor's assets such as mechanics' lien statutes. The Bankruptcy Code respects the first two methods, and although it recognizes statutory liens, it allows the trustee to set aside certain statutory liens as contrary to bankruptcy policy.[43]

A. What is Bankruptcy?

There has long been a robust debate about the nature of bankruptcy law. Generally, however, bankruptcy is recognized as an orderly collective proceeding that is designed to mitigate the harm to creditors that inures when each creditor pursues its individual remedies when there are insufficient assets to satisfy all.[44] Although bankruptcy rules are based on property concepts, in a large percentage of individual bankruptcies, there is

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powers . . . to promote the general welfare of the municipality." *See also* Michelle Wilde Anderson, *The New Minimal Cities*, 123 YALE L.J. 1118, 1158 (2014).

[42] David Skeel has explored the various types of liens and lien substitutes. *See* David A. Skeel, Jr., *What is a Lien? Lessons from Municipal Bankruptcy*, 2015 U. ILL. L. REV. 675.

[43] Even state laws that grant liens to creditors can be disregarded in bankruptcy. *See* 11 U.S.C. § 545 (allowing the trustee to set aside landlord's liens and statutory liens that arise upon bankruptcy).

[44] Thomas H. Jackson, *Statutory Liens and Constructive Trusts in Bankruptcy: Undoing the Confusion*, 61 AM. BANKR. L.J. 287, 288 (1987).

no property to distribute. Even in those bankruptcies, there is a notion of "worthier" promises that is embodied in the Bankruptcy Code through the rules on non-dischargeability. As a result, bankruptcy priority rules reflect the realities of finance and incorporate distinct bankruptcy policies and values. The key to bankruptcy distribution is based on property concepts, and the distinction between secured and unsecured claims is critical.

Bankruptcy rules reflect the core goals and values stated above. The Bankruptcy Code's rules promote an orderly and collective debt relief proceeding that provides predictability to markets and transacting parties. The stay of collection proceedings that arises immediately upon the filing of a bankruptcy petition promotes orderliness.[45] The migration of causes of action to one forum, the Bankruptcy Court, as well as rules ensuring the equal treatment of similarly situated creditors promotes the collective nature of the proceeding.[46] The Bankruptcy Code promotes predictability by setting forth clear priorities.[47] Bankruptcy's predictability also springs from its uniformity, but the constitutional uniformity mandate requires only that debtors within each state be treated uniformly, not that debtors nationwide be treated in a uniform manner.[48] Bankruptcy provides debt relief through discharge, and solves the holdout problem through its cram down provisions.

B. First-Level Priorities: Secured and Unsecured Claims

The Bankruptcy Code respects security interests. Some courts, including the Supreme Court, have implied that the only way that a creditor can ensure itself of full payment in bankruptcy absent a Code priority is by obtaining a security interest in some of the debtor's assets.[49] This security interest can either been a consensual one governed by the Code or one granted statutorily. The Supreme Court recognizes that states may grant statutory secured priority.[50] One reason that the Code respects security interests is the Fifth Amendment to the Constitution, which prohibits the

[45] 11 U.S.C. § 362.

[46] *See* 11 U.S.C. §§ 726 (b) (mandating *pre rata* sharing); 1122 (allowing a Chapter 11 debtor to place claims in the same class only if the claims are substantially similar).

[47] 11 U.S.C. § 507.

[48] *See* 11 U.S.C. § 522 (b)(2) (recognizing that a state may require that individual debtors take advantage of state property exemptions rather than federal property exemptions); Hanover Nat'l Bank v. Moyses, 186 U.S. 181, 190 (1902) (the bankruptcy system is uniform in the constitutional sense when "the trustee takes in each State whatever would have been available to the creditors had the bankrupt law not been passed").

[49] *See* Ohio v. Kovacs, 469 U.S. 274, 286 (1985) (O'Connor, J., concurring).

[50] *See* Ohio v. Kovacs, 469 U.S. 274, 286 (1985) (O'Connor, J., concurring).

taking of private property without just compensation. There has been robust debate, however, about both the Fifth Amendment foundations of the primacy of secured credit in bankruptcy and its desirability from a business perspective.

As all law students are taught, "property" does not mean an asset itself; rather, "property" means the relationship among persons with respect to assets. Commercial law rules tend to turn on whether a party has property rights in an asset or not. They also tend to differentiate between property and contract rights without acknowledging the blurry line between the two. Several authors have explored the edges of this distinction.[51]

On the first level, commercial law recognizes secured and unsecured debt and nothing in the middle.[52] Those who have explored negative pledges in depth decry the bipolar distinction between secured and unsecured creditors, claiming that there are several status positions between the two poles. The negative pledge calls up the property/contract distinction, and thus the priority questions, that are raised by various promises in municipal bonds.

C. Second-Level Priorities Among Unsecured Creditors: The Worthy

1. Priorities as an expression of worthiness

In individual and business entity cases, the Bankruptcy Code prioritizes among unsecured creditors based on various notions of creditor worthiness. Although priorities apply to unsecured claims, their existence is rooted in the property aspects of bankruptcy. If an insolvent debtor, by definition,[53] does not have sufficient assets to pay the claims against it in full, then some particularly worthy creditors will not receive full payment of the claims against them. As a result, the Bankruptcy Code provides that some of those creditors must be either paid before all others (in the case of a Chapter 7 liquidation) or paid in full in order for a plan to be confirmed (in the case of

[51] *See, e.g.* Carl S. Bjerre, *Secured Transactions Inside Out: Negative Pledge Covenants, Property, and Perfection,* 84 CORNELL L. REV. 305 (1999); Peter Coogan, *et al., The Outer Fringes of Article 9: Subordination Agreements, Security Interests in Money and Deposits, Negative Pledge Clauses, and Participation Agreements,* 79 HARV. L. REV. 229 (1965).

[52] Carl S. Bjerre, *Secured Transactions Inside Out: Negative Pledge Covenants, Property, and Perfection,* 84 CORNELL L. REV. 305, 313 (1999)

[53] *See* 11 U.S.C. § 101 (32) (defining insolvency for all debtors other than a municipality and a partnership as a "financial condition such that the sum of such entity's debts is greater than all such entity's property").

repayment/reorganization bankruptcies).

Where unsecured creditors are concerned, the only categorical priorities that are permitted are the ones set forth in the Bankruptcy Code. Chapter 9 of the Bankruptcy Code contains no priorities, however. The reasons for this omission are unclear but believed to be born of Tenth Amendment concerns. In other types of bankruptcy, which incorporate priorities, courts may not fashion their own using equitable principles. [54]

2. Non-Dischargeability as an Expression of Worthiness

The Bankruptcy Code also distinguishes particularly worthy promises through its rules on dischargeability. The goal of all (non-municipal) bankruptcies is to discharge all pre-bankruptcy debt, but the Bankruptcy Code excepts some debt from discharge. Examples from individual bankruptcy include student loan debt and debts for domestic obligations.[55] The dischargeability rules express the bankruptcy policy that some debts should not be avoided through the use of the bankruptcy process.

D. Rarely-Used Non-Priorities: The Unworthy

The Bankruptcy Code reserves a place for the unworthy creditor by the vehicle of equitable subordination.[56] Equitable subordination is a close relative of equitable reclassification, in which a capital contribution by an insider designed as a loan is re-cast as an equity investment. The effect of such a reclassification is to subordinate the insider to creditors.

Equitable subordination is rarely used, and when it is, it remains twinned with equitable reclassification in the sense that courts are reluctant to use the tool to subordinate outside creditors.[57]

IV. DESIGNING A MUNICIPAL INSOLVENCY STATUTE IN THE ABSENCE OF PROPERTY RIGHTS (OR THE VALUES OF MUNICIPAL BANKRUPTCY)

[54] U.S. v. Noland, 517 U.S. 535 (1996).

[55] 11 U.S.C. § 523.

[56] 11 U.S.C. § 510.

[57] I explore the use of equitable subordination in more detail in Juliet M. Moringiello, *Mortgage Modification, Equitable Subordination, and the Honest But Unfortunate Creditor*, 79 FORDHAM L. REV. 1599 (2011), in which I advocate for its use to punish subprime mortgage lenders.

A. Defining Values

Property does not provide the foundation for municipal insolvency law. The Bankruptcy Code incorporates that idea in several places. Unlike other debtors, a municipality must be insolvent to file for bankruptcy.[58] For Bankruptcy Code purposes, individuals and entities are insolvent when their debts exceed their assets. A municipality is insolvent, on the other hand, when it is unable to pay its debts as they become due.[59] For all debtors other than municipalities, a bankruptcy estate consisting of all of the debtor's interest in property is created at the moment a bankruptcy petition is filed.[60] A Chapter 9 filing does not create such an estate.[61]

As discussed above, a foundational value of bankruptcy law is the fair and orderly distribution of an insolvent debtor's property. The lack of a property foundation is just one of the complications in designing a municipal insolvency law. An even bigger hurdle is the Tenth Amendment of the U.S. Constitution, which limits the power of the federal government over states. Although congressional power to enact a municipal bankruptcy law has been held to fall within the Bankruptcy Clause of the Constitution, bankruptcy means many different things, even for individuals and business entities. To think about an appropriate design of municipal bankruptcy law, it is first necessary to define its values.

Some of the values of municipal bankruptcy are identical to those of individual and corporate bankruptcy. Any municipal insolvency regime should provide predictability and certainty, it should establish a binding collective proceeding, it should eliminate debt overhang, and it should solve the problem of holdout creditors.

The underlying values diverge, however, in governance. The state has the first say on whether and how a municipality can file for bankruptcy.[62] In another article, I question whether bankruptcy courts should defer to state choices regarding the treatment of municipal creditors.[63] Unlike a corporation, a municipality must remain in existence in some form to provide services. Municipal insolvency has a severe impact on residents,

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[58] 11 U.S.C. § 109 (c).
[59] 11 U.S.C. § 101 (32)(C).
[60] 11 U.S.C. § 541.
[61] 11 U.S.C. §§ 901, 902.
[62] 11 U.S.C. § 109 (c).
[63] *See generally* Juliet M. Moringiello, *Chapter 9 Confirmation Standards and the Role of State Choices*, 37 CAMPBELL L. REV. 71 (2015).

and the municipal bankruptcy law requires that the court consider the impact of any plan of debt adjustment on the ability of the municipality to provide services to its residents.[64]

Bankruptcy uniformity may play a role in municipal insolvency. One of the motivating forces behind the enactment of a federal municipal insolvency statute in the 1930s was the need to address the concerns of bondholders scattered throughout the country.[65] If uniformity means only uniformity within a state, then perhaps each state can determine its own priorities.

The notion of creditor worthiness informs the priority scheme in the Bankruptcy Code. The question then arises as to whether federal law should impose notions of creditor worthiness on states. The Puerto Rico legislation leaves priorities to the Commonwealth's own laws, stating that a fiscal plan must "respect the lawful priorities or lawful liens, as may be applicable, in the constitution, other laws, or other agreements of a covered territory."[66] Although many are likely troubled by the fact that Puerto Rico law appears to elevate bondholder repayment over the provision of public services, those priorities may not, at least in Chapter 9, be a matter of federal concern. On the other hand, the protection of federal laws may involve some trade-offs, and municipal insolvency law might incorporate some core values such as the desirability of continued public services.

B. Values and Priorities

Bankruptcy law has not always rejected state law priorities. Until the Chandler Act in 1938 federal bankruptcy law incorporated non-property priorities provided for by state law.[67] Fearing that honoring such priorities would leave little or nothing for a debtor's unsecured creditors, the Chandler Act shifted the state priority focus to liens. As a result, today's bankruptcy law honors state property priorities but not other state-created priorities. Yet liens play no role in municipal finance except for in revenue bond financing. Although some states have passed laws granting general

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[64] 11 U.S.C. § 943 (b)(7) (requiring that a plan of adjustment be feasible); *In re* City of Detroit, 524 B.R. 147, 219 (Bankr. E.D. Mich. 2014) (explaining that the feasibility requirement prevents a municipal debtor from promising more than it can deliver).

[65] *See* Juliet M. Moringiello, *Goals and Governance in Municipal Bankruptcy,* 71 WASH. & LEE L. REV. 403, 440 (2014).

[66] PROMESA § 201 (b)(1)(N).

[67] *See* Richard M. Hynes & Steven D. Walt, *Pensions and Property Rights in Municipal Bankruptcy,* 33 REV. BANKING & FIN. L. 609, 645 (2014)(explaining that the Bankruptcy Act of 1898 before the Chandler Act amendments included a fifth priority to "persons entitled to priority by state or federal non-bankruptcy law).

obligation bondholders a lien on taxes,[68] liens, and lien analogies, may not be a useful tool in determining municipal priorities.

Priority based on property rights has been lauded for many reasons, one of which is ease of administration. Because property rights generally must be publicized in order to carry with them priority rights, it is fairly simple to determine who has the prior right to a debtor's property. Yet there are many ways to give notice of priority in addition to public filing or recording offices. Statutory priorities and protections can work just as well as a recording system in ordering priorities.

Discarding rules of property-based priority does not mean that an insolvency statute for municipalities should yield completely to state priority preferences. Leaving Tenth Amendment concerns aside for a moment, remember that when a state authorizes one of its municipal entities to file for Chapter 9, it is conceding that its own processes are not sufficient to get the struggling municipality back on its feet. It is thus consenting not only to a federal process that adds compulsion to the state's own processes, it is consenting to a state collective proceeding. Although bankruptcy law recognizes property rights created by state law as a starting point for determining creditor entitlements, that recognition yields when some federal interest otherwise requires.[69]

The Supreme Court's decision in *Butner* is probably over-cited for the proposition that bankruptcy law respects state created property rights. The proposition is both an overstatement and an understatement. It is an overstatement because bankruptcy law modifies property rights all the time. It is an understatement as well – contract rights are also respected in the first instance in order to determine claims against a debtor. The question is then "is there any federal value that should be incorporated in municipal insolvency law?" Perhaps the focus should not be on federal values. If, as some have stated, the only role of federal municipal bankruptcy law is to solve the holdout creditor problem, perhaps there are no essential federal priority values.

Although property and priority rights need not go hand-in-hand, in commercial law as applied to private entities, they do. One way to justify the Bankruptcy Code's bipolar secured/unsecured distinction is that it reflects (almost) universally accepted principles in the commercial world.

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[68] *See* David A. Skeel, Jr., *What is a Lien? Lessons from Municipal Bankruptcy,* 2015 U. ILL. L. REV. 675.

[69] Butner v. United States, 440 U.S. 48 (1979).

Some lenders have a claim to the debtor's property; others do not. Fifth Amendment aside, many would likely bristle at a bankruptcy regime that ignored the one mechanism that parties use to avoid the sting of bankruptcy. Bankruptcy law in the private sphere thus respects several core principles of American commercial law. A debtor can encumber all of its assets, creditors have the right to seize those assets upon default, and unsecured creditors are entitled to no priority rights.

In the municipal world, however, property rights and priority rights are uncoupled. No creditors have a right to municipal property to satisfy their claims.[70] The Bankruptcy Code includes a set of priorities that are based principles of fairness that apply to all debtors, regardless of their state of domicile. In the municipal context, it is necessary to seek universally held beliefs about worthiness. Should some basic level of services be provided before other creditors are paid? Most people would probably say yes, although Puerto Rico law says no. Many municipal bonds enjoy a federal tax exemption that expresses a view, on the federal level, that bond debt incurred to improve a municipality deserves favored treatment. Some municipal bonds, for example, pension obligation bonds, do not enjoy that favored tax treatment.

Because municipal bankruptcies are so rare, there are no universally recognized methods of bankruptcy proofing. More precisely, these methods do not exist in the sense of bankruptcy proofing property. A private party can shield its assets from general creditors by granting a security interest or by placing property in trust. Shielding municipal assets from creditors is a useless exercise.

Commercial priorities are sometimes said to be based on value added to the borrower. Purchase-money security interests fall into this category. In commercial law, added value means an increase in assets in which all creditors can, in theory, share. Added value must mean something different in municipal finance. Commercial finance law, although uniform state law, is state law. If state law elevates one type of security interest over another, the Bankruptcy Code will respect that ordering. In the municipal realm, therefore, there may not be a reason to override state ordertin.

Subordination of harmful debt is virtually unused in the commercial world. If otherwise, it might have been a tool used by bankruptcy courts in

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[70] Municipal entities often monetize assets to satisfy claims. Some thus question whether the idea of "best interests" in the municipal context should include the requirement that a municipal debtor monetize some assets.

the recent mortgage fueled financial crisis. Perhaps such a tool should be revived in the municipal insolvency context.

The terms "best interests" and "fair and equitable" are often questioned in the municipal context. "Best interests of creditors" is a term that should be stricken from the municipal insolvency lexicon. Bankruptcy courts interpret the term to mean that creditors would fare better than they would have otherwise,[71] which is meaningless and gives no guidance to creditors. Analogizing different types of unsecured bond debt to secured commercial debt is no more helpful – it is an exercise in mapping commercial concepts onto a capital structure that does not incorporate those concepts.

Because property rights do not play the same roles in municipal finance as they do in private finance, the bankruptcy rules for determining priority in payment need some rethinking. Congress enacted the first predecessor to Chapter 9 in the 1930s to respond to an emergency precipitated by the Great Depression. Since them, municipal insolvency legislation on both the state and federal levels has been reactive. The recent and ongoing crises in places like Detroit, Puerto Rico and Atlantic City have led to a combination of judge-made law and reactive legislation. In the Detroit confirmation opinion, Judge Rhodes described the treatment of pension creditors as a judgment of conscience and explained that the pension protections in the Michigan constitution deserved some deference although they did not control in bankruptcy.[72] If there is no municipal bankruptcy value that would cause state priorities to yield to federal priorities, perhaps courts should honor state pronouncements on creditor worthiness.

V. CONCLUSION

Several years of municipal bankruptcies and a bespoke statute for Puerto Rico have given policymakers the opportunity to think about what a municipal bankruptcy regime should look like. It is now time to try and identify core municipal bankruptcy values in order to design an approach to public entity insolvency that will be predictable and take the realities of municipal finance promises into account.

[71] *In re* City of Detroit, 524 B.R. 147, 216 (Bankr. E.D. Mich. 2014).
[72] *In re* City of Detroit, 524 B.R. 147, 256-57 (Bankr. E.D. Mich. 2014).

Credit Cluster and Contagion Risk Related to Distressed Municipalities

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Abstract:

Whenever a distressed municipal credit situation emerges, the potential for spillover risk to other municipal entities becomes a serious concern for analysts. Recent experiences in Detroit, Jefferson County (AL), Puerto Rico and Illinois have elevated these fears to levels not seen since the late 70s and early 80s, when New York City cast a negative light on the muni market, in particular, older industrial, central cities.

This presentation takes a contemporary look at what may be called municipal cluster risk; the potential for additional fiscal problems to emerge out of any common characteristics, vulnerabilities or interdependencies. The danger of contagion due to overlapping or systemic influences can be examined both from a state and local centric orientation. This discussion will take a look at traditional credit analysis measures to create a framework intended to help identify the emergence or intensity of cluster risk, including economic base contraction, overlapping debt and taxes, and newly developing risk factors.

Using selected key risk elements, the presentation will rely heavily on Merritt Research Service's nationwide municipal bond credit database to provide a comparative assessment of higher profile cities. In addition, a list of cities and counties which ranked among the most vulnerable cluster risk candidates in the nation will be spotlighted. Rankings are based on a statistical model used by Merritt Research that analyzes financial and other credit data related to over 1800 cities.

Introduction

Serious municipal fiscal problems have a tendency to impact or to be shared by other governments. Often, the effective implications of the crisis find their way beyond their geographic boundaries and into the boardrooms of one or more other governments. Sensing the probability for interconnectivity, the municipal bond market has an initial tendency to apply a broad brush discounting to any borrower that it suspects may share common elements with a particular problem credit. Once the market has more time to analyze the extent of the common risk, distinctions often transpire and any borrowing rate penalties are fine-tuned, subject to market conditions.

New York City was the center of municipal finance attention in 1975 and remained under scrutiny by municipal analysts and investors for nearly a decade after the city defaulted on its notes. At the time New York's fiscal problems were exposed, the market at the outset focused not only on the cash and debt management issues that were directly related to its default, but also on the underlying reasons that led to that crisis. The list of factors contributing to New York's City's fiscal crisis ranged from management to economic base contractions in the region's industrial base to the middle class population flight to the suburbs and beyond affecting central cities generally. Similar patterns of concern were common among many central cities, especially in the Northeast and Midwest. The fact that the underlying issues were threats to the local economy meant that all New York City credits sharing the same or partial economic base were immediately placed on the potential suspect list. That list extended to the state of New York, which had not only a moral responsibility to intervene, but a legal responsibility as well. The state was also an interested party because the foundation of its own economy was heavily reliant on the city of New York for a substantial share of its own revenues. Declining economic base situations in Buffalo, Yonkers and other cities in upstate New York further stoked the anxieties of municipal bond investors nationwide by penalizing many credits related to New York City, as well as the state's borrowers generally. It wasn't until the 1990s, when national economic growth significantly bolstered New York's economy that the city was able to rid itself of the borrowing penalty initiated by the crisis.

The market's broad brush generalizations about elevated cluster risks associated with older industrial central cities in the Rustbelt was well founded. During the decades following New York City's crisis, a number of central cities with similar demographic or economic base commonalities, such as Detroit, Philadelphia, Pittsburgh and Cleveland, among others, encountered serious financial challenges that earned them downgrades and borrowing penalties. In the case of Cleveland, an actual default occurred on a portion of its debt. These situations had more to do with a cluster risk pattern that focused on characteristics associated with a city's economic maturity rather than geographic integration and proximity.

Over the past several decades, we have also seen municipal market generalities appear periodically, not just among cities and states due to their overlapping economic composition, but also whenever the market suspects there is evidence of common systemic causal risk factors. These issues span a diverse list of potential sources and links, including pensions and oil based economies. The two most recent examples of governmentally related associated risk have placed the spotlight on Puerto Rico and Illinois.

However, contagion risk concerns are not just limited to municipalities in the narrow meaning of the word. When the Washington Public Power Supply [WPPSS] default occurred in 1983, the market took aim at public power credit borrowers involved in major nuclear construction programs. Emanating from that situation, any public power authority with a heavy debt load, especially if it uses nuclear power sources, became a likely object of cluster risk, regardless of its geographic closeness to WPPSS.

Although cluster risk can apply to many segments of the municipal bond market, the primary interest of this paper is to narrow the focus to that related to municipalities in distress, including those that are interwoven with the state. Our first goal is to examine the key issues that we believe increase the chances for intergovernmental cluster risk that often leads to a contagion effect. Second, we will use those characteristics to identify candidates that are more likely to share their financial hardships to one or more overlapping or nearby governments. Although this article is intended to highlight risks and implications for municipal bond investors, governmental leaders who formulate strategies, policies and opportunities of co-operation to pro-actively stabilize the region will be rewarded in the long run. Like infectious diseases, serious governmental problems can't always be isolated at the source.

The Potential for Contagion and Interdependent Relationships

Predictive research, as it applies to municipals, requires a basic understanding of intergovernmental relationships and their shared taxpayer burdens. While the starting point for state and local cluster concentration is their common geographic and economic interplay, the unique characteristics of the individual governmental units can either work to compound the cluster problem or soften the blow.

How local governments manage and react to the challenges that beset them can be made easier or harder by the political will and legal structures that are created at the state level. Understanding the upward and downward dynamics involving the states and cities should be useful to assess and anticipate either party's role to spread risk.

There are several key factors that are often at work in determining the potential risk that one government's fiscal problems are likely to spread to another. The most important of which is the degree to which they share a dependency on the same economic base. Other factors that can have multi-government impacts over time include shared debt and pension overlays, tax incidence, and infrastructure condition. All of these issues have the potential to impact taxpayer burdens, influence residential choices or grow commerce. In addition, state laws and political culture can play a role in formulating policy that supports prudent practices and local co-operation.

At the most basic level of negative state centric influence, weak state financial conditions normally leads to declining support to its governmental subunits. Sooner or later, heavy debt and pension obligations as well as deferred infrastructure maintenance will likely increase the burden on the similar base of taxpayers. In so doing, they are bound to have a depressing longer term effect on state or local economic vitality and its ability to affordably invest in the state's future. State laws that limit local governmental flexibility or promote less than prudent fiscal management policies can work against a local government's long term fiscal health (e.g. Illinois's statutory rules concerning limited employer contributions at levels that are less than actuarial standards) .

Positive political cultures that actively support good government, co-operation between governmental units and intervention when trouble emerges are better able to handle distressed situations than those in which units are completely left to fend for themselves. A couple of positive examples can be found in the state created North Carolina Local Government Commission, which assists its local governments on fiscal matters, and the Minneapolis-St. Paul Metropolitan Council, established in 1975 to provide a certain amount of tax sharing to counter the effects of taxpayers leaving older cities for the suburbs.

State centric financial decisions dictate the symbiotic relationship with their local governmental units. In recent years, state decisions to cutback appropriations to local units have produced a downward spiral that forces city halls to scurry for replacement funds in order to fill budget gaps. States may also make decisions to that mandate increased spending by local units. In addition, states have been known to make structural statutory changes that affect the taxing ability of local units and even redirect funds back to the state government. In the latter case, that's what happened in California several years ago when the state essentially closed down the local redevelopment agencies run by the cities. Instead of surplus redevelopment monies flowing to the city, the monies went to Sacramento. State rules can also be used to systematically impair prudent financial management. For example, Illinois did a disservice to itself and its local units when it enacted a law for pension funding that used amortization and funding schedules that were based on a slower statutory method rather than best practice actuarial accounting. This state law has had detrimental consequences for Chicago and other local governments.

On the other hand, the interplay between a state and a troubled local government can work in the other direction. Local fiscal distress problems that are pushed upward to the state level as the result of calls for assistance or mandatory intervention programs. While state involvement can often be positive in dealing with occasional trouble subunits, they can present reverse risks if multiple overlapping units of government require state assistance simultaneously and they suddenly become burdensome to the state. The state of Michigan, for instance, guarantees local school debt under its qualified program. At the end of June 30, 2015, these school debt guarantees, which amounted to $13.1 billion, require the state to issue general obligation debt of its own if its available resources are not sufficient to cover debt service on the loans. By comparison, the state had outstanding on the same date only $1.7 billion of state GO bonds. To make matters worse, any state government intervention or bailout is all the more complicated if it has serious fiscal problems of its own.

Before this paper specifically addresses the key factors that we chose to identify cities that are most likely to be impacted by cluster risk, it is worthwhile to examine how states and local areas can become instigators of contagion.

State Centric Perspective

Since local governments are subdivisions of state sovereignty, the state grants them powers to enact laws, collect taxes, issue debt and administer responsibilities from the state. Although a state authorizes local governments to act on its behalf, it retains ultimate responsibility for maintaining the health, safety and welfare responsibilities for all its citizens, if the local government is unable or unwilling to do so. In so doing, states normally share the costs in varying degrees with local governments to provide support for issues involving socio-economic fairness and statewide growth. Public education and health care for the indigent are the most common responsibilities that states share the financial burden with local governments.

The state's own financial health can affect the amount and degree to which it is able to fund and allay the cost of local governance. A downturn in state tax revenues or rise in costs for operations or to pay its debts often spells trouble for local governments burdened by their own liabilities.

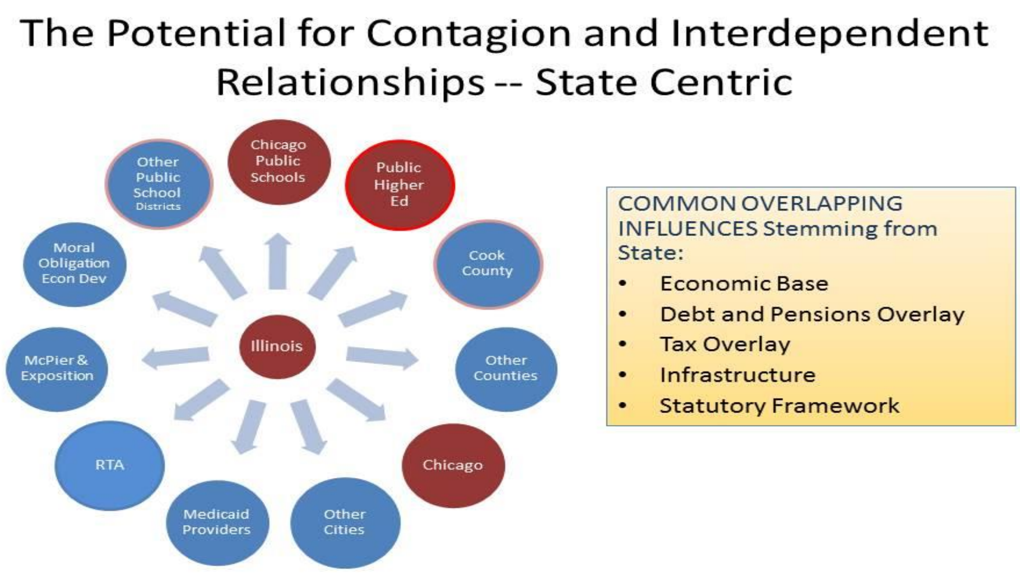
Illinois as an Example

Illinois is a prime example of cluster risk at work. Its chronic failure to maintain adequate appropriations to fund its public pensions on an actuarial basis has left the state with a huge budget gap to cover escalating pension costs. The state's constitutional protection clause that prohibits the diminishment of pension payments to workers, upheld by the State Supreme Court, appears to have left the state in a highly difficult position to close the gap without dramatically raising taxes or reducing services. The severity of the burden has left state leaders with differences on the need for serious reforms and in conflict as how to solve the issue. The net impact has resulted in a deadlocked legislative and executive standoff with no state budget approved for the entire 2016 fiscal year. This unusual situation has resulted in severe de facto cutbacks to departments or programs that haven't received protection either under a Court order, automatic appropriation protection or a legislative consent decree.   Throughout the standoff, public universities, state aid educational appropriations and social service funding were among the spending needs that were most affected. At the same time, an urgent request for additional support from Chicago governments, including the Chicago Public Schools, has gone unanswered. The state's own credit distress has led to numerous credit downgrades by the rating agencies and higher borrowing costs for state agencies and local government borrowers.

For these reasons, Illinois is probably the current headline epicenter of cluster and contagion risk among the fifty states.   The situation is exponentially compounded by co-incident major fiscal challenges that currently exist in the City of Chicago and the Chicago Public Schools.   At both the state and local levels, the root issue of the Illinois problem emanates from its failure to adequately address its underfunded public pension funds. Illinois's economy, tax base and debt levels are so interconnected with Chicago that it is highly difficult to isolate the fiscal problems that exist for taxpayers in the Prairie State.   Recent fiscal shortfalls have had an adverse waterfall effect on a number of associated state agencies and many local units.

The chart below shows some of the governments and agencies either most impacted by the state's problems

Chart 1



Several units of government are looking to Springfield, the state capital, to find new money through higher state taxes to ease their own financial crunch. Chicago, the Chicago Public Schools, public higher education and the RTA are all among those whose current credit conditions are substantially linked to the state of the Illinois.   At the same time, the creditworthiness of many other state authorities and local units of governments are affected in the municipal bond marketplace by their real or perceived reliance on the state for financial support or guarantees.

Local Centric Perspective

At the local level, the potential for contagion due to intertwined and interdependent relationships threatens to spill over into overlapping and adjacent governments, apart from whatever is going on at the state level.

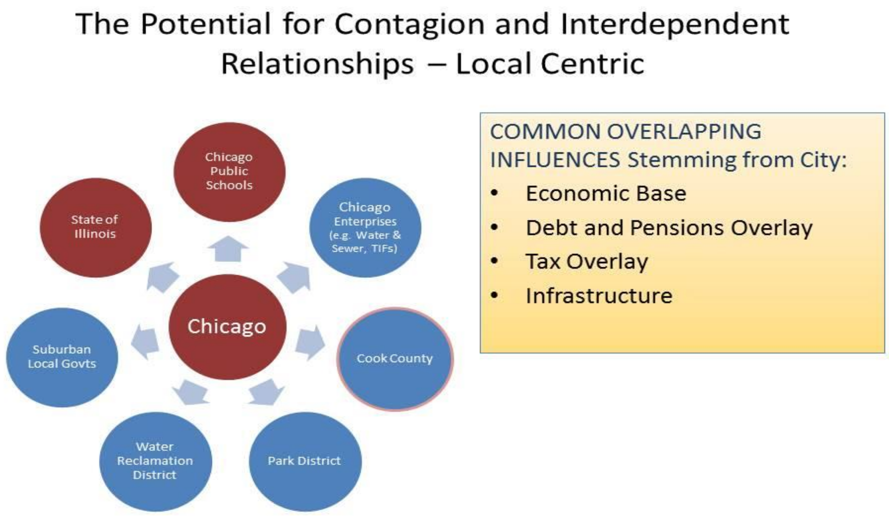
At the core, the strength and resilience of an area's economic base provides the foundation for an area's penchant for local cluster risk. Growing local economies are more resistant but not immune to the spread of fiscal contagion to overlapping or nearby governmental units. Distressed situations which are triggered by factors other than local economic base weakness have the best chance of eventually working themselves out. For example, Chicago's broad and vibrant economy provides a more buoyant base to eventually work through its debt crisis than the economic underpinnings of Detroit. Nevertheless, if fiscal problems are allowed to fester, that resilience is likely to be diminished. At the very least, eroding fundamental situations are likely to suffer stiff penalties in the form of higher taxes or borrowing rates.

Dramatically higher taxes to cover an overhang of debt can affect local and regional attractiveness. Local fiscal policy that has gone awry can jeopardize the health of the metropolitan area if affordability, quality of life, adequate public facilities, and land development and transportation networks are adversely impacted. This is especially true when the main culprit triggering the negative trend emanates from the primary commercial or population centers in the area.

While a fiscal crisis affecting a declining central city has the propensity to negatively affect a broader base involving the surrounding area; it is not a foregone conclusion. A contagion effect will occur if an overlapping governmental unit or a nearby community has unique resources of its own or a record of prudent and disciplined financial management.

The following diagram (Chart 2) illustrates the range of multi-party interactions that one city can have with other governmental bodies in its sphere of influence. In the case of Chicago, the city is the primary driving force in the region by virtue of its dominant role as the center of jobs, capital, entrepreneurship, higher education, transportation, culture and population. The economic vitality of overlapping governmental entities as well neighboring communities are intricately tied to their association and proximity to Chicago. While economic influences may be more obvious, shared fiscal liabilities affecting a similar base of taxpayers can also contribute to a stronger or weaker outlook for credit quality and economic viability. In Chicago, the overhang of the city's debt and pension liabilities combined with all other liabilities incurred by overlapping governmental bodies, including the state, reduce the cushion of credit protections during down times.

Chart 2



Common Elements of Cluster and Contagion Risk at the Local Level

For the purposes of this examination, we analyzed U.S. census information and financial data compiled by Merritt Research Services, LLC from its data base that covers over 1800 cities and over 10,000 total municipal bond borrowers of all types in the United States. Based on observational experience, we selected several factors that we believe to be good indicators to identify cities and areas of the nation that are more inclined to be vulnerable to credit cluster risk. The elements examined for this study relate primarily to population, overlapping debt/pension burdens, total taxes and infrastructure. For purposes of this discussion, our lists refer to cities with populations of 100,000 or more.

Population

The most basic element normally associated with distressed situations has to do with the degree of weakness associated with the economic base. One of the best measures of economic health is observing the population growth trend. Since mobility is relatively easy in the U.S., population trends tend to mimic economic opportunity and places that are relatively attractive to live.

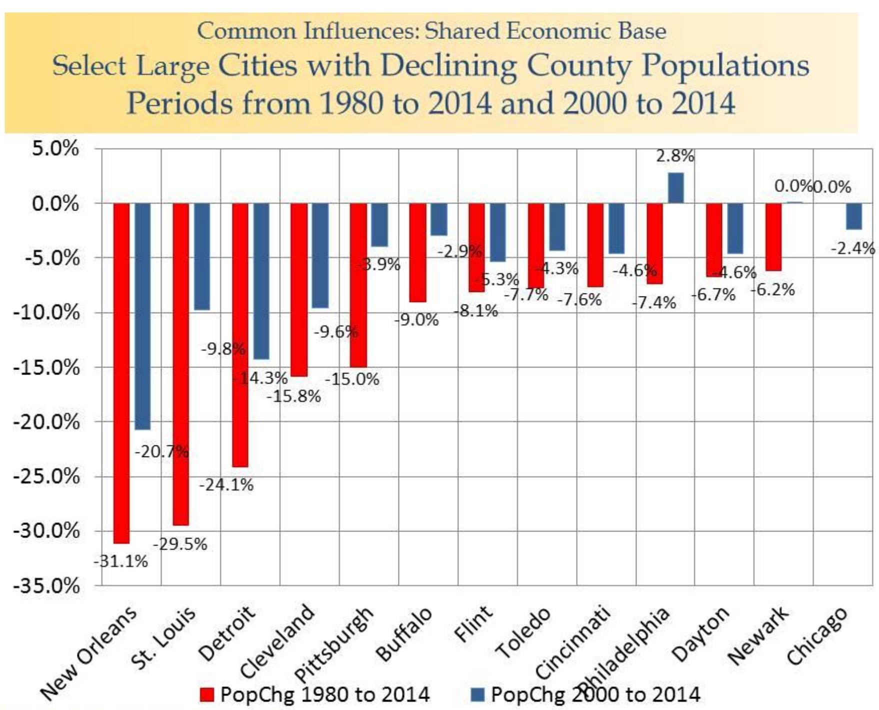
With this in mind, negative population trends become our first filter to identify cities throughout the nation that are more susceptible to cluster and contagion risk. Looking at 1800 cities, we considered two population trend periods that apply to the primary county that they are located. The first trend is the longer time horizon from 1980 to 2014; then, the more recent trend line covered the time span since 2000. We used the county population base rather than the city in order to better assess the foundational strength of the local area to fend off adverse influences stemming from the central city.

The county which tops the population decline list (Chart 3) for both periods belonged to New Orleans with a drastic 31.1% decrease recorded over the longer period since 1980; then, by 20.7% for the more recent period. Certainly, New Orleans situation is extraordinary because of the huge population exodus that took place after the Hurricane Katrina in 2005. While the city has shown a gradual and consistent bounce back in population since the natural disaster, New Orleans' population remains 28% below its pre-storm population. Likewise, its employment base is still nearly 10% smaller than pre-Katrina. The city of New Orleans and the Parish of Orleans are co-terminus, so we are not able to assess and make apples to apples to apples county perfect softness comparison; however, data relative to the New Orleans-Metairie Metro area indicates that the local economic condition for surrounding governments has been rebounding but still shows a smaller economy than it did before the hurricane. Bureau of Economic Affairs statistics for the metro area shows the real GDP base for the area to be $8.8 billion smaller than what it was at the end of 2005. While the city of New Orleans' economic base is smaller than it was before the storm, its legacy liabilities are not. Providing room for optimism, the city and the area has seen solid positive momentum in population and jobs since 2006 as renewal efforts are visible and significant.

The second worst long term population decline percentage among cities over 100,000 belongs to St. Louis but it has fared better than the trend for Detroit-Wayne County since 2000. Other large cities with negative county population trends for both periods include: Detroit, Cleveland, Pittsburgh, Buffalo, Flint, Toledo, Cincinnati, Dayton and Newark. Chicago showed a modest decline since the millennium began but its population is on par with the level it saw in 1980. Philadelphia and Newark showed modest upticks between 2000 and 2014.

Since cluster risk is more likely to occur where population growth and economic condition trends are weaker in the surrounding area, the analysis looked at county population growth rather than the cities. If a city and county are co-terminus, then only the city's population applied. In our analysis, we found that 5% of the 1800 plus cities examined are located in counties registering 10% or more declines in their population since 1980. Of these, only 1% of all cities showed double digit declines since the year 2000. Given the relative small percentage that is undergoing population contraction, economic cluster risk is not fertile ground based for most areas of the nation on this condition alone.

Chart 3



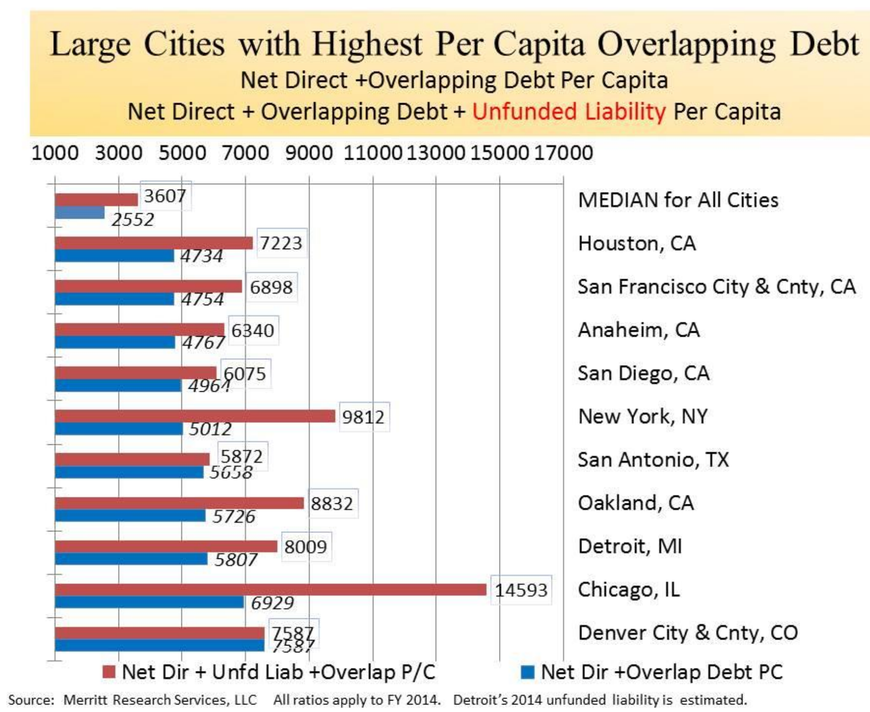
Source: Merritt Research Services based on U.S. Census

Overlapping Debt and Pensions Per Capita

Economic decline and cluster risk among cities is not a serious concern to the municipal bond market in areas where there is little debt outstanding. As bad as the farm crisis was to rural cities during the mid-1980s, the economic upheaval which they did experience resulted in negligible defaults or bankruptcies because these governments had relatively modest overall debt loads. By contrast, the situation today for urban America is considerably different, when you add to the overlapping governmental local unit debt calculation unfunded pension obligations.

Based on 2014 financial reports compiled by Merritt Research, a number of large cities (those over 100,000), have a relatively high per capita direct and overlapping debt load especially when the figures are combined with their direct unfunded pension liabilities. Chart 4 below shows that the risk burden is especially egregious in Chicago at $14,953. New York at $9,812, Oakland at $8,832, Detroit at $8,009, Denver at $7,587 and Houston at $7,223 show much heavier overall debt loads than the median $3,500 for all U.S. cities; but, their relative per capita burdens are still significantly lower than Chicago.

Chart 4

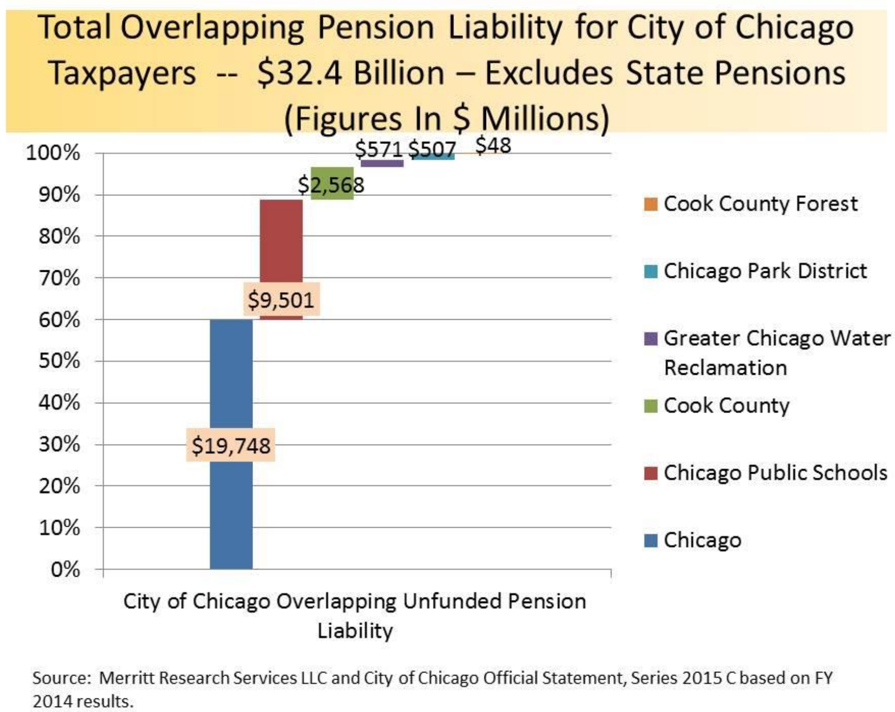


In the municipal credit analysis world, the traditional analytical approach to compare overlapping debt ratios is based on the inclusion of a city's own direct debt plus the proportionate share of the overlapping indebtedness that pertains to the assessed tax base of the government being analyzed. A broader approach that has become increasingly popular among analysts expands the numerator to include the direct unfunded pension liability into the debt ratio equation. The rationale for doing so is that even though the unfunded pension liability fluctuates year to year due to actuarial assumption variances such as market valuation and contribution considerations, the pension liability is still a fairly immutable form of indebtedness that weighs on taxpayers for years to come.

What is missing from a true long term indebtedness burden to a city is the total proportionate share of overlapping unfunded pension liabilities that must be borne by taxpayers. For example, Chicago's taxpayers must pay their share of the unfunded liability that applies to all five of the city's pension funds as well as all or a portion of the unfunded liabilities that are related to its overlapping governmental units (i.e. Chicago Public Schools, Cook County, Greater Chicago Water Reclamation, Chicago Park District and the Cook County Forest Preserve). Since the overlapping pension liabilities are not available in the official financial documents of any one governmental entity, it is necessary to manually calculate the proportionate share in order to have an appropriate total indebtedness number to use against traditional burden comparability ratios against population and the full market taxable value of property in the city.

As seen in Chart 5, when all unfunded liabilities applying to Chicago's other overlapping units are added together, the city's taxpayers are on the hook for $32.4 billion in unfunded liability, which is nearly double from the $19.8 billion that applies only to the city's funds. This number excludes the city's proportionate liability for the huge state unfunded liabilities.

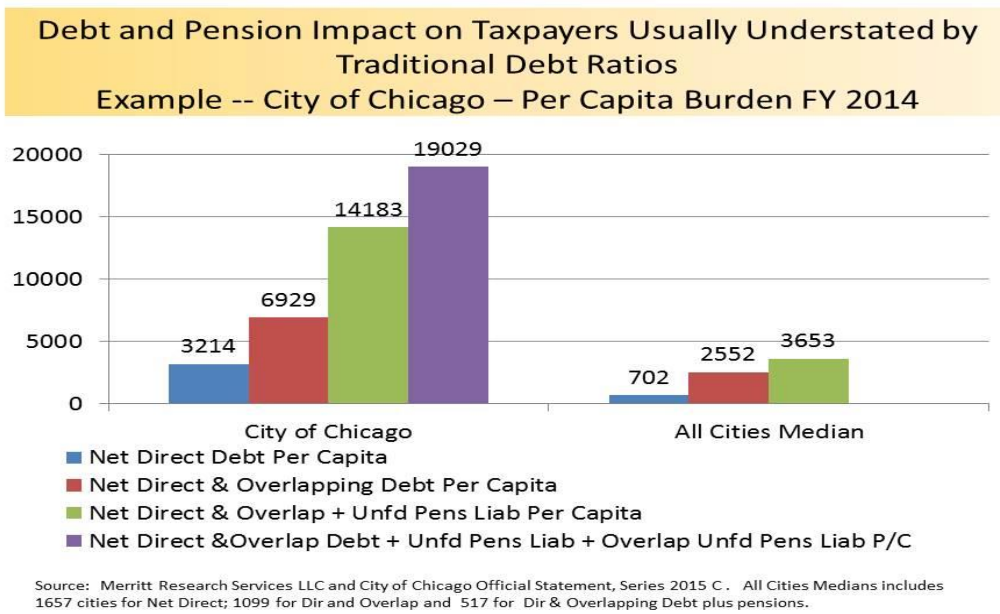
Chart 5



Moreover, by adding the proportional overlapping pension liabilities to the traditional debt ratios used by municipal credit analysts to compare one city to another, Chicago's indebtedness stands out well above the medians for all cities as compiled by Merritt Research relative to its population and the full taxable value of its property tax base by all levels of comparison.

Chart 6 details a four step approach to calculate debt per capita relative to the medians for all U.S. cities. Starting at the base level, net direct debt per capita (deducts all self-supporting or non-general obligation tax supported debt) is reflected on a per capita ratio that is close to 4 times more than the 2014 median level for all U.S. cities. As overlapping layers of indebtedness are added to the ratio comparison, the impediment of debt on Chicago's taxpayers becomes increasingly more evident as shown in Chart 6 below.

Chart 6

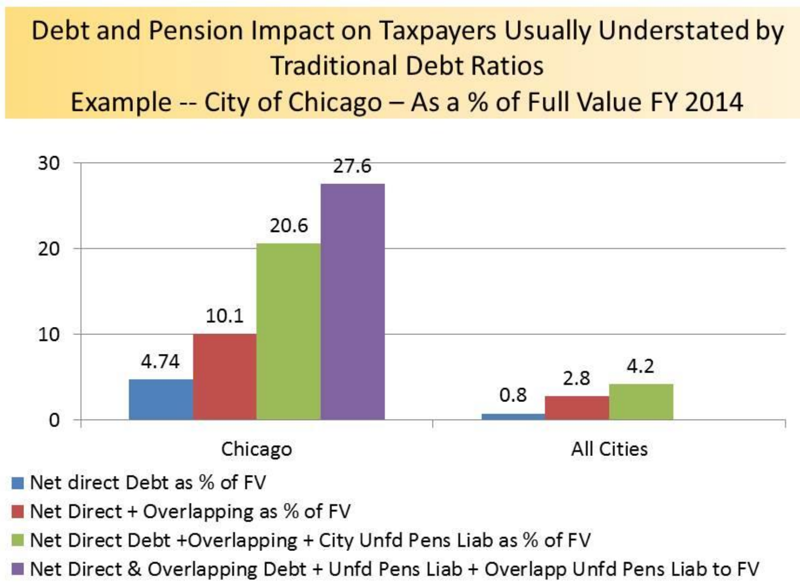


At the second level, the city's net direct is combined with the pro-rata overlapping general obligation debt from other units falls to 3x the median of all cities. However, when the city's unfunded pension liability is included the ratio tips the scale back to nearly 4x the median for all cities. Then, if the pro-rata overlapping unfunded pension is piled onto to the scale, the per capita all-in debt and pension bill to Chicago taxpayers rises to a towering $19,029 per person. Any comparison of the all-in overlapping number to a national city median would likely show a continued upward trend differential that uniquely imposes a long term burden on taxpayers. Unfortunately, a proportionate overlapping pension liability is not available on a city by city basis since they number is not reported in official financial records. The Chicago example was possible only by manually calculating the number using multiple sources.

Looking at a per capita measure to assess debt load shouldn't be the only test since a wealthy and broad tax base can essentially mitigate the impact on taxpayers. In order to make that assessment in Chicago, we compared the same four layers of the city's overlapping debt and pension liabilities to the full market value of the city's taxable property. Here we found, as shown in Chart 7, a strikingly similar steep pattern of escalating burden compared to the medians for all cities found in the Merritt Research database. The net direct and overlapping debt plus the direct and overlapping unfunded pension liability shot up to nearly 28% of the city's full market value of all of its property. A median comparability all-in number which included overlapping government pension liabilities wasn't available for all cities; however, the huge differential between Chicago and the city median relative for the debt and pension ratio without overlapping pension portion suggests that the enormous relative burden would likely remain a handicap to current and future taxpayers.

The mismatch of total indebtedness relative to the resources to pay them would be even more conspicuous if this analysis included the additional inclusion of the state of Illinois' debt and huge unfunded pension liability allocated on a proportional population and real estate valuation basis to the same city taxpayers.

Chart 7



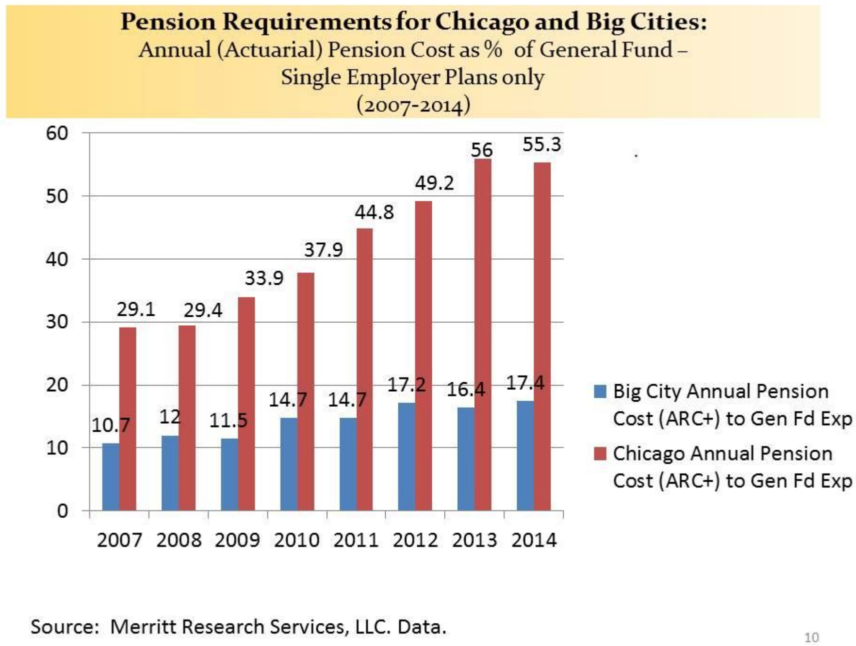
Source: Merritt Research Services LLC and City of Chicago Official Statement, Series 2015 C. All Cities Medians includes 1532 cities for Net Direct; 1073 for Dir and Overlap and 506 for Dir & Overlapping Debt plus pensions.

Placing overlapping debt and unfunded liabilities into perspective on a collective basis reinforces the premise that problems with one or more governmental body can adversely impact and compound the weight of the taxpayer problem for multiple government entities and thereby be an important driver of cluster risk. The same taxpayers that are accountable to cover a massive accumulation of debt for the city are also responsible to cover the Public School District, the County and other governmental units, which share the same territory. That makes solutions to pay for them more difficult as well as the ability to provide for public services.

Chicago's unfunded pension obligation has been building for many years in no small part to the fact that a state legislated rule tied the city's annual pension contributions to a "statutorily based" funding formula that limited their ability to otherwise to cover the full actuarial requirement. As a result, the funding gap over the past ten years swelled from what they actually contributed to what they should have paid if their contribution was tied to a concept called the Annual Pension Cost (APC) under the Governmental Accounting Standards Board Rules that existed throughout that time period. By the time that 2014 came around, our calculation showed that if the city had paid the APC, the contribution would have represented 55% of the same year's general fund expenditures compared to the median Big City

(Cities over 500,000 persons) annual pension cost share of 17% (Chart 8). Instead, the city's actual contributions represented only about 14%, which was on par with the year's median level for Big Cities.

Chart 8



The failure to annually fund the actuarial estimated contribution eventually comes home to roost as the day of reckoning to cover benefit payments rises and requires higher taxes to foot the bill.

Taxing Capacity

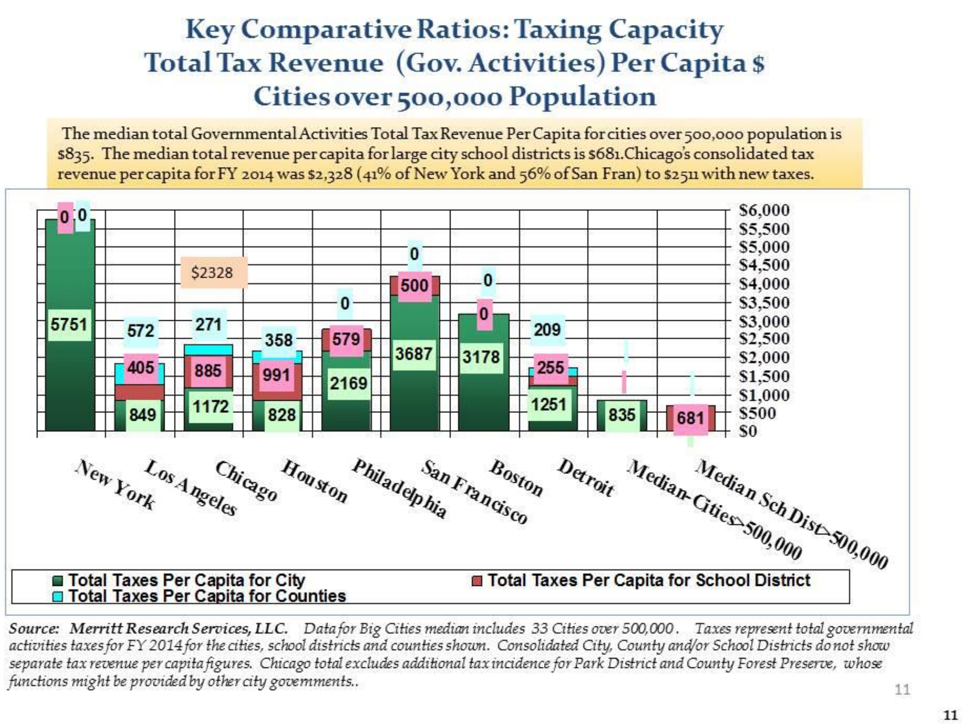
One of the most important remedies available to defend against cluster and contagion risk is the ability and willingness for local governments to use their available tax capacity to cover fiscal challenges without seriously impairing their economic condition. To the extent that taxes have been raised historically to cover outstanding legacy liabilities explains to a large extent why municipal bonds earn their relative lower risk reputation. However, this analysis attempts to raise awareness that city fiscal issues should not be analyzed in isolation; rather, they should be considered in light of conditions involving overlapping or interconnected government units that require payment from a shared base of taxpayers.

The ability to raise taxes is a highly subjective proposition, subject to many variables, including but not limited to local economic growth, relative wealth levels, political culture and public support. To the extent that tax capacity is evaluated based on norms, we look at median tax revenue levels per capita. In order to avoid the single operating fund distortions such as the general fund, we lessened that risk by using the GASB 34 created Governmental Activities Account, a broader measure that applies to governmental functions to make better comparisons. Tax revenue comparisons among local governments, especially across state lines, can be difficult due to the effect of different state approaches to funding or performing different governmental responsibilities.

In order to gauge big city tax capacity, we consolidated governmental activities tax revenues of the most common overlapping governmental units (i.e. city plus school district and county) so that we could account for functional differences in responsibility.   As a defined sample group, we compared Big Cities (those with populations over 500,000) in the context of both their population size and the real estate full value base, as a proxy for relative wealth, so as to provide a basis for finding a tax range continuum that might be a useful indicator to size up big city tax capacity.

In the accompanying Chart 9,   eight big cities were selected to compare a combined total of tax revenues that applied to the 2014 fiscal year. Total tax revenue was based on a measure of revenue called “Governmental Activities Taxes”.   As was mentioned above, this approach was used since it is has a broad application of all taxes and purposes, which provides a somewhat better “apples to apples” comparison across state lines than the frequently used General Fund.   Recognizing that some governments, such as New York, have responsibility for school and/or county functions, we applied the governmental activities revenue noted in the respected annual comprehensive financial reports of the overlapping school district and/or county to tally a compilation of each city’s combined tax revenues compared against population and also Full Market Valuation of the taxable property base.

Chart 9



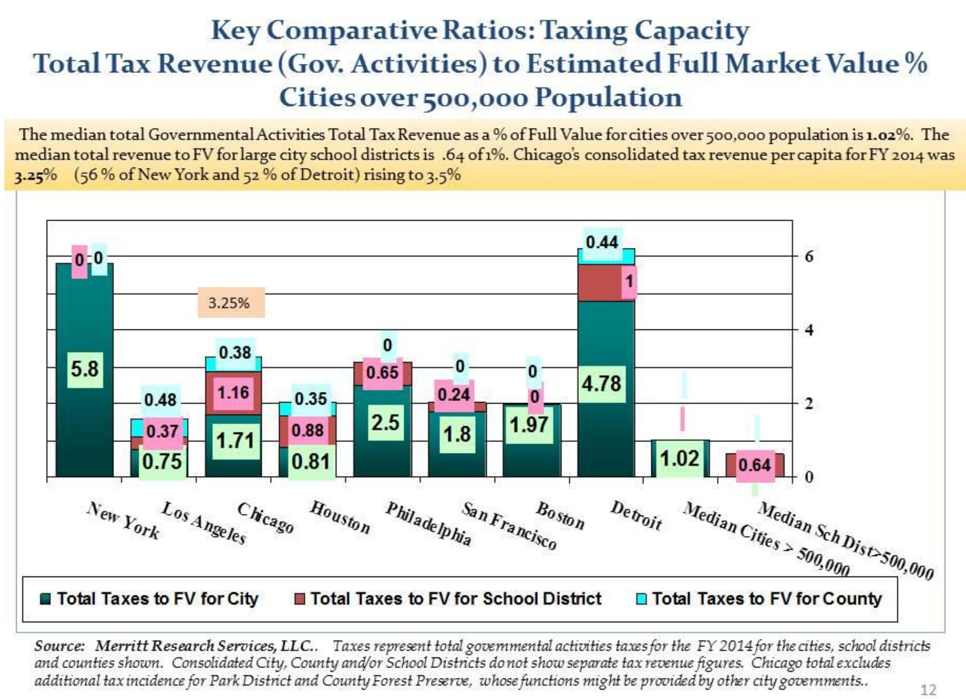
New York easily tops the highest total tax revenue per capita list among the big cities at $5,751, followed by San Francisco at $4,187 and then Boston at over $3178.
On the lower side are Houston, Los Angeles and Chicago $2331.

Chicago’s combined tax revenue per capita ratio, which includes its school district and the county suggests that it has some relative capacity to raise taxes if New York is an acceptable threshold level.

However, the two charts also show the median for all Big Cities and the median level of all School Districts with populations of over 500,000. When these two medians are combined, they amount to around $1561 per capita. By that measure of normalcy, Chicago would appear to have somewhat less flexibility to raise taxes. Since the depth and economic vitality of Chicago has more similarities to the eight largest U.S. Cities, there is an argument that a tax capacity comparison may be more meaningful with the cities which are viewed as more globally important.

The tax capacity comparison that measures the total governmental activities revenues as a % of the Estimated Full Market Value of the city's property provided some interesting differences and implications. Here, Detroit had the highest tax burden relative to its taxable property of all Big Cities. New York, a true global city and a commensurate high cost of living ranked second. Detroit's relatively high tax level in 2014 was used as a justifying factor in the city's bankruptcy case. Given the extraordinarily weak wealth levels of its citizens, its tax capacity was stretched to the limits, which made it more difficult to generate any significant upside in tax levels if the city had not filed for bankruptcy. Chicago's combined city, school district and county tax revenues ranked third highest of the eight Big Cities relative to the full market valuation of its tax base; it also ranked well above the combined ratio for the median of the consolidated median for cities with populations of over 500,000 persons. From this perspective, Chicago seems to have some capacity to generate higher tax levels if New York City is used as its benchmark. However, its already above average position on this measure suggests that a sharp rise in tax revenue triggered by tax rate hikes rather than by virtue of economic growth might pose a shared challenge for all three of Chicago's three main overlapping units of government (city/county and school district) as well as its minor overlapping governmental taxing units. The tax challenge is further complicated by separate tax rate increases that could occur at the state level.

Chart 10



12

Uncertainties about the political and economic impact of tax increases when they must purposely rise sharply in a short time can, at least initially, result in outmigration of taxpayers. To some, New York lost both residents to the Sun Belt and taxpayers to adjoining states after its fiscal crisis in 1975 before the city's global economic standing and its cosmopolitan attraction to foreign in-migrations provided it the eventual resilience to rebound, especially during the 1990s. However, New York's continued high tax levels suggest that New York City's upside flexibility to raise taxes should a future fiscal crisis occur might be more limited.

Still, taxes alone are not the only cost of living that residents or employers might use to determine locational viability. Prominent global cities which derive their energy based on their political or economic significance can withstand higher costs of living due to the essentiality of their industry. In a recent study by GOBanking Rates, Chicago ranked 10th among big cities in the U.S. relative to total cost of living. Cities at the top of the list included San Francisco, San Jose and New York.

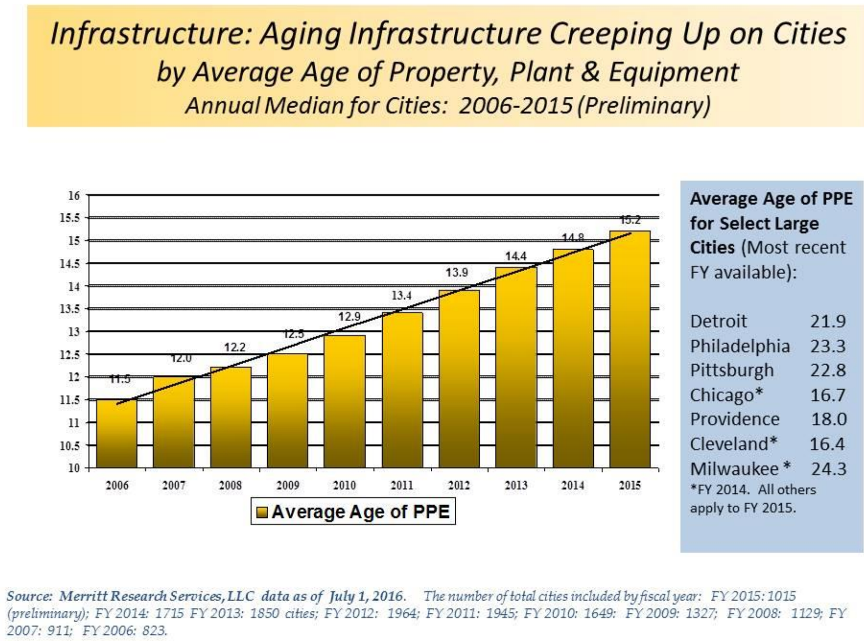
Infrastructure

Deferring infrastructure improvements and replacement has been a long standing problem in municipal finance. It is widely known that the failure to fund infrastructure projects on a timely basis is likely to lead to adverse consequences or more expensive financial obligations down the road. The relevance of this particular problem in relation to cluster risk is that overdue projects have the makings of an off balance sheet debt liability that will eventually have to be covered by taxpayers one way or another. Consequently, cities which have a disproportionate share of older infrastructure will become even less desirable to attracting and retaining businesses and residents. The burden to pay for infrastructure repair will fall on future taxpayers to cover either debt or pay as you go programs, which is especially troubling if the local economy and population base is already on a downward path.

While there are no perfect ways to size up the quality of a city's infrastructure from afar, a decent proxy for identifying deferred infrastructure is to look at the GASB Statement 34 entity wide balance sheet to calculate an average age of property plant & equipment ratio. A form of this ratio, commonly used for municipal enterprises and corporations, reflects the estimated annual depreciation expense relative to the government's appraisal of the asset value and its full depreciation schedule, when the asset was placed on the books.

When tracking Merritt Research's the average age of infrastructure (i.e. property, plant and equipment) measure for cities since 2006, there is a straight line message that clearly reinforces the view that the situation is only worsening. As shown in Chart 11, the median average age of infrastructure in 2015 has increased from close to 11 years in 2006 to nearly 15 today. A number of major cities stand out and are even much higher than the median. Milwaukee leads the list at 24.3 years, followed by Detroit and Philadelphia at 23.3 years and Pittsburgh and Providence at 18 years.

Chart 11



Some caution is warranted when looking at average age comparisons from city to city since the assets that are contained on a city's balance sheet omit any public plant built before the effective date (early 1980s) associated with the implementation of GASB 34 entity wide balance sheet statement. In addition, cities can determine the useful lives of their capital assets and they don't have to record capital assets in which they have used a modified approach that involves a consultant which provides an infrastructure assessment report.

While the GASB based capital appraisal numbers which feed the average age of a city's infrastructure are not perfect, the ratio is still the best statistical accounting approach available to estimate how active a city is in maintaining the upkeep of its infrastructure. Comparative nuance problems relative to each city's asset valuations aside, the number's meaning is particularly telling when it is viewed on a trend line basis for any given city.

Cities with high property, plant and equipment age numbers more likely to vulnerable to cluster and contagion risk not only because they are more likely to have a relatively mature economy, but also because there is a greater likelihood that they have been postponing inevitable debt or taxes increases.

Identifying Local Areas with Elevated Cluster and Contagion Risk

Predicting areas that are most susceptible to cluster and contagion risk are normally those in which the central city has already have been showing symptoms that are associated with economic weakness or fiscal strain. While this concept is not news to the municipal analytical world, the degree to which the fiscal health of other governmental bodies is most likely to be at risk depends on a combination of factors being present not only in the central city but also within the local area, normally places situated in the same county.

Those characteristics that we deem of primary importance have already been discussed at length in this paper. They include those related to county population trends, total and direct debt, overlapping debt, direct city unfunded pension liabilities, tax revenue levels and infrastructure age.

There are also other secondary symptomatic factors which may signal that cluster risk might be festering, such as median household income, the median age of a county's housing stock and the overall condition of the central city's unrestricted net position relative to the size of the city's total governmental expenditures. The first of these factors recognizes that wealth matters; little explanation is needed for its ability to mitigate the otherwise eroding influence of a challenging fiscal environment. The median age of the housing stock serves as a proxy indicator to gauge the economic maturity of the area's development. While there are occasions such as in Charleston, SC in which preserving housing is a positive attribute that can enrich the city, but those situations are fewer in number. With respect to the last factor, cities that manage their liabilities within their means are more likely to carry a positive or less negative overall net position balance sheet. A more negative unrestricted net position suggests that the government's fiscal condition is vulnerable to its legacy liabilities and more susceptible to a path that lends itself to decline in the region.

Situations in which multiple primary and secondary characteristics are present increase the likelihood and intensity that the economic and fiscal shortcomings of one or more governments will tip other related governments into a cluster pattern of fiscal malaise. [1]

Cluster Risk Model

Based on all of these factors, we formulated a simple multi-variate statistical model to incorporate our primary and secondary factors in order to rank city/county areas that appear most vulnerable to the threat that we refer to as the "cluster" risk. Cluster rankings involving the same risk factors were calculated for both the city and for the median for the cities that belong to the same county. Although cluster risk may go beyond county boundaries, we have limited this portion of the analysis to this grouping in order to keep the discussion more focused. The essence of cluster risk presumes that one government's fiscal problems can be passed along or shared by other governments because of one or more shared root causes that impact a similar base of taxpayers who must bear the burden of its impact. The rankings based on a percentile national ranking among all cities and counties in the database with those receiving the highest rank (from 0 to 99.9%) associated with the least vulnerability to cluster risk. The economic based factors used in the city model (i.e. Population, median household

[1] Factors used in the study are: Total Direct Debt, Unfunded Pension Liability & Overlapping Debt as a % of Full Value; Net Direct Debt, Unfunded Pension Liability & Overlapping Debt as a % of Full Value; Net Direct Debt, Unfunded Pension Liability & Overlapping Debt Per Capita; Net Direct Debt & Overlapping Debt as a % of Full Value; Net Direct Debt & Overlapping Debt Per Capita; Population Change of County 1980 to 2014; Population Change of County 2000 to 2014; Total Tax Revenue – Governmental Activities Per Capita; Average Age of Property Plant & Equipment (PPE); Estimated Useful Life of PPE; Unrestricted Net Assets to Total Expenditures – Governmental Activities; County Median Household Income; and County Median Year of Housing Built. All factors are city based except those specifically mentioned as County.

income and median age of the population) were based on county figures; however, all other factors were related to the city except to the extent that they applied to overlapping net bonded indebtedness. Cluster risk rankings pertaining to the county are based on the median ranking of the cluster risk for all cities situated in the same county (primarily but not limited to those over 35,000 persons). Medians were calculated using incomplete data in situations in which one or more financial data points were not available or applicable.

Individual governmental units that belong to an area in which cluster risk is prevalent can and do overcome the potential spillover risk that they are exposed. Typically, they are better able to maintain more resilient outcomes if they have a record of proactive fiscal maintenance policies and they remain attractive places to live and work. Communities that are better positioned to defend themselves in such circumstances normally carry higher municipal bond ratings unless they actively exhibit weaknesses recognized by the agencies; however, a high rating itself shouldn't be construed to mean that a city isn't subject to cluster risk. In lieu of bond ratings, we used the CreditScope Credit Risk rankings[2] (standard credit risk model formulated by Merritt Research that incorporates a weighted formula of selected financial and economic credit factors used for municipal credit analysis to size up default risk) to measure quality for both the city and county. Like the Cluster Risk rankings, the CreditScope rankings are based on a percentile national ranking among all cities. County CreditScope ratings were based on a median of all cities that are located in the primary county associated the central city. Rankings receiving the **highest percentile** on a scale from 0 to 99.9% were associated with the better credit quality.

Chart 12 The Results:

Select City & County Areas with Highest Elevated Cluster Risk

(Statistical Model Results Based on National Ranking using FY 2014 Financials and Census Data)

Ranked In Order of Most Cluster Risk by City	Cluster Risk Rank Percentile (City / Med. for County Cities)	CreditScope Credit Rank Percentile (city /Med. for county cities) Credit Quality
New Orleans, LA	.46 / NA	7.2 / NA
Detroit/Wayne, MI	.63 / 9.55	1.02/ 13.86
Newark/Essex, NJ	.98 / NA	3.92/ 22.15
Philadelphia City & County, PA	1.17/ NA	1.51/ NA
Pittsburgh/Allegheny, PA	1.66 / 13.19	8.26/ 42.29
Chicago/Cook IL	1.77 / 13.22	2.22/ 35.1
Syracuse/Onondaga, NY	1.82 / 2.58	1.18 / 33.95
Cincinnati/Hamilton, OH	3.7 / 9.49	4.36/ 62.27
St. Louis, MO	2.86 / NA	.41 / NA
Birmingham/Jefferson AL	2.91 / 27.04	8.64/ 42.07

Rankings to the left in **red** indicate bottom 15% ranking of all cities or counties.

Source: Merritt Research Services, LLC. Data based on FY 2014 financials, US Census data and Merritt Statistical Model Scores. Cluster Burden represent statistical model results based on inputs related to stress factors. The two cluster risk rankings relate first to the city-centric orientation while the second ranking refers to the median for cities followed by Merritt that belong to the same county. The CreditScope rankings reflect a Merritt developed quantitative model credit standing assessment for the city, specifically, and the median for all city credit rankings in the county.

[2] CreditScope Rank is a standard statistical model that is incorporated in a credit software package. The general obligation city statistical model was jointly developed by Merritt Research Services, LLC and Investortools, Inc.

We applied our cluster risk statistical model to 1832 U.S. cities in the nation of all population sizes. However, relative to the model in this presentation, this article focuses on those cities with populations of at least 100,000 for specific commentary. Of those, the bottom ten cities which ranked as the most vulnerable areas in the nation, where conditions appear to be most apt for spilling over into overlapping or nearby governments were as follows: New Orleans, Detroit, Philadelphia, Pittsburgh, Chicago, Syracuse, Cincinnati, St. Louis, and Birmingham. Since the statistical model used several county indicators to assess economic conditions that were intended to characterize the common exposure of the adjoining governmental bodies to contagion risk, this approach lessened the predictive potential of cluster for cities that were not part of a separate broader territorial county (e.g. New Orleans, Philadelphia, St. Louis and New York). Nevertheless, the value of the cluster risk concept is still likely to be relevant in these places, since the same dynamics of the elements used in the study would probably have an adverse reaction to those cities in close proximity to the central city.

We have excluded Newark's cluster ranking in our discussion because of statistical drawbacks due in large part to unique New Jersey local government financial and debt reporting practices that limit the model's usefulness in this analysis. While the city's subpar economic and demographic characteristics placed it among cities that might have tendency for cluster risk, the absence of comparable and important debt and tax issues, discounted the usefulness of its statistical score.

New Orleans' massive upheaval to the city's population base in the aftermath of Hurricane Katrina only explains a portion of its low ranking. While many residents have returned to the area helping to fuel new energy into the area's economy, a number of measures that we used in the study indicated that cluster risk vulnerability is still very much an issue of concern. (i.e. debt, pensions, overall balance sheet, infrastructure age and income levels). The area's ability to stave off a worsening contagion of local financial problems has been helped by its gradual bounce back as well as federal funds and special programs to help them with their rebuilding. Applying the cluster risk model in this case has its statistical challenges. Its weak ranking is complicated by the fact that New Orleans is one of the large cities on our list that doesn't have a separate county to provide more definitive information relative to the health of neighboring local governments in the area. However, economic base weakness in the metro area, as noted in the population section of this paper, is evident by the decline in real GDP for the New Orleans metro area since 2005, the year of Hurricane Katrina.

The fact that Detroit/Wayne County, MI ranked as second only to New Orleans on the most vulnerable list seems to reaffirm the validity of the statistical model as a predictive tool. In Detroit's case, both the city and the county's cities ranked in the lowest one percentile. Wayne County cities fell in the bottom 4% percentile. While Detroit's fiscal plight has long been well known, resulting in its own bankruptcy in 2014, the overlapping factors and conditions that characterized the city are shared to a large degree with the Detroit Public Schools, Wayne County as well as a number of suburbs adjacent or nearby to Detroit that have officially been placed under state emergency management or are on the brink of inclusion. Wayne County governmental units with emergency managers include: Allen Park, Ecorse, Hamtramck and Highland Park.

Since cluster risk is highly correlated with fiscal stress emanating from the center point of the area, it isn't surprising's that Detroit's own credit profile is emitting red distress flags of its own. As a compilation of a variety of key credit factors used the CreditScope Rank, Detroit's overall credit ranking placed the city in the worst 1% of over 1800 cities in the U.S. based on 2014 figures. As an additional confirmation that cluster and contagion risk is already at work and adversely affecting other local cities, the median CreditScope ranking for the 17 Wayne County cities included in the Merritt Research database, combined to place in the weakest 13th percentile of all counties in the nation.

Like New Orleans, Philadelphia's cluster rank, which falls in the weakest 1% of all cities, has its limitations as a comparative example of the cluster model since the city and county are one and the same. Nevertheless, as mentioned earlier, its low ranking has direct negative implications for its overlapping fiscally troubled school district as well as potentially other governmental units in the wider metropolitan area. In general, weaknesses in the central city present economic and fiscal vulnerabilities in a region that can spillover to other governmental units if debt and tax liabilities are directly or indirectly passed along to taxpayers in the surrounding area. While parts of Philadelphia have been showing signs of economic revitalization and a youthful infusion of some new residents, a turnaround is far from complete. High indebtedness levels and overall weaker residential wealth levels are still negative influences on the city's individual CreditScope credit ranking, placing it in the bottom 4% of cities.

Two other major city/county areas that ranked in the bottom decile for cluster risk are particularly interesting: Pittsburgh/Allegheny County and Chicago/Cook County.

Recent trends for the city of Pittsburgh are somewhat optimistic with stabilizing signs evident in its population and employment statistics as well as reinvestment. Faced with severe issues of industrial dislocation spanning decades, the city has had it to steady itself after many years of economic erosion that displaced residents, its tax base and city finances. The pressures affecting the central city also had an adverse impact on Allegheny County and other governmental units in the area. Including Pittsburgh, four of the 17 cities that came under the state's financial distress emergency program (Act 47) were located in the county. For that reason, Pittsburgh is a classic example of the contagion risk problems that can spread from the central city to other governments around them. Since the cluster risk model ranked the city of Pittsburgh in the bottom 2% of all cities in our study, recent signs of its recovery remain a delicate challenge for the area. By the same token, the city's overall credit quality remains vulnerable, as measured by the CreditScope rank, placed it in the bottom 10% of all U.S. cities. Despite the fact that three other Allegheny County cities have received oversight under Act 47 and the 13 cities in the county included in our study showed a higher cluster risk as a group, these same cities suggest good fiscal management and somewhat better control over their own credit quality by registering a median CreditScope quality rank of a mid-range 42nd percentile ranking.

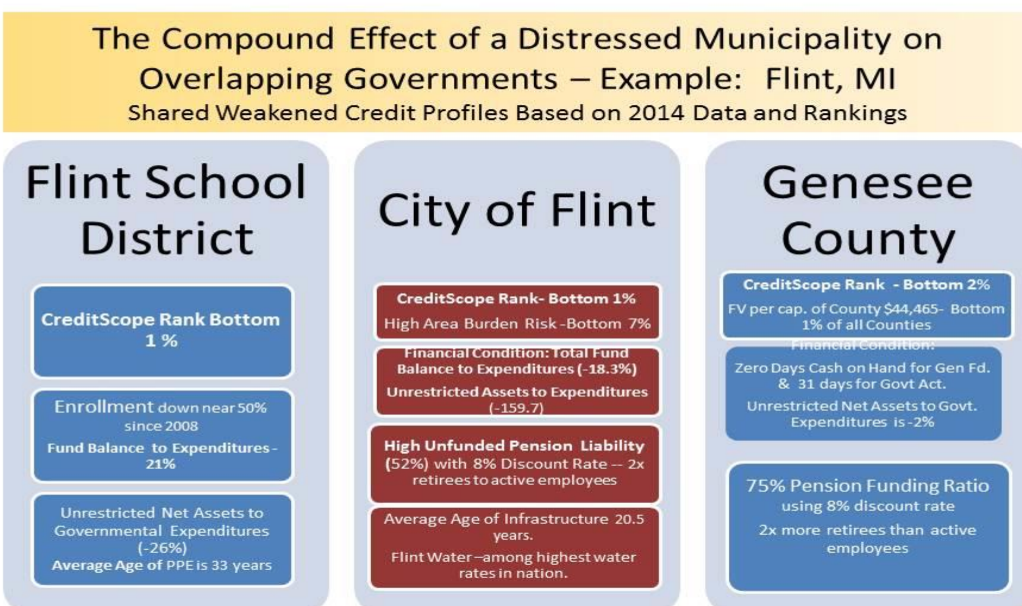
Chicago is probably the most interesting city to watch relative to cluster risk over the next decade or two. While it's economic base appears to be much healthier than most of the cities that are ranked low on the cluster scale and thus deemed vulnerable, the long standing deferral to pay down long term pension liabilities at both the local and state level, place Chicago as well as Illinois at the epi-center of this discussion. Relying on a plethora of positive strengths as a prominent global city, including a strong base of headquartered companies, outstanding academic institutions, vital transportation connections, trend setting architecture, tourism and a core of revitalized neighborhoods, Chicago would seem to be unlikely candidate for negative cluster risk. The breadth of its economic base and broad tax capacity present a strong argument that Chicago can muster the resources to handle its debt load.

On the other hand, Chicago's weaknesses, outside the pension exposure, are mostly related to the socioeconomic ills in the poorer sections the city. Recent population statistics have shown some slippage due to slowing in-migration to the city from foreign countries and mild exodus of less affluent residents to the suburbs or out of the state. These demographic issues are a factor but not the primary reason that Chicago ranks as one of the most vulnerable cities in the nation relative to be a source of cluster risk in the area. Its bottom 2% rank is primarily due to its huge debt and pension liabilities as well as the likelihood that major tax increases will be needed to cover the burden. These factors also contribute to Chicago's weak CreditScope credit quality rating that also puts it in the lowest 2% of cities. The condition is exacerbated by the fact that both the overlapping local governments as well as the state will likely require higher taxes to fund their own unfunded pensions. The median cluster ranking (13% percentile) for the 42 cities included in the database for Cook County similarly reflect that individual nearby cities to Chicago are faced with weakened economic defenses to easily ward off contagion. The question for Chicago is whether taxpayers will demonstrate the will to accept gradual or steep increases or will walk with their feet to less taxing pastures. In the end, avoiding a situation in which taxes must go up while the tax base declines is critical to the challenges ahead. This concern applies to not only the city, but also to the overlapping governments and the cities which depend on Chicago in its region of influence. In many ways, knowing that an area is sensitive to an elevated cluster risk should be a cause and justification to work more closely together and with the state to fend off and mitigate cluster risk.

The Compound Effect of a Distressed City on Overlapping Governments – Flint as Example

The City of Flint is at the center point of distress for the area that it is located. They share the same tax base with Flint School District and an important part of Genesee County's economic base. Based on our cluster risk ranking they fall in the bottom 7% in the nation while their individual credit quality ranks even lower by its bottom 1% rank. The dramatic economic decline that has affected Flint's School District own credit standing as much as the city's as mirrored by a similar bottom 1% national ranking among all school districts. The county's credit ranking is hardly any better as it falls in the bottom 2% of the nation's counties despite the fact that Genesee County covers a larger land area than Flint.

Chart 13



Source: Merritt Research Services, LLC

Flint is a powerful ongoing example of how difficult it is to isolate the problems of a distressed city from its overlapping units of government and the dampening effect it has on nearby governments. The city of Flint, which has been under state emergency management, faces a host of problems that are characteristic of distress. Beginning with its negative balance financial condition, to its high unfunded pension liability that covers twice as many retired and inactive members as active employees to its aging infrastructure as measured by its 21 year average age of Property, Plant and Equipment. Adding salt to the wound, the recent scandal involving Flint lead tainted water suggests significant water plant improvements but its water rates are already among the highest in the nation. Following the same depressing profile, the school district has seen a near 50% decline in its enrollment since 2008 and a relatively ancient average age of its PPE at 33 years. Flint's problems have swept into the County too. The Full Value per capita of the County ranks it in the bottom 1% of the nation's counties so there appears to be little offsetting taxable property wealth there. As a cluster crisis widens, it bears pressure on the state government to become increasingly involved. If a crisis is in an earlier stage, intervention boards and emergency managers can help stabilize the situation. However, cutbacks that go too far can backfire as Flint saw with its water quality problem. Sooner or later, state grants or loan guarantees entail the upward spiraling effect of cluster risk to wider base of taxpayers.

The Municipal Bond Market and Early Detection of Cluster Risk

Municipal bond ratings and borrowing rates are inherently linked to credit quality. However, distinctions by the rating agencies are dependent on specific criteria that may not immediately exist for developing vulnerabilities like credit cluster risk. The same can be said for municipal bond pricing. While guilt by association borrowing penalties frequently arise whenever a distressed credit becomes public knowledge, the pricing evidence suggests that negative cluster risk are not always incorporated into borrowing costs. Market factors such as bond structure, tax exemption nuances, global credit conditions, supply and demand as well as absolute interest rate levels can diminish credit quality distinctions especially related to longer term susceptibilities, like cluster risk.

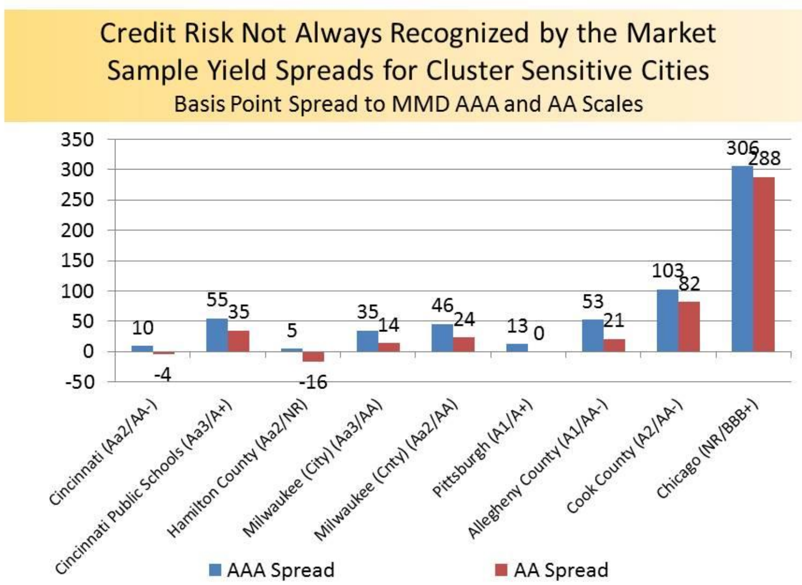
Since 2013, several high profile advanced stage distressed credit risk situations have gained widespread attention, such as those linked to Puerto Rico, Detroit and Flint. These cases have already revealed themselves as good examples of cluster risk situations in which related governmental units are dragged down by their relationships with the incipient distressed credit. Intensified credit scrutiny, credit ratings and borrowing rates have been lumped together to reflect their entanglement. The market is also well aware of the developing distressed cluster risk associated with Chicago Public Schools, City of Chicago and the state of Illinois. While the degree of distress has not reached the same level of severity of Puerto Rico and Detroit, they clearly epitomize the hazards of intertwined cluster as shown by their current ratings and market prices on their bonds. Ratings don't assign a specific rating for cluster risk because the concept vaguely represents an element that more closely resembles a propensity for being affected by a causal agent rather than the realization of an actual occurrence. Generally, market prices follow the ratings unless negative headlines or characteristics of fiscal distress begin to manifest themselves.

Given that cluster risk may not be evidenced in current ratings or prices on bonds, we examined the recent trading levels associated with sample of local governmental units related to four cities that showed cluster risk characteristics according to our model. The following cities and their Moody's and S&P general obligation ratings as of June 24, 2016 were included since they are had city centric cluster risk rankings in the bottom five percent of all U.S. cities: Cincinnati (Aa2/AA-), Milwaukee (Aa3/AA), Pittsburgh (A1/A+), and Chicago (NR/BBB+). The measure used to assess trading strength was to compare the most recent trading levels on specific bond issues associated with the credits to the MMD AAA and AA benchmark levels.

In most cases we were able to match trades with the MMD scale for the same day and same maturity; however, it was necessary in a few cases it was necessary to provide an approximate spread based on the best comparative benchmark scale information available. While this approach is not as precise as we would like, we believe that market volatility during the comparison time period was not material enough to distort our conclusions.

Except for the city of Chicago, we found that trading spreads on these cluster sensitive cities did not reflect any meaningful borrowing penalty. The fact that current quality spreads in the municipal market are compressed is due to these reasons: significant demand for fixed income tax exempt paper, a shortage of supply, relative safety for the asset class and low absolute rates. Moreover, trading levels are in generally in line with the AA MMD scale in line with the ratings assigned by the rating agencies. Chicago and Cook County, to a lesser extent, are outliers in that regard. Cook County, presents the best evidence that cluster risk may be a factor in bond pricing since it still holds a AA- rating by S&P; however, that argument is weakened by the fact that Moody's rates is at the mid-A level. The market shows no sign of recognizing any fiscal weakness or susceptibility to cluster risk in case of the city of Cincinnati or Hamilton County where recent quality spreads were so narrow that they even registered below the AA scale.

Chart 14



Sources: Emma Trade Activity data, The Bond Buyer, New Issue Scales and Thomson Reuters TM3. Trade data applies primarily to the period from 6/20/2016 to 6/27/2016 except for Cincinnati School Dist. (4/27/2106 and Milwaukee County (5/31/16). Milwaukee County trade reflects small odd lot purchase yield since no other recent trades available.

The municipal bond market can't always be counted on to signal negative cluster risk.
The fact that trading levels don't necessarily equate with cluster risk shouldn't dismiss the importance of using this concept as a longer term risk factor to determine an investor's appetite and the appropriate pricing for the bonds. We reinforce our contention that rating criteria is not necessarily designed to reflect the theoretical vulnerability of forward looking cluster risk. In June

2013, Moody's and S&P still had an Aa3/A+ rating on the city of Chicago and an Aa3/AA- on the Chicago Public Schools. Our concern is that the market doesn't fully integrate cluster risk into ratings and pricing until the impact presents a clear and present danger. The potential for contagion due to gradual regional economic erosion and burdensome regional fiscal policy eventually has the propensity to harm overlapping governments, suburbs and the region as a whole.

Recognizing Cluster Risk as a Strategy to Promote Intergovernmental Co-Operation

Acknowledging the reality and dynamics of cluster risk is a useful process for analysts, investors and the public to better identify cities and areas most in danger of credit deterioration.

From the investor's standpoint, wholesale market reactions to a superficial association with a single headline problem can result in little more than inefficient pricing phenomena unless there is knowledge and understanding of cause and effect patterns. Pricing cluster risk into the equation legitimately acknowledges incremental risk but also creates a market mechanism for incentivizing governmental officials to work together at a relatively early stage to promote co-operation and better long term fiscal planning.

Recognizing that a distressed credit situation can become a harbinger for scattering distress to a wider area might trigger pricing adjustments in areas believed to be in the shadow of the source of the problem. This is not to suggest that all governmental entities that fall within the perimeter of cluster risk are doomed to distress. Pricing might be adjusted modestly or not at all to the extent that they reflect management practices, individual economic fundamentals and bond security features that are unique to individual credits.

Serious cluster risk situations are not tied to one negative factor. Our research suggests that threat of serious cluster risk is more likely to be activated if there is a confluence of negative factors rather any one single cause. The negative effect of economic base erosion has to be assessed within the context of a variety of fiscal factors that are in line with degree of decline. Among the most important factors to watch for when assessing the potential for contagion are: overlapping debt and pensions, tax levels, active infrastructure management and the unique economic capacity of an individual governmental unit. These elements can inhibit or encourage cluster risk. The capability and political will of the state are also critical when sizing up the potential for contagion as well as treatment.

Proactive strategies to identify cluster risk situations before they become acute can lead to the advocacy and enactment of laws, policies and pacts that encourage better intergovernmental co-operation. Political leaders and citizens at all levels and governments throughout a region must recognize that it is in everyone's best interest to prevent and address fiscal distress before it spreads to other units of government and weighs down taxpayers, public services and local economic growth. Waiting too long can compound the enormity of fiscal consolidated cluster problems and require taxpayers to accept more extreme remedies. Awareness and agreement that fiscal malaise has the propensity to cluster and spread is a good first step to encourage governments to think long term, match debt and pension outstanding obligations to useful service lives, co-ordinate fiscal and economic planning, consolidate when appropriate, and formulate state policies that benefit the common good. Over the past 50 years, those inner ring suburbs that failed to prepare the days in which their metropolitan area was no longer the driving economic force that it once was are finding their own fiscal challenges to be harder to overcome.

Municipal bond investors, taxpayers and governmental officials are better off when they identify at an early stage the potential risk that state or locally derived fiscal malaise can become the catalyst of contagion impacting interrelated units of government, especially when weakened by economic or fiscal weaknesses of their own. Cautious investors might want to either avoid or seek risk premium penalties to compensate them for the potential threats.

This treatise is intended to provide an overview of the potential threat posed by cluster risk which is often overlooked until problems become advanced and obvious. The quantitative ranking model that was used in this study produced results that appear consistent with observable geographical concentrations of fiscal weakness. Nonetheless, it is intended to be a starting point for further analysis to fine tune risk assessment as well as a catalyst to promote discussion that contributes to common sense approaches for governmental entities to work together to solve their shared problems and challenges.

June 30, 2016

Don’t Waste a Free Lunch: Managing the Advance Refunding Option

Andrew Kalotay and Lori Raineri

Abstract

A callable municipal issue which funds a new project is usually eligible for advance refunding. Under favorable market conditions this enables the municipality to lock in lower interest rates prior to the call date; waiting until the call date exposes the issuer to the risk of higher rates.

The right to advance refund is an option, whose value depends on the issuer’s borrowing rate and on Treasury rates. Significantly, the Advance Refunding Option (ARO) is free to the issuer. While investors pay a lower price for a callable bond, the price is not affected by the bond’s eligibility for advance refunding. In fact, investors prefer advance-refundable issues for well-understood reasons — inefficient refunding decisions by borrowers, and the fact that advance refunded bonds trade up since their credit effectively becomes that of the Treasuries backing the remaining cashflows to the call date.

Some may argue that there is no free lunch, but the ARO is a notable counterexample. This is evident when the escrow yield is higher than the issuer’s funding rate to the call date. In this case, the present value of the cashflows to the call date exceeds the cost of the escrow. Thus the issuer can effectively repurchase the bonds below their fair market value. Hence municipalities should prefer an advance-refundable issue, and use the embedded ARO wisely.

An important consideration is that the ARO is exercisable only once in an issue’s refunding life-cycle. If an issue is advance refunded, its replacement is not advance-refundable. However if an issue is called (current refunding), a callable replacement keeps the ARO alive. In this paper we develop an analytical framework to help issuers and their advisors deal with this problem. First, we take an in-depth look at the value of the ARO and explore how it depends on coupon, maturity, time to call, and prevailing Treasury rates. We then use the results to make a recommendation about the advance refunding decision – do it now or wait? In order to answer this question, we extend the standard measure of refunding efficiency to incorporate the value of the ARO of the replacement issue.

Our analysis shows that incorporating the ARO of the replacement issue provides a slower signal to advance refund than when it is ignored. This is most noticeable within a couple of years of the call date. In practical terms, disregarding the ARO of the replacement issue may lead to a sub-optimal advance refunding decision. Close to the call date, locking in savings with

a hedge is preferable to sacrificing the advance refunding eligibility of the replacement issue. Sophisticated issuers and their advisors will want to factor these important results into their debt management practice.

Don't Waste a Free Lunch: Managing the Advance Refunding Option
Andrew Kalotay and Lori Raineri

Overview

Advance refunding is a common practice in municipal finance. It enables the issuer, under favorable market conditions, to lock in lower interest rates and thus reduce debt service *prior* to the call date. Waiting would expose the issuer to the risk of higher interest rates.

An advance refunding occurs when:

> . . . new bonds are issued to repay an outstanding bond issue more than 90 days before its first call date. Generally, the proceeds of the new issue are invested in government securities, which are placed in escrow. The interest and principal repayments on these securities are then used to repay the old issue, usually on the first call date.[1] (O'Hara, 2012)

Bonds issued to fund a new project (as opposed to a refinancing) are generally eligible for advance refunding.[2] The proceeds of the refunding issue are invested in an escrow portfolio consisting of Treasury bonds, which is structured so that its cashflows defease the original issue to the call date. Therefore the savings from advance refunding depend on both the issuer's refunding rate and on the yield of the escrow – the lower the refunding rate and the higher the escrow yield, the greater will be the savings.[3] In order to eliminate arbitrage, the yield of the escrow is capped by the yield (a slightly specialized version defined by federal regulation[4]) of the refunding issue.

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[1] See also the Municipal Securities Rulemaking Board's glossary entry for advance refunding, (http://www.msrb.org/Glossary/Definition/ADVANCE-REFUNDING.aspxfor advance refunding).
[2] State statutes govern refundings of local government bonds. The U.S. Internal Revenue Code (See 26 U.S. Code § 149) makes the distinction between advance and current refundings.
[3] The escrow yield determines the size of the refunding issue; the refunding rate determines that issue's debt service. Contrary to Congress's public policy objective of minimizing the volume of tax-exempt bonds outstanding, advance refunding in the presence of negative arbitrage has the opposite effect (low Treasury yields increase the cost of the escrow portfolio and therefore the size of the refunding issue).
[4] 26 CFR 1.148-4 - Yield on an issue of bonds.

The right to advance refund is an option. Significantly, this Advance Refunding Option (ARO) is free to the issuer. While investors pay a lower price for a callable bond, the primary market does not reveal any difference in price based on eligibility for advance refunding. In fact, investors prefer advance-refundable issues for well-understood reasons — inefficient refunding decisions and the fact that advance refunded bonds become rated AAA. Thus, with nothing to lose and something to possibly gain from an advance refunding, investors do not charge for the ARO.

An important limitation on the ARO is that once exercised, the replacement issue is not advance-refundable. By this rule, the IRS curtails the volume of tax-exempt bonds associated with the funding of a project. However, if the original issue is called[5], the ARO is kept alive in the replacement issue. In other words, the municipality can acquire additional value at no cost when it calls a bond and replaces it with one that is also callable. To summarize, the call option of a municipal bond can provide two related benefits to the issuer: to replace the outstanding bond with one with a lower cost, and, in case of calling, to obtain a free ARO. This gives rise to a challenging problem, not explored in this article: how to structure the call feature to maximize the value of the ARO?

An emerging trend in issuance is to include a 'make-whole' call (Kalotay, 2010) to the initial par call date (Weitzman, 2016). The make-whole price is determined by a fixed spread to an agreed upon benchmark yield, such as the AAA MMD yield to the regular call date. This feature enables the issuer to lock in interest savings prior to the regular call date, in a manner analogous to advance refunding. However, because the make-whole call price is higher than fair, there can be no free lunch in this case. If the bonds were advance refundable, the ARO could be preserved (which is not the case with advance refunding). But to date, the make-whole to call feature has been restricted to non-advance-refundable bonds. A plausible reason for this is that in an advance refunding the applicable call date and call price are the nearest ones – in this case the current make-whole date and price. This would effectively eliminate the possibility of a 'free lunch' in the event Treasury rates (which determine the escrow yield) exceed the issuer's funding rate to the call date.

Everything else being the same, an advance-refundable issue is preferable to one which is not. Thus the ARO should not be relinquished without adequate compensation. As an extreme example, advance refunding shortly before the call date would be foolish, because by deferring refunding until the call date the issuer could obtain a new ARO at no additional cost. Of course,

[5] Throughout this paper, 'called' means 'current refunded'. A refunding that occurs more than 90 days prior to the call date is an advance refunding.

normally the situation is not as clear cut. If the contemplated date of advance refunding is several years prior to the call date, waiting would entail considerable interest rate risk. At the same time, negative arbitrage of the escrow (discussed below) tends to discourage issuers from acting.

In this paper we develop the analytical framework to help issuers and their advisors deal with this problem. First, we take an in-depth look at the value of the ARO and explore how it depends on coupon, maturity, time to call (lock-out), and prevailing Treasury rates.[6] We then use the results in the second part to make a recommendation about the advance refunding decision – act now or wait? In order to answer this question, we will extend the standard measure of refunding efficiency to incorporate the ARO of the replacement issue.

What is the Value of an ARO?

As discussed above, the value of an ARO depends on both the municipality's borrowing rate and on Treasury rates, the latter determining the yield of the escrow. While these rates are positively correlated, the correlation is far from perfect. A discussion of the co-movements municipal and Treasury rates is beyond the scope of this article. Note, however, that the value of the ARO assuming no negative arbitrage does not require the modelling of Treasury rates. In the examples below the AROs are valued using Kalotay's proprietary approach; alternative approaches can be incorporated seamlessly. Our objective is to develop a method to determine the optimum refunding policy, assuming that the required ARO values are available.

The total optionality of the bonds under consideration can have as many as three components: the right to call, the right to advance refund, and the right to issue a replacement bond which is advance-refundable (for now, we will not consider the third component). We define the value of the ARO as the residual, after removing the values of the other options from the total.

Table 1 displays the assumed prevailing interest rates for both the issuer and the Treasury. In accordance with current practice (Kalotay, 2012), the issuer's rates are expressed as YTC's for 5% NC-10 bonds. Table 1 also shows the issuer's par non-callable (NCL) curve implied by the 5% NC-10 curve, assuming that the issuer's yield curve follows a lognormal process with 15% volatility. This volatility is used for all the examples below.

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[6] Escrow portfolios may consist of Treasuries purchased in the open market or lower-yielding 'State and Local Government Securities' (SLGS, colloquially 'slugs') issued by the U.S. Treasury for this specific purpose.

Table 1: Interest Rate Assumptions

Maturity (yrs)	1	2	3	5	10	15	20	25	30
5% NC-10 Yield (%)	0.50	0.81	1.09	1.40	2.15	2.62	2.91	3.10	3.19
Par NCL Yield (%) @ 15% vol	0.50	0.82	1.11	1.43	2.21	3.15	3.48	3.62	3.63
Treasury Yield (%)	0.58	1.03	1.30	1.74	2.25	2.50	2.66	2.89	3.00

Source: MMA, Bloomberg

Our 'base case' will be 5% NC-10 bonds, which are the current standard. Because 5% is well above the prevailing rates, these bonds are priced at significant premiums over par, depending on maturity, and they are excellent candidates for advance refunding. We will explore how the value of the ARO of 5% NC-10 bonds depends on maturity and Treasury rates, and then investigate the sensitivity of the results to other factors, namely coupon and lock-out (but not volatility).

5% NC-10 Bonds: No Negative Arbitrage

As discussed earlier, the allowed yield of the escrow is capped by the yield of the refunding issue. Everything else being the same, the most favorable case, i.e. the one that maximizes the value of the ARO (and minimizes the size of the refunding issue), is when the escrow yield achieves the refunding yield. The terminology for this case is that 'there is no negative arbitrage' (Kalotay and May, 1998, and Zhang and Li, 2004). Under the current conditions of historically low Treasury rates value of the ARO is significantly smaller.

To begin, we observe that the term 'no negative arbitrage' is a misnomer, because it implies that an escrow yield lower than the issuer's refunding yield is a 'bad deal'. In fact, the critical threshold of the escrow yield is the issuer's *funding yield to the call date*, rather than the (higher, longer-term) refunding yield. From the issuer's perspective, an escrow yield higher than the issuer's funding rate to the call date gives rise to an arbitrage (free lunch), because the fair value of the to-be-defeased bonds would then exceed the cost of the escrow portfolio.

Free Lunch Example

Consider advance refunding a 5% 20 NC-10 bond with 15 years left to maturity, i.e., 5 years to the call date. This bond would be trading at a price reflecting the certainty of being called, assuming the issuer's credit is roughly in line with the benchmark curve shown in Table 1. So, its fair value would be about 117.33 (YTC of 1.40%, the 5-year yield in the table). The refunding yield (maturity-matched 5% 15NC-10) would be 2.62%. This would be the 'no-arbitrage' cap for the yield of the escrow portfolio of Treasuries. In other words, if Treasury rates were high enough, the escrow portfolio would be permitted to earn as much as 2.62%, making the cost of the escrow portfolio 111.09% of amount outstanding. In other words, the issuer would be able to extinguish an obligation with a fair value of 117.33 at a cost of 111.09 — a financial arbitrage of over 6 points in a (legally speaking) no-positive-arbitrage advance refunding. But even at the current 5-year Treasury rate of 1.74% there is a free lunch, because the cost of the escrow is only 115.60, which represents a 1.78 point of arbitrage *without* violation of the no-arbitrage rule. Ang et al. (2013) completely miss this point.

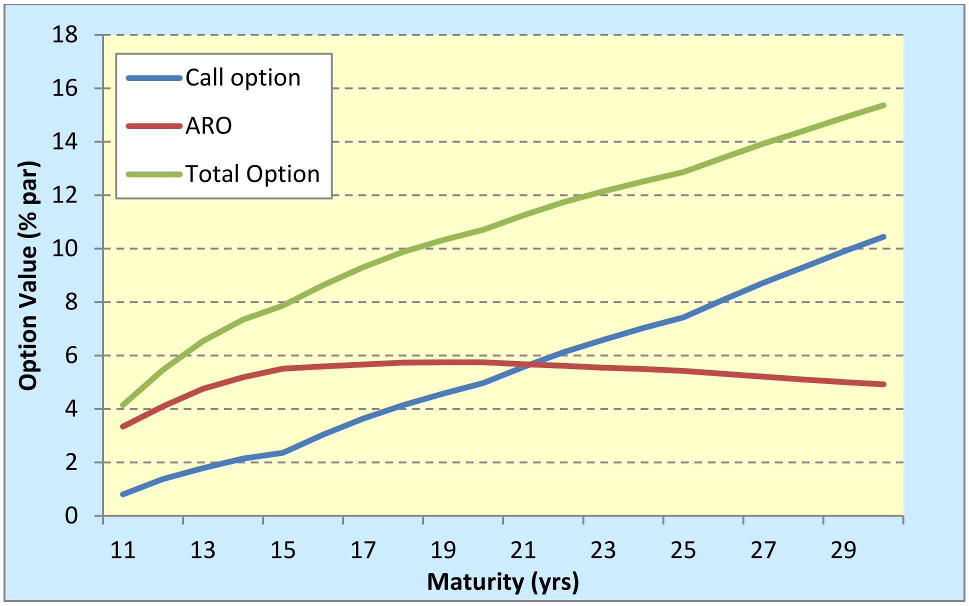
Issuers can raise the refunding yield, and therefore the legal cap on the escrow yield, by manipulating the structure of the refunding issue. Of course, in the current regime of low Treasury rates, there is little incentive to do so.

Figure 1 displays the value of the ARO for 5% NC-10 bonds of various maturities under the assumption of no negative arbitrage, along with the value of the call option. As shown, the total option value and that of the call option increase as the maturity increases. However the value of the ARO peaks between 15 and 20 years, at slightly below 6% of the face amount, and then gradually declines to about 5% for a 30-year maturity.

Under the 'no negative arbitrage' assumption Treasury rates do not have to be considered explicitly – all we need to know that the Treasury rates exceed the refunding yield.[7] In general, the value of an ARO does depend on the prevailing Treasury rates.

[7] Bankers used to 'assist' issuers in meeting the escrow yield cap by selling them Treasuries for the defeasance portfolio at lower yields (higher prices) than available in the market, a practice known as yield burning. For many years now, Treasury rates have been too low for yield burning opportunities.

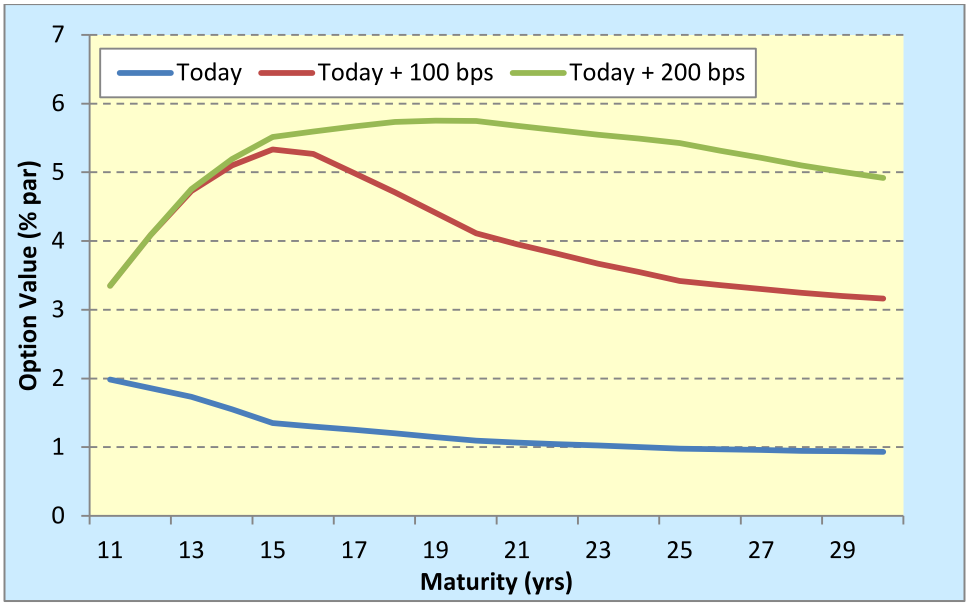
Figure 1: Option Values of 5% NC-10 Bonds Assuming No Negative Arbitrage



5% NC-10 Bonds: Dependence of ARO on Treasuries

Figure 2 displays the how the values of the AROs of 5% bonds with different maturities depend on Treasuries (today's, +100 bps, +200 bps). Here, we do not show the value of the call option, which is the same as in Figure 1. The +200 bps case is essentially the no negative arbitrage case considered above. As the maturity increases beyond 20 years, the value of the ARO gradually declines. As we have seen earlier, at the 20-year maturity the value of the ARO at current Treasuries is 1%, and at +100 bps it is 4%.

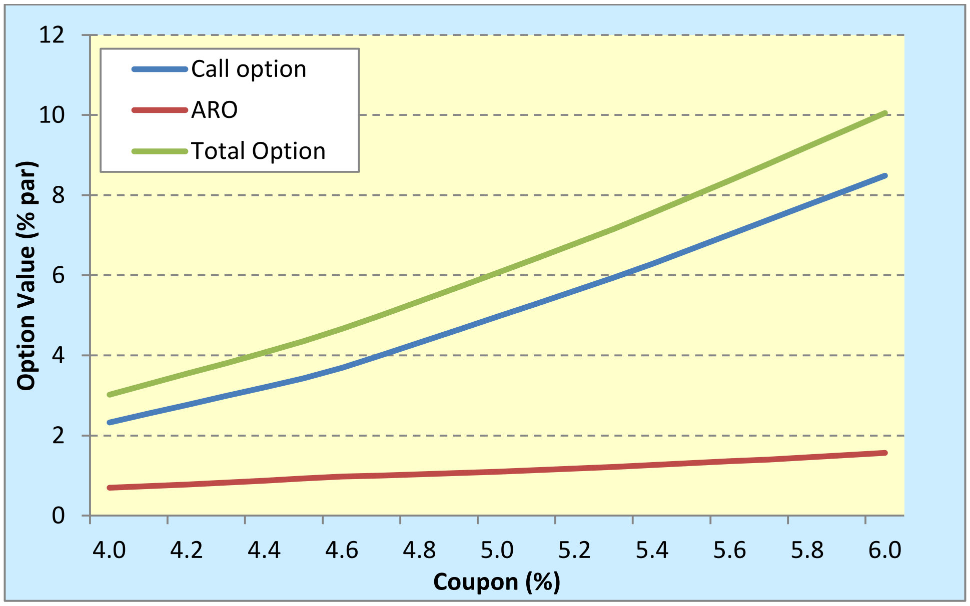
Figure 2: Sensitivity of ARO of 5% NC-10 Bonds to Treasury Rates



Coupon Effect for 20 NC-10s at Current Treasuries

Figure 3 displays how the coupon affects the value of the call option and the ARO for 20-year NC-10 bonds. As expected, the higher the coupon, the greater is the value of both the call option and the ARO, because there will be more opportunities to refund. The value of the ARO is around 0.75% at a 4% coupon, rising to 1% at a 5% coupon, and 1.75% at a 6% coupon.

Figure 3: Effect of Coupon on Option Value of 20 NC-10 Bonds (Current Treasury Rates)



20 NC-10's — Effect of Treasuries

Next, we'll explore the effect of Treasuries on the value of the ARO, keeping the issuer's current borrowing rate unchanged. Note that the value of the call option depends only on the issuer's borrowing rates.

Figure 4: ARO Value of 20 NC-10 Bonds – Sensitivity to Treasury Rates

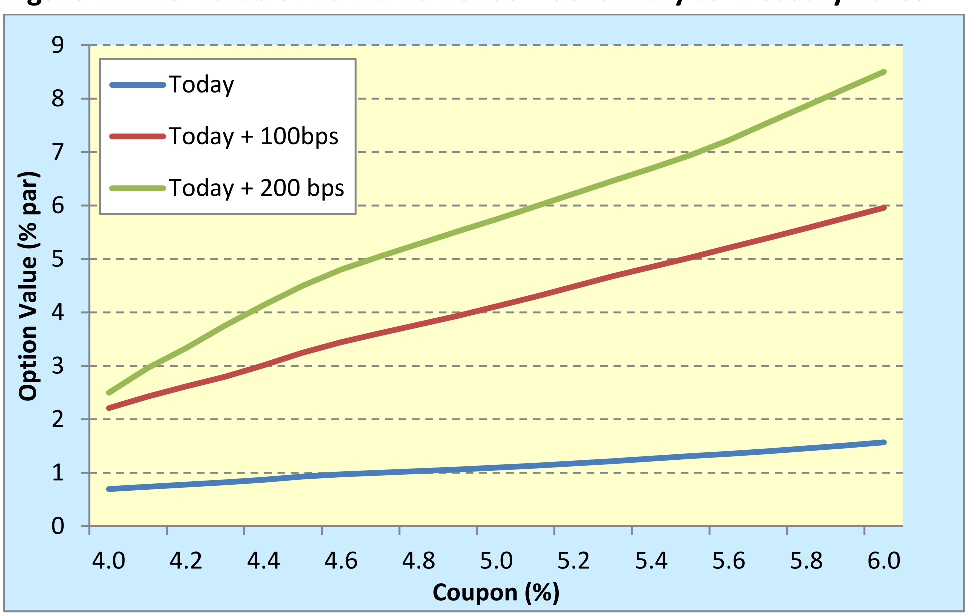


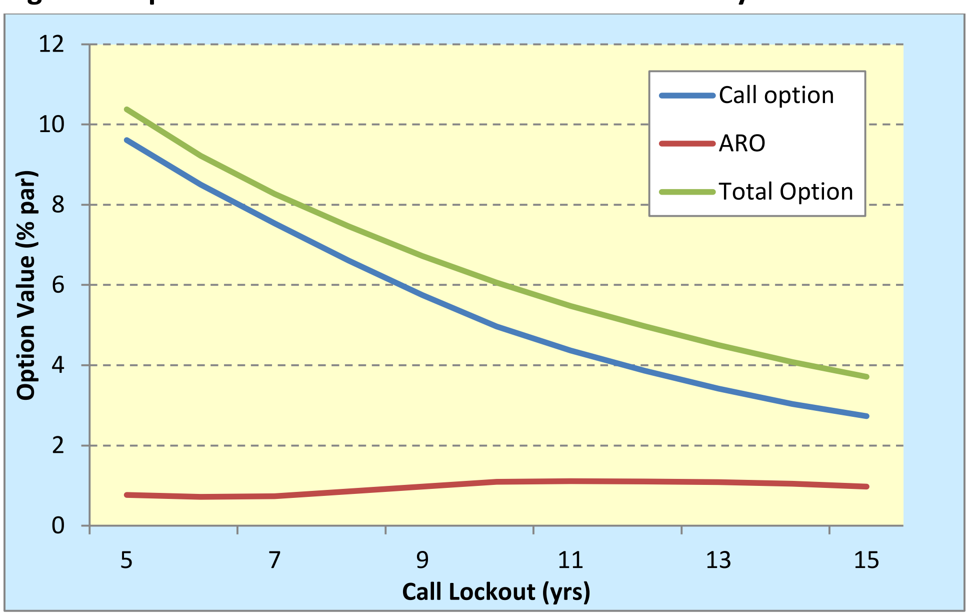
Figure 4 shows the values of the AROs for 20-year bonds, coupon ranging from 4% to 6% at current Treasuries, +100 bps, and +200 bps. Not surprisingly, the higher the escrow yield, the greater the value of the ARO. For example, at a 5% coupon increasing Treasuries by 100 bps raises the value of the ARO from 1% to 4% of the face amount.

Let's keep in mind that the issuer's borrowing rate is correlated with Treasuries. If Treasury rates increase, muni rates are likely to follow suit. Also, the value of the ARO does not increase indefinitely with Treasury rates, because the escrow yield is capped by the yield of the refunding issue (which, in order for the refunding to be beneficial, has to be significantly lower than the coupon of the outstanding bond[8]).

Effect of Remaining Time to Call

Figure 5 displays how the value of the call option and the ARO is affected by the lockout, for 20-year 5% bonds at current Treasury rates. A shorter lockout steeply increases the value of the call option (and commensurately reduces the price of the bond). Although a shorter lockout provides fewer opportunities to utilize the ARO, the value of the ARO is relatively insensitive to the lockout; at current Treasury rates it is roughly 1%.

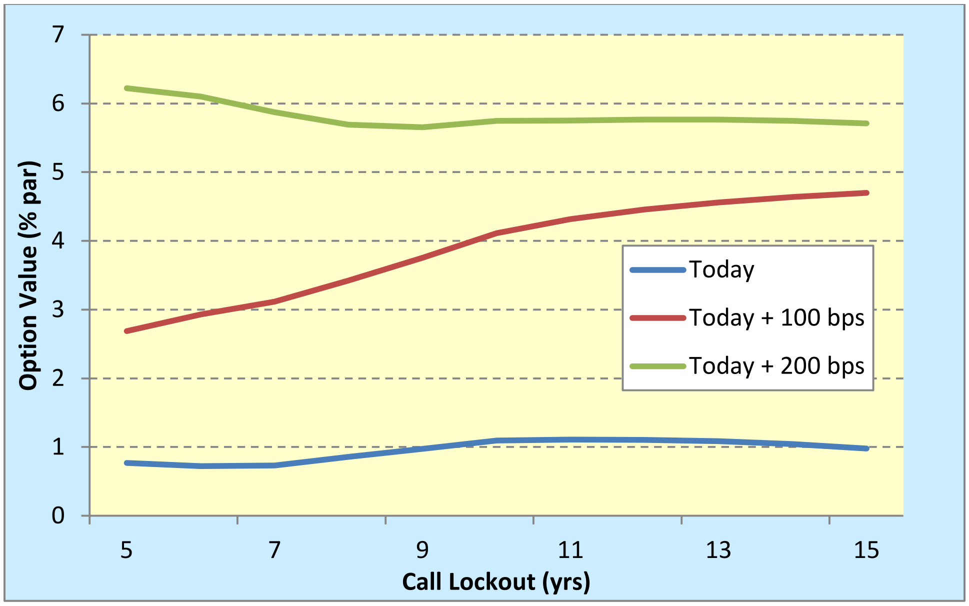
Figure 5: Option Value of 5% 20-Year Bonds – Sensitivity to Call Lockout



[8] Assuming the refunding is being done to achieve savings. Occasionally, refundings are executed to get out of cumbersome covenants, or for some other non-economic reason.

Figure 6 displays the relationship between lockout period and Treasury rates. As we have seen, at current Treasury rates, it is worth roughly 1 point virtually independent of the lockout period. In the no negative arbitrage case (+200 bps) it is worth roughly 6%, independent of lockout. Between these extremes the value of the ARO gradually increases, because there are more opportunities to use it.

Figure 6: ARO Value of 5% 20-Year Bonds – Sensitivity to Call Lockout and Treasury Rates



Recap of Factors Affecting Value of ARO

As shown above, the value of an ARO of a new issue depends on the interest rate environment – it varies from substantial to almost negligible. Because the ARO is obtained at no cost to the issuer, a callable bond which is eligible for advance refunding is a preferable to issuing a bullet. Transaction costs (not considered here) should be taken into account.

How the Refundability of Replacement Bond Affects Option Values

As previously mentioned, the value of the ARO is defined as the residual, after removing the values of the other options from total optionality. Advance-refundability of the replacement bond in the event of a call increases total option value. It also provides an incentive to wait until the call date and then issue a bond which is advance refundable. However, if the initial call date is in the distant future, we would expect this consideration to be relatively insignificant, in contrast to when the call date is imminent.

Analytical Framework for the Refunding Decision

Refunding is an option exercise. The primary benefit is cashflow savings, but it comes at a cost. Refunding today forfeits the option to refund the outstanding bond in the future. Advance refunding also forfeits the opportunity to advance refund the replacement bond. A callable replacement bond reduces the savings (because it increases the coupon or lowers the price), but provides additional option value in return.

We need a formula which, based on the above variables, provides a sensible recommendation for the refunding decision (act now or wait). In the absence of advance refunding, the recommended approach is to use the so-called generalized refunding efficiency (Kalotay, et al., 2007):

$$Refunding\ Efficiency = \frac{PV(Savings)}{Option\ Value_{old} - Option\ Value_{new}}$$

The numerator is the correctly discounted present value of the cashflow savings. The denominator is the difference between the option value being given up and that acquired through the replacement bond.

The maximum value of refunding efficiency is 100%. Once that level is reached the issue should be refunded; there is no incentive for waiting. Risk aversion may provide an impetus to refund below 100%. However, in that case alternative transactions such as hedging or market purchase should be considered.

The challenge is to incorporate the ARO into the refunding efficiency formula. The critical consideration is that the call option of the outstanding bond provides two potential benefits to the issuer: to refund at a rate below the coupon, and to obtain an ARO at no cost by issuing a callable replacement bond. Advance refunding forfeits both of these options. However, in the case of calling, the issuer can acquire a new ARO.

$$Refunding\ Efficiency = \frac{PV(Savings)}{Option\ Value'_{old} - Option\ Value'_{new}}$$

Option $Value'_{old}$ = Old call option + R + Old ARO, where R is the right to issue a replacement bond eligible for advance refunding
Option $Value'_{new}$ = New call option + New ARO

These option values depend on prevailing market conditions. (Perfectionists may include the negligible value of subsequent ARO’s, in the event the replacement bond is eventually called rather than advance refunded.)

Waiting until the call date preserves the right to advance refund the refunding issue. In that case the benefit would consist of cashflow savings, the call option of the refunding issue, and the ARO of the refunding issue.

Refunding Efficiency in Action: Examples

We consider an advance-refundable 5% bond, with original maturity 30 years, and explore the efficiency of refunding it at various times prior to the call date. In this case the replacement bond would not be advance-refundable. However, beyond the call date the replacement bond could be advance refunded.

We assume that the replacement bond is a maturity-matched 5% NC-10 structure. Thus if the outstanding bond is refunded at the end of Year 7 the replacement bond would be an 23-year 5% NC-10 bond, and if it is called at the end of Year 12 the replacement bond would be an 18-year 5% NC-10 bond.

The results for 3 years prior to the call date are shown in Figures 7 and 8. For illustrative purposes, we assume the value of the ARO in the replacement bond is 2% of the amount outstanding. In Figure 7, the results are under a 'no negative arbitrage' regime. Under this assumption both efficiencies are close to 100%, but it is higher if the new ARO is (mistakenly) ignored. The difference is striking during the year just prior to the call date: new ARO-aware analysis reduces the efficiency below 94%; otherwise it is essentially 100%, signaling incorrectly that the bond should be advance refunded. (Risk-averse issuers who recognize the value of the new ARO should consider hedging.)

Figure 8 considers the same decision under current market conditions. In this case the efficiencies are uniformly lower than those in Figure 7. As before, near the call date the efficiency in the case ignoring the new ARO is very close to 100% (recommending advance refunding), while in the ARO-aware case it is only 91% (recommending waiting until the call date). Note that two years prior to the call date the efficiency, ignoring the new ARO, is about 94%, while including it causes the efficiency to be significantly lower, roughly 86%.

Figure 7: Refunding Efficiency of Seasoned 30 NC-10 Bonds Assuming No Arbitrage

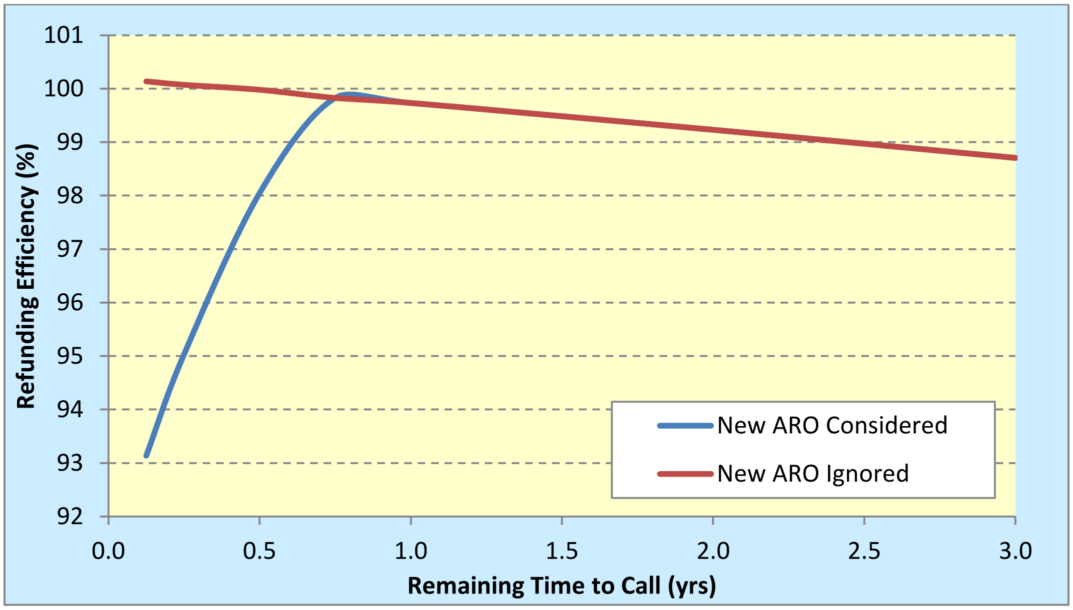
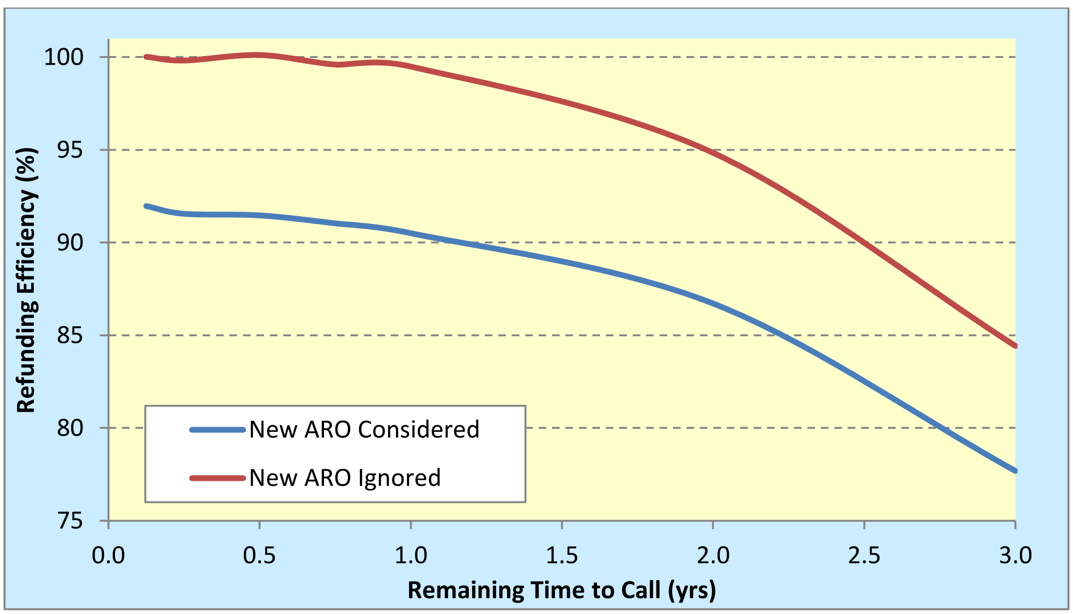


Figure 8: Refunding Efficiency of Seasoned 30 NC-10 Bonds Assuming Current Treasuries



Summary

A municipal issue funding a project may be eligible for advance refunding. Advance refunding is a valuable option; when the escrow yield is higher than the issuer's funding rate to the call date, the issuer can in essence repurchase the bonds below their fair market value. The advance refunding option is acquired automatically, at no cost, by issuing a fairly priced callable bond.

If the original issue is advance refunded, the replacement bonds are not advance-refundable. However, refunding beyond the call date preserves eligibility – there's a potential free lunch down the road.

To determine how the above consideration affects the advance refunding decision, we extended the refunding efficiency formula to incorporate the advance refundability of the replacement issue. Application of this formula reveals that close to the call date ignoring the ARO of the refunding bond favors the wrong decision of advance refunding. In such cases, it may be preferable to hedge the forward long-term rate, and then current refund as of the initial call date.

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FROM NIC TO TIC TO RAY:
CALCULATING TRUE LIFETIME COST OF CAPITAL
FOR MUNICIPAL BORROWERS

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We greatly appreciate the contributions of Delphis Hanover Corporation for municipal yield curve data used in this paper. Any errors are entirely our responsibility.

FROM NIC TO TIC TO RAY:
ESTIMATING THE TRUE LIFETIME COST OF CAPITAL FOR MUNICIPAL BORROWERS

Abstract: Cost of capital metrics for state/municipal government and not-for-profit borrowers have evolved over time from net interest cost (NIC) to true interest cost (TIC) to all-in TIC. However, each of these metrics is incomplete in that they all ignore the likelihood of refinancing given they are calculated using debt service to maturity. This is a significant shortcoming given the majority of fixed-rate, municipal bond issues are callable and issued with premium coupon rates that make future refinancing highly likely. This paper describes an improved lifetime cost of capital metric called Refunding Adjusted Yield (RAY). RAY incorporates refinancing probabilities utilizing the issuer's own refinancing criteria in calculating cost of capital. RAY offers significant advantages in optimal bond structuring and is a more comprehensive and complete metric for use in financial policy decisions involving true capital cost.

Key words: municipal bonds, public financial management, net interest cost, true interest cost, refunding adjusted yield

1. Introduction

Like private sector businesses, state/municipal governments and not-for-profit entities sell debt instruments to fund their capital and operating budget activities. These instruments, often called municipal securities, finance critical infrastructure like roads, bridges, and airports as well as societal institutions like schools, hospitals, and universities.[1] Total capitalization of the U.S. municipal securities market is approximately $4 trillion, representing roughly 2% of the world's financial assets.[2] Over the last ten years municipal borrowers have issued an average of $379.5 billion in long term fixed rate bonds per year.[3] Despite the size and significance of the market, the primary cost of capital measures employed by municipal borrowers today are fundamentally incomplete in that they fail to account for the likelihood of refinancing callable bonds for interest cost savings. Such failure reduces financial management transparency and can lead to suboptimal capital market policy decisions by these borrowers. This paper describes an improved lifetime cost of capital metric called Refunding Adjusted Yield (RAY) which incorporates refinancing probabilities utilizing the issuer's own refinancing criteria. RAY offers significant advantages in optimal bond structuring and is a more comprehensive and complete metric for

[1] This paper will refer to state, municipal and not-for-profit issuers of municipal securities as "municipal borrowers"
[2] McKinsey Global Institute estimated the value of all debt and equity worldwide at $212 trillion in 2010.
[3] *The Bond Buyer*, *Statistical Supplement*, 2016.

use in financial policy decisions that rely on cost of capital metrics.

2. Previous Research

Cost of capital refers to the cost of funds (usually equity or debt) required to finance an activity. For municipal borrowers this mainly entails the interest cost on their debt instruments since these entities generally do not sell equity. Prior to the 1970s, most municipal borrowers evaluated their cost of capital using the net interest cost (NIC) measure. NIC is calculated as the total amount of interest accrued in a bond issue less the amount of any premium or plus the amount of any discount divided by the product of the principal amount of the bonds maturing on each maturity date by the number of years from the issue date to their respective maturities. Beginning in the late 1960s and early 1970s, the NIC metric came under criticism as it did not take into account the time value of money. Hopewell and Kaufman (1974) evaluated the disadvantages of using NIC relative to true interest cost (TIC), a more internal rate of return-type metric that appropriately captures the time value of money. TIC is the rate that sets the present value of principal and interest payments equal to the net proceeds from the issue. If proceeds are further reduced by the costs of issuance at closing, this is called All-in TIC.[4] TIC is formally defined in the following equation:

$$\text{Net Bond Proceeds} = \sum_{i=1}^{n} \frac{P_i + I_i}{(1 + {}^{TIC}/_{2})^{t_i}}$$

where

TIC = true interest cost
i = scheduled payment dates for principal and/or interest
P = principal payment at date i
I = interest payment at date i
t_i = number of 30/360 semi-annual periods from issue date to date i
n = number of payment dates through final bond maturity

Subsequent research also criticized the use of NIC claiming it lead to flawed financial policy making. Braswell, Nosari and Sumners (1983) analyzed the use of net interest cost in evaluating which

[4] By convention, TIC and all-in TIC are calculated using semi-annual discounting and a 30/360 day count.

bond sale method, competitive or negotiated, results in the lowest borrowing costs. Their research used TIC rather than NIC to evaluate the sale method question as they claimed NIC was an inferior measure of the dependent variable in this line of research. More recent research continued to detail the benefits of TIC over NIC. For example, Benson (1999) estimated the cost to municipalities still using NIC instead of TIC in competitive bond sales.

Though TIC (or all-in TIC) is now used predominately by municipal borrowers for calculating cost of capital, it has been criticized in recent years for not being consistent or complete. Simonsen and Robbins (2001; 2002) note that some municipal borrowers calculate TIC to the dated date, while others calculate it to the delivery date with associated offset of accrued interest. Further, they point out TIC fails to incorporate the effect of other funds associated with borrowings such as capitalized interest or debt service reserves. For these reasons they conclude that standard TIC calculations understate true borrowing cost.[5] They introduce the concept of internal financing rate (IFR) which reflects payments on these funds, all issuance costs, and is calculated to the delivery date by definition. For these reasons, Simonsen and Robbins claim IFR is a more comprehensive measure in calculating the true cost of capital compared to TIC.[6] However, many municipal security offerings do not include capitalized interest or debt service reserve funds 9i.e., most general obligation bonds) so the benefit of IFR is limited to securities that include these funds.

3. Limitation of Previous Cost of Capital Measures

The evolution of cost of capital measures from NIC to TIC to IFR has certainly improved the accuracy and comprehensiveness of municipal bond borrowing cost calculations. However, all these previous measures fail to take into account a significant aspect of most municipal securities offerings: the

[5] We note that IFR appears to omit other costs of borrowing in the public markets such as trustee fees, meeting ongoing disclosure requirements, and tax compliance costs. If these estimates are identical across structures being compared, the relative attractiveness will not change. In that case, these costs may be safely omitted.
[6] This paper focuses on the limitations of TIC rather than IFR since TIC is much more commonly used by municipal borrowers. However, our criticisms of TIC can just as easily be extended to IFR since neither measure takes into account future refinancing impacts.

ability to call bonds early through refinancing which can result in lower lifetime interest costs. Specifically, the majority of municipal fixed-rate bond issues have optional redemption features that give the issuer the right to redeem the bonds at a specified price, usually par. Currently, these callable bonds tend to be issued with a premium coupon where the bond yield is calculated to the call date.[7] Despite this fact, the capital cost metrics in the existing literature and predominantly used in practice ignore call features, incorporating principal and interest calculations to maturity only.[8] Note that the net proceeds raised by the borrower are clearly impacted by the existence of this call feature: the left side of the TIC equation (i.e., net bond proceeds) is calculated assuming certain bonds are priced to their call date. However, the right side of the equation shows cash flows to maturity only and ignores the likelihood that the bonds may be refinanced to achieve nominal interest cost reduction.

This cognitive and calculated disconnect is significant as the call feature can be worth 5% or more of originally issued par relative to the bond's non-callable equivalent, particularly in light of the premium coupons commonly issued today.[9] This disconnect in TIC, by definition, results in an overstatement of municipal borrowers' true expected lifetime cost of capital because debt service used in the TIC calculation is assumed to run to maturity, even for callable bonds. The financial policy implications of this overstatement are far reaching and generally include 1) reduced transparency in bond borrowings that can be misleading to elected officials, rating agencies, investors and the public, 2) flawed decision-making in choosing optimal bond structures and in the timing and amount of future debt issues, and 3) inappropriate competitive bid awards. A fuller exposition of these policy implications is discussed later in this paper.

4. A Better Cost of Capital Measure: Refunding Adjusted Yield (RAY)

[7] See (Landoni, 2014) for optimal couponing by municipal issuers and optimal trading behavior by municipal bond investors. Also, see MSRB rules G-12(c)(v)(l) and G-15(a)(v)(l) defining when a municipal bond's yield is yield-to-worst.

[8] Though no formal research exists, an idea named "TIC+" also uses cash flows to maturity but proposes increasing the net borrower proceeds by some estimate of call value to lower the capital cost calculation.

[9] 5% estimate of call value worth is based on author's calculations which are available upon request

The problematic assumption of TIC that debt service will be paid to maturity is addressed by a concept we call refunding adjusted yield (RAY). RAY aims to incorporate the possibility that a municipal borrower will refinance a new municipal securities offering sometime in the future. In the parlance of the municipal securities market, these refinancings are known as “refundings”, a term we will use in this paper. In order to calculate RAY, we first must realistically model municipal refundings. Municipal refundings (and therefore callable municipal bonds) are complicated in part because their complete analysis involves not only different points on the yield curve (“tenors”) but even entirely different markets. As such there is some debate as to the appropriate type of model.[10] In this paper we use a real-world market model that offers the ability to capture multiple tenors from different markets simultaneously (Deguillaume, Rebonato, and Pogudin, 2013). The model by construction perfectly captures the historic covariance of each modeled tenor, both intra and inter-market. We create callable AAA, AA, A, BBB and state and local government securities (SLGS) escrow markets across 3 month and 1, 3, 5, 10, 15, 20, and 30 year tenors.[11] Data is derived from Apr 5, 1987 through Apr 5, 2012.[12] The starting and ending horizon yield curves for the borrower’s bond yields are shown in Figure 1.

[FIGURE 1]

In modeling refunding, we use the following assumptions:

1. Refunding bonds: assumed to be matched maturity par bonds; refunding bonds with maturities greater than 10 years are callable in 10 years at par
2. Refunding policy: 5% present value savings; refunding criteria are tested quarterly and a simulated refunding occurs on the same date criteria are satisfied.[13]
3. Advance refundings: only tax-exempt advance refundings are calculated.[14]

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[10] Such debate is beyond the scope of this paper. However, we feel the use of standard, lognormal bond option pricing models like Black, Derman, Toy (1990) or Black-Karasinski models are inappropriate for two primary reasons. First, the municipal market is not arbitrage free. Second, the purpose of the analysis from the issuer’s perspective is one of performance and risk management, not relative pricing in a no-arbitrage setting. For more details in the tax-exempt market see Orr & de la Nuez (2013). For a more general discussion see Nawalkha and Rebonato (2011).

[11] Although this is a 40 factor model as is, it can be extended to include interest rate swap curves, other fixed-income markets, currencies, and even investment returns. The covariance matrix for all simulated market elements is preserved and we are limited only by memory and computational resources.

[12] For market model details see Deguillaume, Rebonato, and Pogudin, (2013) and Orr and de la Nuez (2014)

[13] A more realistic assumption would be to introduce a 30 day lag between the time when criteria are satisfied and when refunding hypothetically occurs, though this has no effect on relative results.

4. Cash flow savings: interest cost reduction is taken in equal annual amounts starting from the simulated refunding date through the maturity of the refunded bond. Savings in short periods is pro-rated.
5. Costs of issuance: assumed one percent costs of issuance throughout.
6. Escrow cost: calculated using the yield to the call date from the escrow yield curve from the same simulated environment.
7. Present value savings: the difference between the then market value of the refunding bond, incorporating escrow and issuance costs, and the value of the refunded bond to maturity.

Based on the above assumptions, Figure 2 analyzes the interest costs on a hypothetical $10 million par bond with a 5% coupon rate maturing in 20 years callable in 10 years. One nuance in looking at true issuer capital cost is that the refunding bonds themselves may be callable, giving the issuer the ability to effectively refinance the original debt multiple times over the life of the project. We call an initial refunding of bonds originally issued to fund a project a "first generation" refunding. A refunding of the first generation refunding bonds is a "second generation" refunding. Figure 2 illustrates the difference in annual interest cost to maturity versus expected interest costs taking into account first and second generation refundings assuming a 5% present value savings policy as the refunding trigger. The black lines in Figure 2 show the difference between interest cost to maturity (solid) and expected interest expense (dashed). Note that the expected interest expense falls as first generation refundings lead to cash flow benefit. Close to year 10 we begin to see second generation refundings of the callable refunding bonds issued in the first generation. Probability of first generation refunding approaches 90% by the maturity of the bond (solid blue line, right vertical axis) while the probability of second generation refunding, tax-exempt refunding of the callable refunding bond, peaks at roughly 34% (dashed blue line, right axis). By the end of the ten years interest expense has dropped by over 10% to under $445,000. Armed with new expected cash flows, we can calculate RAY and compare this to traditional yields to call and maturity.

[FIGURE 2]

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[14] A natural extension would be to include taxable advance refunding bonds for those bonds ineligible for tax-exempt advance refunding.

Table 1 summarizes the various capital cost metrics. RAY1 is the refunding adjusted yield incorporating only first generation refunding savings. RAY includes both first and second generation refundings and, as expected, is a lower rate than RAY1, in this case by 11 basis points. Yield to maturity assumes that the debt service is paid through maturity.[15] Yield to call is the yield assuming debt service to the call date at which point the bond will be called for redemption. RAY is 11 basis points higher than yield to call and approximately 43 basis points lower than yield to maturity. Yield to maturity will always be an upper bound on RAY per bond, assuming the same target value for the yield.[16] Table 1 also shows the expected present value savings (as a percentage of refunded bond par) both for first generation refunding (EPV1) and total present value savings (as a percentage of refunded par) from both refundings (EPV). Given a 5% refunding policy threshold, EPV1 is approximately 5.2%. When the savings from second generation refunding is included, EPV savings increases another 40% to 7.29%. These expected present value savings estimates clearly illustrate that refunding savings should not be ignored when measuring expected lifetime costs of capital.

[TABLE 1]

5. How Municipal Borrower Refunding Behavior Affects RAY

Since a municipal borrower's call provisions are often either practically or legally fixed, the refunding decision embeds the borrower's risk preference. This risk preference relates to the timing in which a municipal borrower thinks it is most advantageous to refinance its debt. The risk preference is manifest in its debt policy when it describes the parameters acceptable to refinance debt. As described earlier, a common practice by municipal borrowers is to execute refundings when the present value savings exceed some threshold (e.g., 5% present value savings). This risk preference drives a refunding tendency that will impact the overall debt service an issuer expects to pay on bonds both individually and

[15] TIC is essentially the aggregate yield to maturity of all the individual bond maturities of a bond issue. We use yield to maturity instead of TIC in this section of the paper since we are only looking at one bond maturity not a bond issue.

[16] Though rare, there may be cases however where RAY is actually lower than yield to call. With sufficiently low borrower and high escrow yield expectations, simulated refundings will lead to a RAY lower than yield to call.

a debt portfolio. We quantify this relationship in Figure 3 for first generation refundings for two bonds, a 4% and a 5% coupon bond both with 20-year maturities but callable in 10 years, at different present value savings refunding thresholds ranging from 1% to 12%.

[FIGURE 3]

The horizontal axis in Figure 3 represents different refunding policies used to simulate refundings that ultimately lead to adjusting debt service for each bond. The yield to maturity for the 5% and 4% bond (dotted green and blue line respectively) are invariant to the change in present value savings policy, and in all cases above their respective RAY1s. Starting with a low 1% present value savings threshold, RAY1 falls as the threshold increases for the 4% and 5% bond (solid blue and green lines). This occurs because, as we move to the right in the chart, the lower probability of refunding is more than offset by the improved cash flow savings when refunding occurs. However, this relationship has its limits. A minimum is reached for both bonds indicating that the aforementioned tradeoff begins to tilt more towards the fact that refundings occur too infrequently to compensate for the higher savings threshold. At this point, RAY1 begins to rise.

Figure 4 extends the previous analysis in Figure 3 to include the second generation refunding as well. As shown in the figure, the RAYs have become much closer between for the 4% and 5% coupon bonds as the second generation refundings for the 5% coupon bond has a greater impact on RAY than those for the 4% bond. This is intuitive as refundings of the 5% bond are more likely to be themselves callable, and hence available for future expected debt service reduction. Most importantly for understanding an issuer's expected cost of capital, the RAYs for the 4% and 5% bond are 0.22% and 0.44% lower than their respective yields to maturity. Again, this illustrates the overstatement of capital cost using yield to maturity compared to a metric such as RAY that incorporates future refinancings.

[FIGURE 4]

6. NIC vs. TIC vs RAY – A Real World Example

Looking at a real-world example we analyzed the $387,025,000 State of Wisconsin's General Obligation Bonds of 2015, Series C, issued in September 2015. Pricing and maturity details for this issue are shown in Table 2. This bond series has a twenty-year final maturity (2036) and first call date on May 1, 2024 for the bonds maturing between 2025 and 2036. At approximately 8.5 years to the first optional redemption date, this issue has a shorter call feature than the standard, 10-year call accompanying most fixed-rate municipal bond issues. Principal and interest payments (i.e. debt service) to maturity are shown in the bars in Figure 5.

[TABLE 2]

[FIGURE 5]

The traditional NIC, TIC and all-in TIC calculations for this issue are 3.666%, 3.318% and 3.404% respectively. Using the AA simulation and the same refunding assumptions as those in the prior section, Table 3 shows the all-in RAY (assuming first and second generation refundings) for these bonds as 3.04% or 0.36% lower than all-in TIC. Assuming just a first generation refunding, the all-in RAY is 3.12% or 0.28% lower than all-in TIC. This calculation uses the same target value as all-in TIC but the principal and interest payments of the callable bonds reflect first or first and second generation refunding activity using the State's own refunding criteria. The State of Wisconsin's actual refunding criteria sets the present value savings threshold at 3% with sensitivity analysis on present value savings assuming interest rates decline in the future (see Note 2 in Table 3). Figure 5 shows aggregate debt service to maturity in the bars, and refunding adjusted (or expected) debt service in the dashed lines assuming first generation or first and second generation refundings. Note that starting from date of issue, simulated refunding activity occurs which gradually increases savings and decreasing expected debt service. However, as callable bonds begin to mature after the call date the amount of effective cash flows savings begins to decline and adjusted debt service moves back closer to debt service to maturity.

[TABLE 3]

Table 3 evidences the robustness of the RAY analysis by altering the bond refunding criteria. The table shows refunding adjusted statistics for this bond issue using five different refunding policies. Similar to the 4% and 5% coupon case, we note that the RAY is higher at the high and low present value savings thresholds and for the same reasons discussed above. But more important are the differences between these numbers and the all-in TIC of 3.40%. RAY is between 30 and 36 basis points lower than all-in TIC under all five refunding criteria. From a dollar budgetary perspective, TIC overstates lifetime capital cost for the state of Wisconsin on a present value basis by over $14.75 million, or nearly 4% of issue par.

A couple other statistical features of RAY are worthy of note as shown in Table 3. First, the aggregate probability of callable bonds being refunded goes downward as the present value savings threshold increases, as one would expect. However, the present value savings generally increase as the refunding threshold becomes more stringent (i.e., higher) which provides empirical support for issuer's adopting more stringent refunding policies. Second, the refunding adjusted weighted average life of the bonds is materially lower than the weighted average life to maturity which empirically shows how more traditional "to-maturity" bond statistics like TIC and weighted average life overstate an issuer's debt burden both in terms of total interest costs and term to maturity.

7. Policy Implications

There are several policy implications that emanate from our claim that RAY is a superior estimate of lifetime cost of capital for municipal borrowers compared to TIC. The use of TIC rather than RAY leads to flawed financial policy in several ways. First, an overstated cost of capital measure can lead to incorrect project selection in the capital budgeting process. Since project selection is often based on net present value analysis, an overstated discount rate will lead to a lower net present value, all else equal. This could lead to some "borderline" projects not selected even though they provide a positive net present value. Second, an inappropriate cost of capital measure will bias bond structure decisions towards alternatives with less refinancing flexibility. For example, using a capital cost measure that does not take into account the likelihood of future refinancing may result in a municipal borrower selecting coupon rates that ultimately result in higher interest costs over time. Third, overstated cost of capital measures inherently bias the bond structure decision towards the use of variable rate debt over fixed rate debt. Since TIC generally overstates lifetime interest costs, variable rate debt looks artificially more attractive given the historical interest cost benefit of variable rate compared to fixed rate debt.

The fourth policy implication involves the competitive bid process. By not taking into account the likelihood of refinancing, competitive bids with reduced call flexibility will be advantaged even though bids with greater call flexibility will likely result in lower interest costs over time assuming future refinancing(s). Fifth, municipal borrowers will understate debt capacity given the overstatement of interest costs. The understatement of debt capacity will make the pay-as-you-go financing approach more attractive than the pay-as-you-use approach, which may not be optimal. Finally, using overstated cost of capital measures like TIC reduces the financial management transparency of municipal borrowers. Citizens will overstate the future debt burden of their jurisdictions based on debt service as a percentage of revenues or expenditures metrics. Such overstatement can also compromise municipal borrowers' credit ratings as the rating agencies will rely on debt service disclosures by these governments in assessing their financial condition.

8. Conclusion

In this paper we show that there is significant value in using an alternative quantification of debt service costs of callable fixed rate bonds to TIC. We introduce a new measure called RAY that improves on TIC as a cost of capital measure because of its inclusion of future refinancing in its calculation. Through a calculation of expected debt service based upon a real-world market model and the issuer's own refunding criteria, we conclude that RAY provides a more accurate estimate of lifetime project financing cost. This is an important component of many essential financial decisions for tax-exempt borrowers.

However, since RAY relies on probability analysis in calculating cost of capital, RAY will likely never represent the actual cost of capital of a bond issue, just as TIC likely will not. Thus, this paper's analyses may raise more questions than it answers as it relates to the actual use of RAY. For bond structuring purposes, should issuers use debt service to maturity or refunding adjusted debt service?[17] How should RAY be incorporated in new issue bond structuring or refunded bond selection or both? This question also applies to debt capacity and feasibility analyses. Since RAY, as a mean, is essentially a first moment of an entire distribution of possible financing costs, should higher moments be explored? RAY volatility, a downside RAY or perhaps a "95% RAY-at-Risk," similar to Value-at-Risk so frequently used in the context of risk management? These questions all get at the overarching question of when is it more important to be approximately correct rather than precisely wrong.[18] In our case this question is very germane to the valuation of the call features embedded in callable municipal bonds in calculating cost of capital. Future research should build on the basic model presented in this paper to address these important operational questions.

[17] See forthcoming research, *Municipal Bond Structuring: Minimizing Lifetime Expected Borrowing Cost* from Intuitive Analytics

[18] Full credit to George Box's famous quote which we have paraphrased here.

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10. Tables and Figures

Figure 1. 10 Year Callable AA Yield Simulation

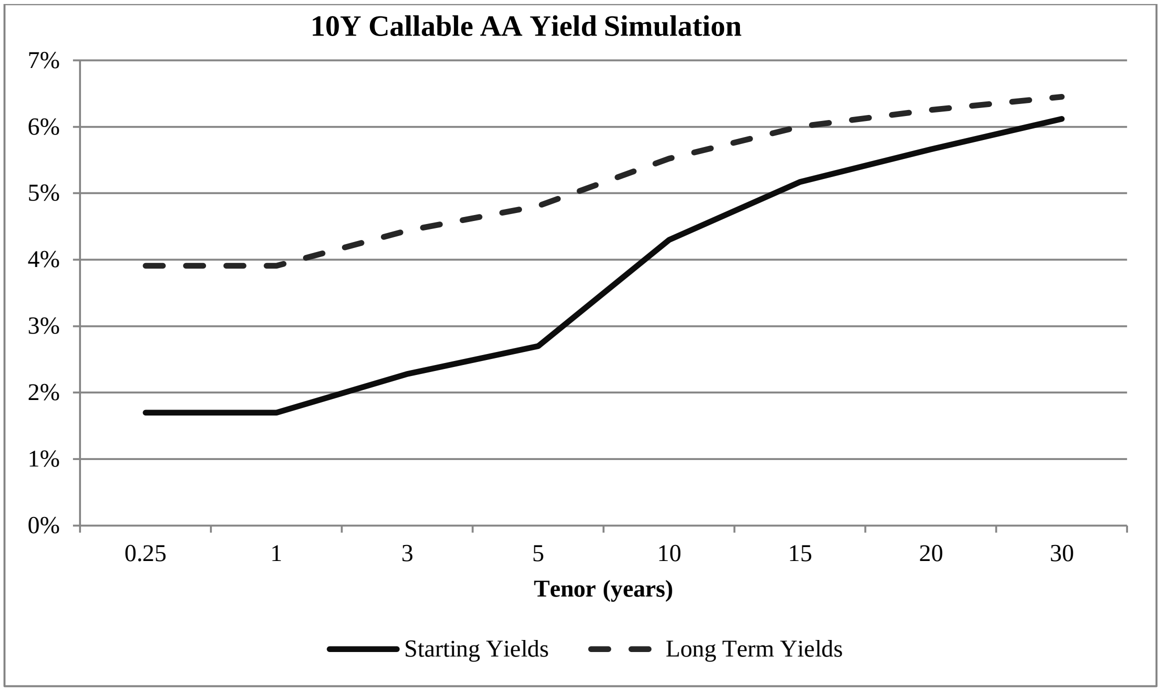

Figure 2. Refunding Adjusted Interest vs. To Maturity Interest / Refunding Probabilities

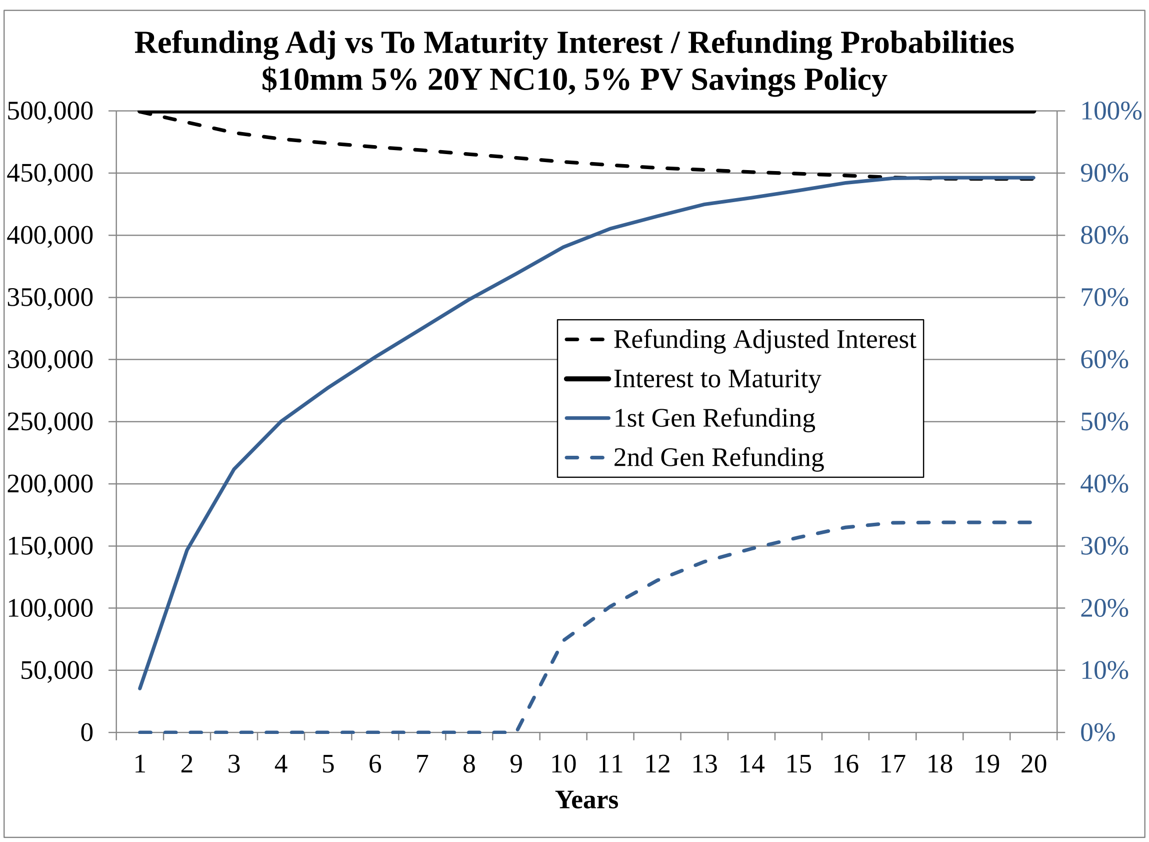

Table 1. Refunding Statistics

Hypothetical Bond 5% Coupon, 20 Year Maturity,10 Year Par Call, 5% PV Savings Refunding Policy									
Coupon Rate	*Maturity*	*Price*	*Refunding Adjusted WAL*	*EPV1*	*EPV*	*Yield to Call*	*Yield to Maturity*	*RAY1*	*RAY*
5%	3/1/35	111.670	11.4	5.187%	7.285%	3.60%	4.14%	3.82%	3.71%

Figure 3. Cost of Capital Comparison between TIC and RAY, 4% and 5% Coupons, 1st Generation Refunding Only

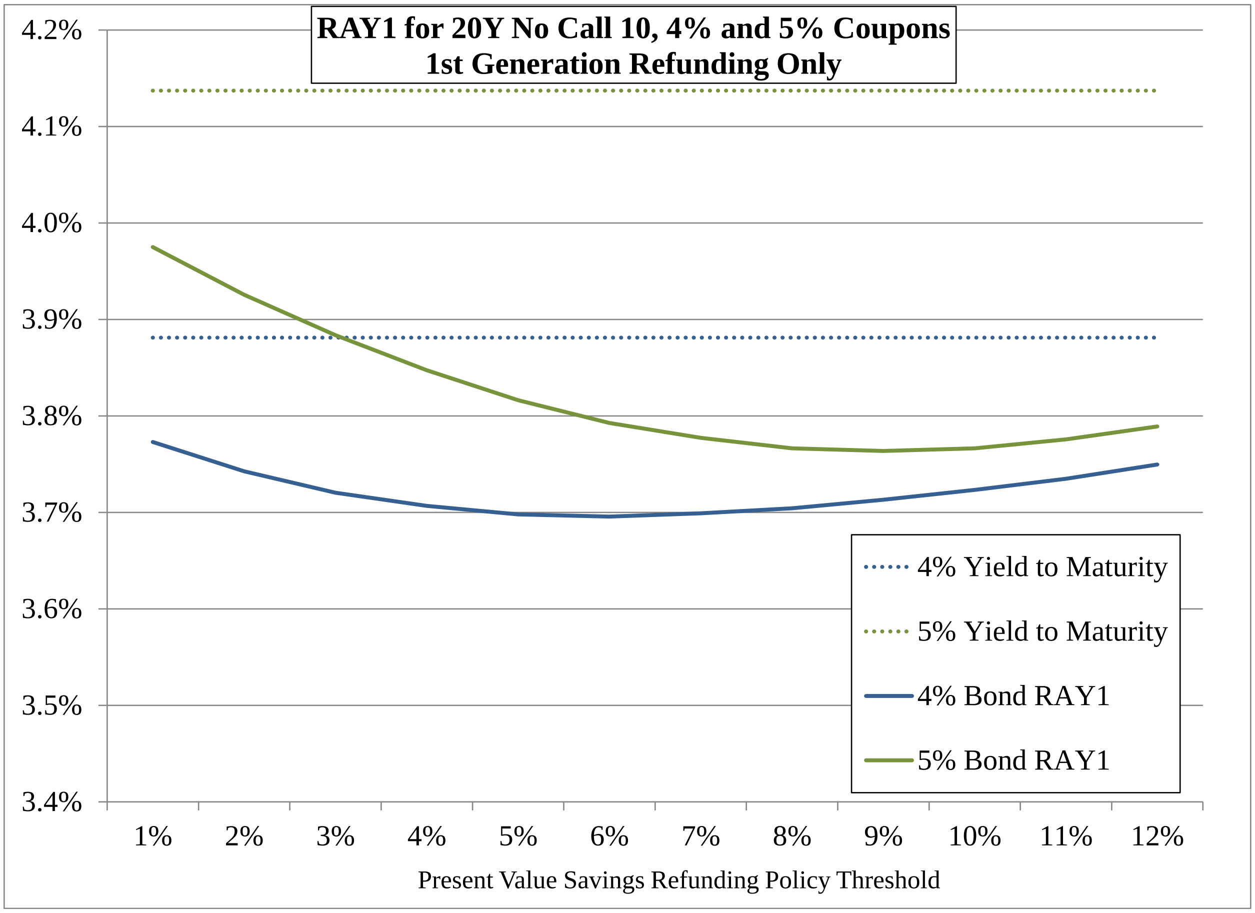

Figure 4. Cost of Capital Comparison between TIC and RAY, 4% and 5% Coupons, 1st and 2nd Generation Refundings

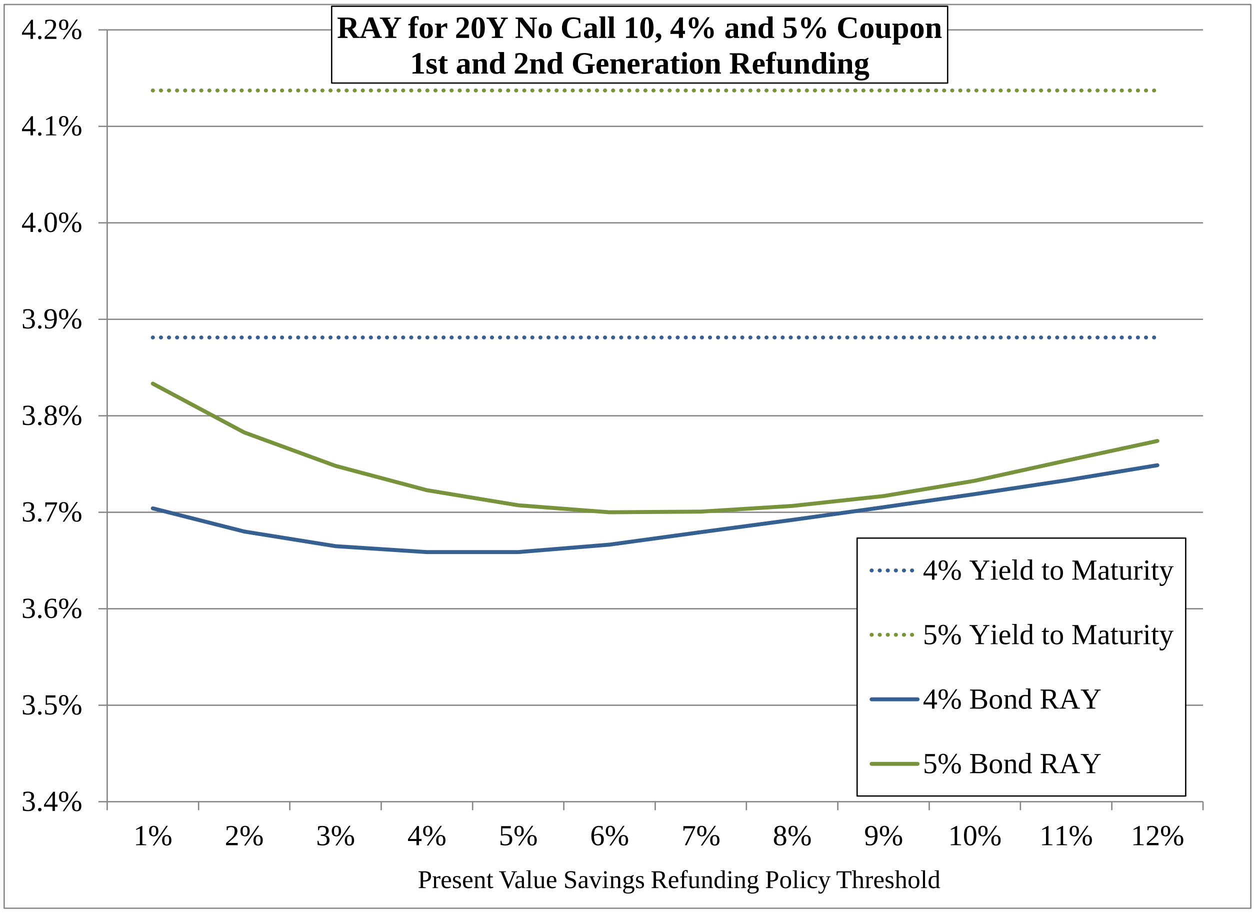

Table 2. Bond Pricing

$387,025,000 State of Wisconsin, General Obligation Bonds of 2015, Series C						
Maturity	*Par*	*Coupon%*	*Yield at Issuance%*	*YTM%*	*Price at Issuance %*	*Price $*
5/1/17	12,820,000	5.00	0.590		107.120	13,732,784.00
5/1/18	13,005,000	5.00	0.900		110.611	14,384,960.55
5/1/19	13,410,000	5.00	1.180		113.515	15,222,361.50
5/1/20	13,800,000	5.00	1.390		116.115	16,023,870.00
5/1/21	14,335,000	5.00	1.690		117.688	16,870,574.80
5/1/22	14,910,000	5.00	1.910		119.141	17,763,923.10
5/1/23	15,500,000	5.00	2.070		120.566	18,687,730.00
5/1/24	16,135,000	5.00	2.200		121.885	19,666,144.75
5/1/25	18,155,000	4.00	2.310	2.458	113.145	20,541,474.75
5/1/26	19,255,000	4.00	2.460	2.704	111.900	21,546,345.00
5/1/27	18,340,000	5.00	2.500	3.020	119.285	21,876,869.00
5/1/28	19,360,000	5.00	2.600	3.212	118.433	22,928,628.80
5/1/29	20,450,000	5.00	2.700	3.378	117.588	24,046,746.00

5/1/30	21,580,000	5.00	2.780	3.511	116.917	25,230,688.60
5/1/31	22,795,000	5.00	2.870	3.634	116.168	26,480,495.60
5/1/32	23,990,000	5.00	2.910	3.714	115.837	27,789,296.30
5/1/33	25,245,000	5.00	2.950	3.786	115.507	29,159,742.15
5/1/34	26,570,000	5.00	2.990	3.850	115.178	30,602,794.60
5/1/35	27,950,000	5.00	3.020	3.903	114.932	32,123,494.00
5/1/36	29,420,000	5.00	3.060	3.957	114.605	33,716,791.00
	387,025,000					**448,395,714.50**

Figure 5. Debt Service to Maturity versus Expected (Refunding Adjusted) Debt Service

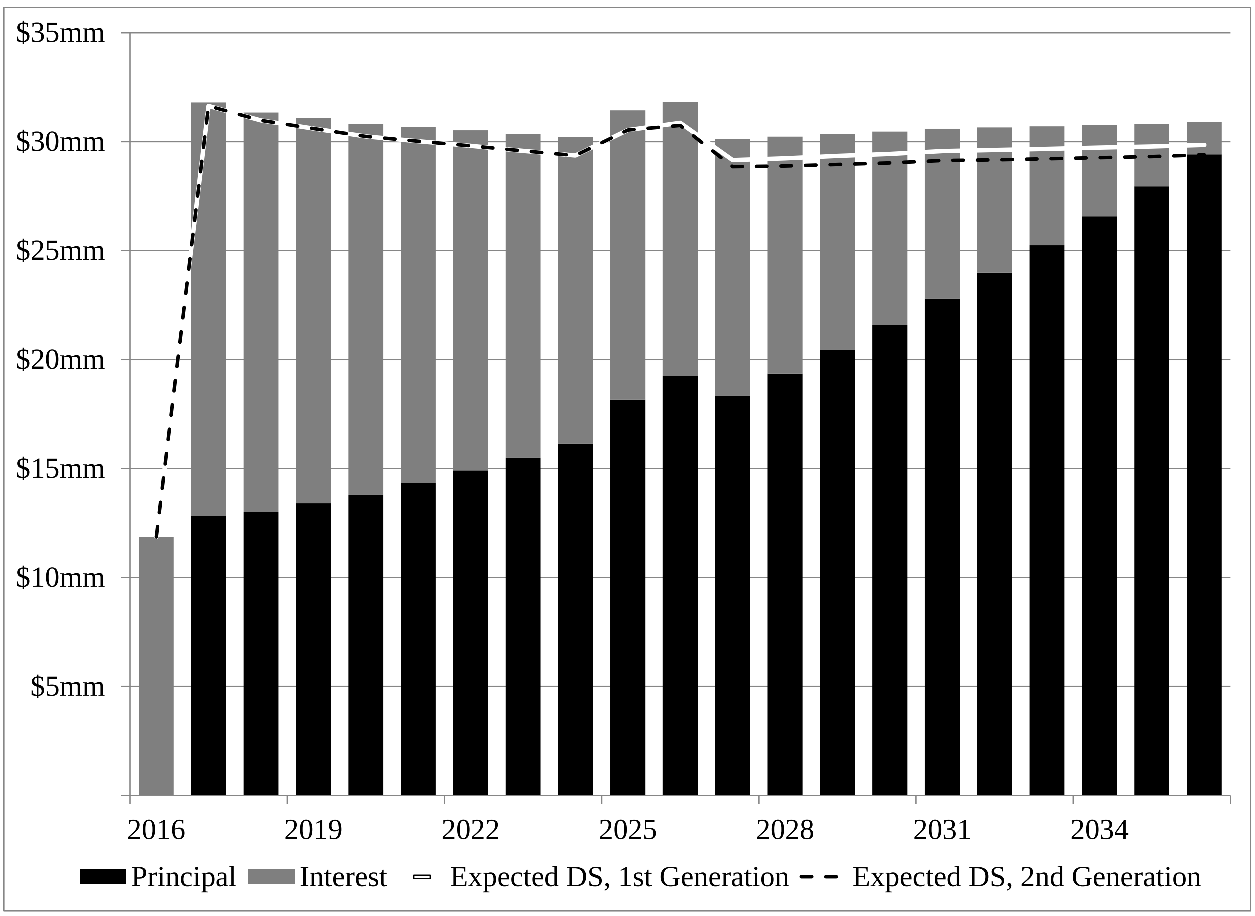

Table 3. Bond Summary Statitics

$387,025,000 State of Wisconsin, General Obligation Bonds of 2015, Series C Refunding Statistics Under Varying PV Savings Debt Policy Thresholds					
	Refunding Policy (PV savings as percent of refunded bonds Par, except "State")				
	State[2]	*3%*	*5%*	*7%*	*9%*
All-in-TIC[1]	3.40%	3.40%	3.40%	3.40%	3.40%
RAY[1]	3.04%	3.10%	3.07%	3.08%	3.10%
RAY1[1]	3.12%	3.18%	3.14%	3.12%	3.12%
Average Refunded	225,193,867	229,265,966	201,419,337	171,134,329	140,064,332
Probability Callable Bonds Refunded	82.46%	83.95%	73.75%	62.66%	51.28%
Average PV Savings, $	16,481,056	13,631,850	14,759,124	14,811,828	14,007,432
Average PV Savings, %	6.46%	5.35%	5.79%	6.28%	5.94%
Average Time to Refunding	4.18	3.2	4.3	5.0	5.7
Weighted Average Life (WAL)	12.6	12.6	12.6	12.6	12.6
Refunding Adjusted WAL	8.25	8.1	8.5	9.0	9.6

[1] Assumes a cost of issuance of 1% of par.
[2] State of Wisconsin actual refunding policy: 3% PV savings, 50% Opportuniyt Cost Index (OCI) sensitivity and 90% negative arbitrage / PV savings

Term Limits and Municipal Borrowing Costs

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This Draft: May 2016
Preliminary.

Abstract

Gubernatorial term limits constrain the number of terms the state governor can serve in office. Models with imperfect information where both voters and incumbents behave rationally show that Governors will spend responsibly in the first term to build political capital. In contrast, the last term of the Governor is associated with higher spending possibly on riskier long lived capital projects. In a sample of states with pre-existing gubernatorial term limits and state fixed effects, we find that municipal bonds issued when the Governor is serving his last term are associated with higher yields over the period 1990 to 2010. The reduced spending in the first term and increased spending in the last term induce greater fiscal volatility in states with Governor term limits. This is reflected in higher yields for all bonds issued from states when they have gubernatorial term limits. House term limits that constrain the number of terms served by state legislators are more recent and have been shown to be associated with higher government spending. We find higher yields for municipal bonds issued from states with house term limits. The difference in yield of municipal bond issues from states with both term limits and states with neither term limits could be as high as 16.37 basis points. The results point to the importance of political institutions in municipal financing costs.

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1. Introduction

State and local governments issue debt to finance development projects, fund emergency services, public schools, and utilities among others. In June 2013, there were $3.72 trillion in municipal securities outstanding. Municipal debt is backed by taxes of some kind: revenue bonds are backed by a specific revenue source while general obligation bonds can be paid by any tax revenue raised by the issuing government. The amount of government spending as well as the willingness to tax therefore have direct bearing on municipal debt.

Political institutions provide the framework under which states and municipalities operate. They create the rules governing economic actions and influence the economic performance of state and local governments. One important political institution is the existence or lack thereof of gubernatorial and legislative term limits. A term limit is a legal restriction that limits the number of terms an office holder may serve in a particular elected office. US states vary in whether they hold elected officials to term limits and this paper examines the impact of term limits on municipal borrowing costs.

The proponents of term limit argue that it limits veteran governors and legislators who might have become used to a “culture of spending”. Limiting “career” politicians allows for the infusion of a fresh breed of office holders that are likely to bring new solutions to old problems, along with an energy and vigor that is good for the government. Opponents argue that there are natural term limits in place as the voters have the right to remove elected officials from office. It has been argued that a term limited legislator could have higher incentives to shirk, that is behave in a manner inconsistent with the constituents preferences as he faces no fear of punishment in an upcoming election. If term limits affect state fiscal policy, they are also likely to impact municipal borrowing. Increased spending by the state competes with promised interest payouts on municipal bonds and increased taxation constrains the ability of the government to increase taxes in the future to cover interest payments on municipal bonds.

Besley and Case (1995) examine the effect of gubernatorial term limits in a model with imperfect information where both voters and incumbents behave rationally. Incumbents with higher first term payoffs to voters are more likely to be re-elected for a second term. Governors in their last term will put in less effort and have lower payoffs to voters compared to their first term. As incumbents place less value on reputation building and fiscal performance in their last term, government spending increases. Further, Crain and Oakley (1995) argue that with term limits current voters cannot make contracts with next period voters, and may limit future policy options by constructing a long lived capital project. If Governor's last term is associated with increased government spending possibly on risky long lived capital projects, then municipal bonds issued to finance these projects are likely to have higher yields.

We examine the effect of gubernatorial term limits on yields of new municipal debt issued over the period 1990 to 2010. There are a myriad of fiscal and political institutions that potentially impact fiscal policy and municipal offerings. To isolate the effect of gubernatorial term limits we include state fixed effects in all our estimations. State fixed effects are possible as there is significant variation across the different states in the US. Over the sample period, there are 10 states that had no Governor term limits, 29 states that had some term limits, and 11 states that changed from having no gubernatorial term limits to having some term limits or vice versa.

One concern is that gubernatorial term limits are not exogenous and fiscal conditions that prompt states to adopt term limits are likely to also impact municipal borrowing costs. To identify the potential effect of term limits we use the sample of bonds from 29 states that had term limits in existence prior to the sample period. The existence of gubernatorial term limits can be traced back to as early as 1790 and fiscal conditions in the past that were related to choice of having term limits or not, are unlikely to be related to current municipal debt offered. These states with pre-existing gubernatorial term limits have years in which the governor is eligible to run again for office and years when the term limit binds. In this sample, with the inclusion of state fixed effects we can isolate the difference in the municipal yield of bonds issued in the last term from the yield of bonds issued from the same state but in the first term of Governors.

In estimating the effect of Governor's last term on offering yields of municipal bonds, we control for a host of bond characteristics like proceeds, maturity, bond rating, general obligation bonds, negotiated contracts, credit enhancements among other bond characteristics and for macroeconomic variables we include matching treasury yield, term slope, and t-note. We also control for state economic characteristics like the ratio of state debt to state GDP, the ratio of state revenue to expenditure, state unemployment rate, marginal tax rate as well as state demographic characteristics like education, age, gender and race. Lastly, we include state and year fixed effects. We find that the offering yield on municipal bonds issued in the Governor's last term is significantly higher than that on bonds from the same states issued in periods where the gubernatorial term limit does not bind.

Municipal bonds issued in the last term are larger in size and are likely to be sold through negotiated contracts. The greater likelihood that last term spending involves large capital projects that are riskier, is reflected in the fact that the higher yields of last term issues are increasing in maturity and confined to revenue bonds and those sold through negotiated contracts. The evidence suggests that the higher yield of bonds issued in the last term of the governor reflect the riskier nature of the projects undertaken in the last term.

The higher and riskier spending in the last term of Governor arises from a diminished concern for reputation building in his last term. However, many governors have future political aspirations like running for the US presidency or the Senate. These continued political aspirations of governors should mitigate the effect of gubernatorial term limits on spending and municipal debt. To shed light on this we collect data on Governor's careers after they leave office and find that Governors that run for elected office subsequent to their Governorship are associated with lower municipal yields in their last term relative to those that do not display further political ambitions. This provides evidence in support of the channel that governors use fiscal policy to build political reputation that has a significant bearing on the cost of municipal debt.

Besley and Case (1995) show that another implication of their model is the greater fiscal volatility that arises from the higher spending in the last term and the lower spending in the first term of the Governor. Crain and Tollison (1993) also document that gubernatorial term limits lead to greater volatility in state fiscal activity. This greater fiscal volatility in the presence of gubernatorial term limits increases the risk of municipal debt and should be associated with higher yields. We test for this and find that after controlling for bond characteristics, state characteristics, state and time fixed effects, the offering yield for bonds issued when the states had gubernatorial term limits is significantly higher than the yield of bonds from the same states but in years with no term limits.

In contrast to gubernatorial term limits, there have been historically no term limits on state legislators.[2] By mid to late 1980's there was growing cynicism about government in general and legislatures in particular. In response to this public unease, citizen initiatives limiting the terms

[2] All 50 states, except Nebraska, have bicameral legislature made up of a smaller upper house and a larger lower house. The legislature approves the state's budget and initiates tax legislation among other duties.

of legislators were passed by voters in California, Colorado and Oklahoma in early 1990. Subsequently, 18 other states adopted term limits, but in four - Massachusetts, Oregon, Washington and Wyoming - term limits were thrown out by the state supreme courts, and they have been repealed by the legislatures in Idaho and Utah. As of 2010, there were 15 states with legislative term limits.

Moncreif, Neimi and Powell (2004) study legislative term limits and find, not unsurprisingly, that they are associated with significant increase in turnover for legislators. Cummins (2012) argues that higher turnover among legislators lead to short term fiscal outlooks and loss of experience and policy expertise. As myopic legislators avoid tough fiscal decisions and loss of experience hinders sound fiscal policy, legislative term limits are likely to be associated with poorer fiscal conditions relative to states with no legislative term limits. This is confirmed by Erler (2007) who examines legislative term limits and finds that they are associated with higher state spending. If legislative term limits are associated with greater state spending this is likely to be reflected in a higher cost of municipal financing.

Unlike gubernatorial term limits, legislative term limits have been more recent and heavily debated, raising concerns that changes in these term limits are not exogenous. Erler (2007) argues that (legislative) term limits are exogenous as their adoption is not correlated with the state's economic conditions but rather to the presence of the initiative process. The initiative process refers to the fact that in 23 states, citizens can propose and pass state laws directly-without recourse to their elected representatives-by means of initiatives. In the other 27 states and at the federal level, laws can originate only from the elected legislature. In every state with the initiative process, except one, voters have passed some form of legislative term limits. The presence of initiative process is uncorrelated with the present fiscal preferences of voters (Matsusaka (1995)).

Most direct democracy procedures such as the initiative process were adopted by states in the early 1900s, well before the start of the sample period under consideration. If the adoption of legislative term limits is related to the existence of the initiative process rather than to state fiscal conditions, it can be considered somewhat exogenous to municipal financings.

We examine the effect of legislative term limits on municipal borrowing costs, and find that bonds issued in the presence of legislative term limits are associated with higher yields. As we include state fixed effects, we can estimate the difference in yields of bond issued in years with legislative term limits from bonds issued by the same states in years without legislative term limits. The difference in borrowing costs between states that have both term limits and states that have neither term limits is 12.87 basis points. For an average municipal bond issue of $35.5 million this entails a difference of $45,688 in interest per bond per year. This difference between the bonds yields from states with both term limits and states with no term limits can increase to 16.37 basis points in years when the governor serves his last term.

We examine whether party affiliation has any impact on the higher municipal yields associated with gubernatorial and legislative term limits. We find that the party of the Governor has no impact on the effect of Governor's last term or the presence of gubernatorial term limits on municipal borrowing costs. We also find that whether one or both houses of legislature are controlled by the Democratic party or not does not have any impact on the role of legislative term limits on municipal borrowing costs. Lastly, there is no differential effect of term limits on municipal bonds when the party of the Governor also controls the legislature.

We contribute to the emerging literature on municipal debt by documenting the effect of term limits on the cost of municipal borrowing. Though budgetary and fiscal institutions are known to impact municipal borrowing, the finding in this paper is among the first to show that political institutions, specifically term limits also impact municipal borrowing costs. The findings reported here should also interest state officials, and a broader policy community especially as state fiscal problems intensify and access to and cost of municipal debt become important.

2. Literature Review and Hypothesis Development

The paper is related to several strands of literature. To begin with, there is a prior literature that looks at the effect of budgetary institutions on municipal bond markets. Poterba (1994) documents a link between tax policy and bond yields. Poterba and Rueben (1999) in a sample constructed from survey data on the current yields of general obligation bonds, available every six months from 1973 to 1995, document that stringent balanced budget restrictions are associated with lower municipal yields.[3] Capeci (1994) examines the effect of municipal fiscal policies, especially, its debt burden on municipal borrowing costs. In contrast to these budgetary institutions, term limits are part of a broader political structure that provides the framework for fiscal decisions. We also contribute to this literature by examining a substantially larger sample of municipal debt offering that spans the recent decade.

The paper builds on the finding of some recent papers that examine determinants of municipal bond offering yield. Butler, Fauver and Mortal (2009) examine municipal bond issues over the period 1990 to 2004 and find that bonds issued from states with higher corruption have higher yields. Bergstresser, Cohen and Shenai (2013) document that counties with greater ethnic

[3] Poterba and Rueben (1999) also examine tax or expenditure limits and document that states with expenditure limitation law face lower borrowing costs, and states with tax limitation laws face a higher borrowing cost. See Also Poterba and Pueben (2001). There is a large literature that examine the effect of fiscal institutions on fiscal policy (See Besley and Case (2003) for a survey)). Others have examined the effect of line-item veto (See Holtz-Eakin (1988), Bohn and Inman (1996)) on budgetary deficits. Zycher (2013) examines Tax and Expenditure Limits (TELS) and argues that they are not effective in reducing spending.

and religious fractionalization are associated with higher offering yields on their municipal debt. We control for state economic and demographic characteristics in our estimations. State fixed effects are included in all specifications to control for state corruption and ethnic composition as these change slowly over time. In robustness tests, we collect data to capture the time varying corruption for states, in line with Butler, Fauver and Mortal (2009) and find that it does not qualitatively change our results. [4]

Lastly, the paper is related to the literature on Term Limits. As discussed earlier, Besley and Case (1995) examine the effect of gubernatorial term limits in a model with imperfect information where both voters and incumbents behave rationally. In their model, incumbents with higher first term payoffs to voters are more likely to be re-elected for a second term. Further, Governors in their last term will put in less effort and have lower payoffs to voters compared to their first term.[5] Consistent with their model, Besley and Case (1995) find that the governors' last term is associated with increased state expenditures and taxes. Crain and Oakley (1995) find that gubernatorial term limits are associated with a greater likelihood of long term capital projects. They argue that the existence of term limits prevents current period voters from contracting with next period's voters and one strategy is to limit future policy options by constructing a long lived capital project. Municipal bonds issued to finance these long term capital projects that are not necessary needed, are likely to reflect the nature of these projects. As the nature of the projects they finance and the

[4] Other papers relevant to municipal finance are Green, Hollifield, Schurhoff (2007a) that document large price differences between trades on the same day potentially due to the opaqueness of the municipal bond market. Green, Hollifield and Schurhoff (2007b) construct measures of dealer cost and market power in the municipal bond market and examine its determinants. Harris and Piwowar (2006) study transaction costs in municipal debt markets and document that they are substantially higher than equity markets and decease with trade size. Shultz (2012) finds that post trade transparency in municipal bond trading reduced the dispersion of prices. Schwert (2015) decomposes the credit spread into liquidity and default components and examines the characteristics of default risk

[5] This prediction does not take into account that party of the governor may not want him to slacken in the second term, he may not want to slacken in the second term if he wants to run for further political office (in which case he wants to preserve political capital) and if there is too little discretion the governor has in setting policy

associated bond characteristics make the bond riskier, the bond issued is likely to be associated with higher yields. This leads us to our first hypothesis

H1: Municipal debt issued in the last term of the Governor has characteristics that are different from debt issued in other terms. Consequently, the municipal debt issued in the last term is likely to be associated with higher yields.

This higher taxation and spending in the last term of the governor suggests that states with term limits should have increasing higher taxation and spending in comparison to states without term limits. Besley and Case (1995) examine this and find that it is not the case: Gubernatorial term limits generate a fiscal cycle rather than higher aggregate spending. Incumbents in states with term limits spend less in their first term in office and more in their second term. Thus states with term limits have more volatile spending and taxation patterns than states without term limits. Crain and Tollison (1993) also document that the presence of gubernatorial term limits leads to greater volatility of fiscal activity. Though Besley and Case (1995) find no evidence of higher aggregate spending in states with term limits, Johnson and Crain (2004) examine term limits in an international setting and report an impact on aggregate spending. Johnson and Crain (2004) find that countries with one-term limits have higher levels of government spending over time relative to countries with no-term limits and countries with two-term limits. This prior evidence suggests that states with term limits are likely to have higher fiscal volatility and possibly higher spending over time. Consequently, the debt issued by these states will be riskier and associated with higher yields. This gives us the next hypothesis

H2: Municipal bonds from states with gubernatorial term limits are likely to have higher yields.

Note that this risk from increased fiscal volatility impacts all municipal debt issued by states with term limits irrespective of whether it is the last term of the Governor. In other words, the effect of Gubernatorial Term Limits is quite distinct from the effect of the Governor's last term discussed earlier.

As opposed to gubernatorial term limits, legislative term limits are relatively more recent. Popular wisdom that ushered in legislative term limits was of the view that these term limits would curb wasteful government spending and reduce the size of government. One fairly obvious effect of legislative term limits is increased turnover among legislators as shown by Moncreif, Neimi and Powell (2007). Though the proponents of legislative term limits were of the view that this increased turnover of "career" politicians will have a positive effect on fiscal policy, Cummins (2012) argues that higher turnover among legislator's leads to a short term fiscal outlook and loss of experience and policy expertise. Legislators subject to term limits are myopic and avoid tough fiscal decisions. Further, the turnover leads to loss of experienced legislators that hinders sound fiscal policy (See also Garri (2009)).

That legislative term limits may be associated with poorer fiscal conditions is confirmed by Erler (2007) who examines fiscal data from 47 states over the period 1977 to 2001, and finds that states have higher level of spending after the passage of term limits relative to what they had before. Erler (2007) discusses that possible changes in the power of committees and party leaders that arise due to term limits may account for the increase in spending. Legislative term limits reduces the power of party leaders to discipline rank and file members and reduces the gatekeeping role of committees due to increased turnover and inexperienced committee chairs (See Carey, Neimi, Powell and Moncreif (2006)). If legislative term limits are associated with poor fiscal conditions and increased spending, then municipal debt from these states will be associated with higher yields. This gives rise to our last hypothesis

H3: Municipal bonds from states with legislative term limits should have higher yields.

3. Data

The data on municipal bonds is from the Securities Data Company's (SDC Platinum) Global Public Finance database. We collect data on all new U.S. issues from 1990 through 2010. The initial data consists of 302,754 new tax-exempt municipal bond issues. We exclude bond issues with a maturity of less than a year, those that are taxable, and issues that are missing state name as well as issues from District of Columbia, Virgin Island, and Puerto Rico. This gives us a total of 255,617 bond issues. Requiring data on bond yields, bond rating and other characteristics restricts the number of bond issues to 99,325, the sample for this study.[6]

As seen in Table 1, the average bond issue in our sample raised about 35.56 million and had a maturity of 18.26 years and a yield of 4.84%. The bond ratings are numerical values of S&P ratings.[7] We use Moody's ratings when S&P ratings are unavailable. The average bond rating for our sample is 2.27, which is equivalent to an S&P rating between AA+ and AA. The worst bond rating in our sample is 9, which is equivalent to an S&P rating of BBB. Not surprisingly, the bond

[6] Municipal bonds are usually issued in series. A municipal offering will consist of the simultaneous offering of many bonds with a range of maturities and with separate CUSIPs. As these multiple bonds by the same issuer trade independently these have been analyzed individually in the papers that examine transaction costs in municipal bond market (See for example Green, Hollified and Schuruff (2007), Schultz (2012)). As we are interested in issuer state characteristics, we treat the municipal offering as one observation and bond characteristics included as controls are weighed averages of the individual series as reported by SDC.

[7] Following prior literature, we assign a numerical value to each rating on a notch basis, with 1, 2, 3, 4, ………. denoting AAA or Aaa, AA+ or Aa1 and so on respectively. Butler (2008) argues that Moody ratings are more likely to be unsolicited and hence likely to be downward biased (also see Butler and Rogers, 2012; Woolley, Schroeder and Yang, 1996). Therefore, we use S&P ratings.

ratings are investment grade and reflect the state's ability to increase taxation to cover the interest and principal payments on municipal bonds.

Many of the bonds have third party insurance referred to as credit enhancements. Nanda and Singh (2004) report that about 50% of municipal issuance in 2001 had these credit enhancements. We find that about 59.7% of the bonds in our sample have credit enhancements.[8] Revenue bonds are secured by a specific revenue source, for e.g. tolls, charges or rents from the facility built with the proceeds of the bond issue. In contrast, General Obligation or GO bonds are secured by the full faith and credit of the issuer and are usually supported by either the issuer's unlimited or limited taxing power. About 62.5% of our sample consists of GO bonds with the remaining being revenue bonds. As repayment for revenue bonds depends on the success or failure of the project they support, they are riskier than general obligation bonds and are expected to have higher yields.

Municipal bonds can be issued either through a competitive bid or a negotiated contract. In a negotiated contract, the issuer issues a Request for Proposal and potential underwriters submit written proposals. The underwriter is chosen based on these proposals and the terms of the bonds are generally tailored to meet the demands of the underwriter's investor clients, as well as the needs of the issuer. In a competitive bid, bonds are advertised for sale and include both the terms of the sale and the bond issue. Potential underwriters submit a sealed bid for purchasing the bonds with the winning bidder being the lowest bid received. About 57.1% of our sample is issued through a negotiated contract.

[8] As many of the third party insurers faced financial difficulties during the financial crisis, the incidence of municipal bonds with credit enhancement has declined significantly since 2008.

We also tabulate and control for the characteristics of the underwriters. In line with Butler, Fauver and Mortal (2009) we control for minority underwriters who account for 1.7% of the deals in our sample. Consistent with Megginson and Weiss (1991), we construct a measure for underwriter reputation. Underwriter reputation is captured by its market share, which is the fraction of total municipal bond issuance that are managed by the underwriter. The average market share of the underwriter for our sample is 2.5%.

States vary in the number of bonds and proceeds that are raised through municipal debt. Texas has the most bond issues over the sample period, about 12,683. California is second with 8,439 bond issues though the total proceeds raised by California is much larger (See Table 2).[9] We match the bond data with state level demographic data from U.S Census. As can be seen in Table 3, the average Debt/ GDP for states that issued our sample bonds is 5.5% with an unemployment rate of 5.86%.

4. Governor Last Term

We obtain gubernatorial term limits for all states over the time period of the study, 1990 to 2010 from Council of State Governments' Book of the States, and the National Governors Association. As can be seen in Panel A of Table 4, there are 10 states that had no term limits over the entire sample period. Among the 29 states with term limits over the entire sample period, 21 states did not change while 8 states made changes to the stringency of the term limits. In line with definitions used by Escaleras and Calcagno (2005), Gubernatorial term limits are classified as Weak if the candidate can serve two consecutive terms and then must wait for 4 years to run again,

[9] The states with less than 500 issues are not tabulated and include North Dakota, Rhode Island, New Hampshire, Maine, Idaho, Nebraska, Alaska, South Dakota, West Virginia, Montana, Vermont, Delaware, Hawaii and Wyoming.

as Moderate if candidates can serve two term limits and then never run again and as Strong if candidates cannot serve successive terms and states where candidates are barred from ever holding more than two terms. Only two states have a strong term limit over the sample period.[10] As seen in Table 4, there are eight states that had term limits over the entire period but changed between the different types. The remaining 11 states changed from having no gubernatorial term limits to having some term limits or vice versa.

To examine the effect of Governor's last term on municipal borrowing costs we estimate a multivariate model where the dependent variable is the yield on new bonds issued. The variable Last Term is a dummy that takes the value of one if bond was issued when the Governor of the state was in his second term and not eligible to run for re-election. About 23.2% of the bonds issued were in periods that corresponded to the last term of the Governor.

In estimating the effect of Last Term on municipal borrowing costs we control for several bond and state level characteristics. We include the natural logarithm of the size of the issue, bond maturity, bond rating and indicator variables for whether the bond has credit enhancements, is GO bond, a callable bond, and whether it was issued through a negotiated contract. We also control for underwriter characteristics by including the Underwriter Reputation and the Minority Underwriter dummy.

In line with prior literature in corporate bonds, we include three macroeconomic variables associated with yields on corporate bonds (See Collin-Dufresne et al. (2001), Longstaff and Schwartz (1995), Campbell and Taksler (2003), and Chen, Lesmond and Wei (2007)). First, we include the yield on the maturity matched treasury, referred to as Matching Treasury. Secondly,

[10] Missouri's Senate passed a bill in 2015 to extend Governor's Term Limit to two terms.

we include the difference between 10-year and 2-year Treasury bills, referred to as Term Slope, which captures the slope of the yield curve. Lastly, we include the one year Treasury bill rate, referred to as T-Note.

We also control for time varying characteristics of the states. Specifically, we control for the state's indebtedness by including the ratio of state debt to state GDP and state's fiscal profile by including the ratio of state revenue to state expenditure. The higher the state's level of debt and the lower its revenue the higher will be the yield on the municipal bonds. We also include log of state population and the state's unemployment rate.[11] Lastly, we control for demographic characteristics of the state. As the nature of the state's expenditures as well as the ability to finance them through taxes depends on the needs and income of the state citizens, their characteristics are likely to influence the cost of municipal debt. Specifically, as older populations provide a higher tax base, we include the median age in the state. A higher fraction of educated and male citizens with greater personal income and a higher ability to pay taxes reduces the risk on the municipal debt. We include the Education rate and male/female ratio to control for this. The details of the construction of all variables are provided in Appendix A.

4.1 Identification Issues

There are several characteristics like tax and expenditure limits[12] that differ across states and have an important bearing on the state's fiscal condition and the cost of its municipal debt. To

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[11] Larger states have a broader revenue base and likely to be less risky. States with high unemployment rate are likely to have lower revenues and limited ability to increase taxation to support bond payments and hence associated with higher yields.

[12] Broadly, revenue limits link allowable yearly increase in revenue to personal income or some type of index such as inflation or population. Expenditure limits, is the most common type of state TEL, and are typically tied to personal income or growth index. 30 states have passed legislation to put in place some kind of TELs. For 16 states the TELs were put in place prior to 1990 the beginning of our sample period. 7 states passed legislation prior to 1995 and 7 states had legislation subsequent to 2000. For more information see http://www.ncsl.org/research/fiscal-policy/state-tax-and-expenditure-limits-2010.aspx.

control for these state characteristics, other than term limits, we include state fixed effects in all our estimation. We also include time fixed effects to control for shocks to the macro economy or national politics that have a bearing on the cost of municipal borrowing.

The second issue in identifying the causal effect of term limits arises from the fact that term limits are endogenous. States choose to have gubernatorial term limits. If gubernatorial term limits are put in place at times when the fiscal performance of the state is worsening then the passage of term limits will coincide with increase in municipal yields. To address this issue we employ the strategy used by Besley and Case (1995). We estimate our model in a sample of bonds issued from states with term limits over the entire sample period.[13] As these states experienced no change in their term limits endogeneity is likely not to be a concern. Fiscal conditions in the past that might have given rise to term limits are unlikely to impact current yields on municipal bonds. In this sample, as the state fixed effects are included, the coefficient of Last Term captures the difference in the yield of bonds issued when the governor is ineligible to run again for office from the yield of bonds issued from the same state but in years when the governor is eligible to run again for office.

4.2 Empirical Results

The sample of bonds issued by states that had term limits over the entire sample period consists of 47,564 bond issues and account for 47.9% of the full sample. In this sample, the estimated coefficient of Last Term is a significant 0.0341 (See Model 1 of Table 5). Bonds issued

[13] We include states that had term limits over the sample period but changed the type of term limits within the sample period. We have also estimated the model in a sample of bonds issued from states with term limits over the entire sample period and with no change in the stringency of these term limit, with similar results. We have not tabulated these results for brevity.

during the last term of the Governor carry about 3.4 basis points higher yield than bonds issued by the same state but in years when the term limits do not bind.

As seen in Table 4, there are ten states that had no term limits over the entire sample period. Next we include bonds issued from these states. As they did not change term limits they are not subject to endogeneity concerns and their inclusion helps in the estimation of the municipal yield model. In this sample of 83,605 bonds from 39 states we continue to find a significant positive coefficient of 0.0446 for Last Term (See Model 2).

In Model 3, we restrict the sample to bonds issued by 11 states that changed their gubernatorial term limits within the sample period and are subject to endogeneity concerns. The coefficient of Last Term in this sample is estimated to be a positive significant 0.0311. As the coefficient continues to be significant and estimated with roughly the same magnitude it suggests that endogeneity is unlikely to account for the results. Finally, in Model 4 we estimate the model in the full sample, and the estimated coefficient of Last Term is a significant 0.0416. Bonds issued during the last term of the governor have to pay from 3 to 4.5 basis points higher yields relative to bonds issued from the same state but when the governor's term limit is not binding in line with Hypothesis 1.[14]

With respect to control variables, we find as expected that bonds characteristics are significant in determining offering yields. Bonds with better rating and credit enhancements have lower yields. Larger bond issues, bonds with higher maturity and those that are callable are all

[14] The state fixed effects capture the time invariant corruption levels in the state. However, for robustness, we control for corruption as captured by Butler, Fauver and Mortal (2009). Specifically, the dummy variable, Corruption, takes the value of one if the number of per capital convictions of local, state and federal official is in the top quartile for all states in that year. In untabulated results we find that including this corruption variable does not impact our results. As corruption in the state is unlikely to change substantially over time, these are captured by the state fixed effects and it is not surprising that the coefficient of Corruption is not significant.

associated with higher yields. General obligation bonds have lower yields while those issued through negotiated contract have higher yields. Not surprisingly, all the macroeconomic variables are significant. Several state level variables are also significant in explaining municipal bond yields. Bonds from states with higher debt level and higher unemployment carry a significantly higher yield. States with larger populations that are older, with a higher fraction of males and non-Hispanic whites have lower yields.

4.3 Nature of bonds issued in the Last Term

As discussed earlier, Crain and Oakley (1995) find that the last term of Governors' is associated with a greater likelihood of long term capital projects. Municipal bonds issued in the last term to finance these long term capital projects are likely to have characteristics that differ from bonds issued in other periods for operational budgets and other needs. We hypothesize that as these capital projects undertaken in the last period are large and long lived, the municipal issue is likely to be larger and with higher maturity. As seen in Table 6, the average proceeds raised from bond issues in the first term of Governors' is 37.74 million and significantly smaller than the 42.3 million raised in the last term. Note that as the sample for Table 6 only includes bond issues from states that had term limits over the entire sample period, this compares the proceeds of issues from the same states based on whether the term limits binds. To see whether larger size of the issues is one of the reasons why bonds issued in the Last Term have higher yields, we include the interaction of *Last Term Dummy* with *Proceeds* in the yield estimation model. As seen in Model 1 of Table 7, the coefficient of the interaction term is positive but not significant at conventional levels. Large bond issues in the last term are perceived to be more risky though the effect is not significant.

There is no difference in the average maturity of bonds issued in the first or last term of the Governor. The interaction of *Last Term* with *Maturity* is positive and significant (See Column 2 of Table 7). Though longer maturity bonds are always associated with higher yields (the coefficient of maturity is positive and significant), longer maturity bonds issued in the Last Term are perceived to be riskier and have significantly higher yields.

As the projects initiated in the Governor's last term are not undertaken for political reputation they may have relatively less support from the voters and citizens of the state. As payments to Revenue Bonds are tied to the specific project being financed, rather than paid by general tax revenues, they are likely to be more palatable to detractors of the capital project. Therefore, bonds issued in the Governor's last term are more likely to be revenue bonds. As seen in Table 6, there is no difference in the propensity with which revenue bonds are issued in the last term. Though not more frequent, revenue bond issues in the last term are perceived to have greater risk and are associated with higher yields. The coefficient of the interaction of *Last Term* and *Revenue Bonds* is positive and significant (See Column 3 of Table 7).

Lastly, selling municipal bonds through the negotiated contract offers more flexibility though it is more expensive. As the last term is not characterized by fiscal restraint, it is more likely to be associated with the use of negotiated contracts. We find that bonds issued in the last term are more likely to be sold through *Negotiated Contracts*. Whereas negotiated contracts account for 65% of issues in the last term they account for only 61% of bonds issued in the first term of Governors. As seen in Table 7, the higher yields in last term issues are confined to those sold through negotiated contracts. The coefficient of the interaction of *Last Term* and *Negotiated Contracts* is positive and significant.

We also check the incidence of credit enhancement. Though the use of *Credit Enhancement* is higher for bond issues during the last term, there is no difference in how it impacts bonds issued in the last term of the Governor. This is not surprising as once the third party insurance is purchased, the yields reflect the higher credit quality of the insurer that does not differ whether the bond was issued in the first or last term. In summary, the nature of the spending in the last term of the Governor causes the bond issues to be larger and more likely to be sold through negotiated contracts. The greater likelihood that last term spending involves large capital projects that are riskier, is reflected in the fact that the higher yields of last term issues are increasing in maturity and confined to revenue bonds and those sold through negotiated contracts. The evidence suggests that the higher yield of bonds issued in the last term of the governor reflects the riskier nature of the projects undertaken in the last term.

5. Gubernatorial Term Limits

The higher yield in the last term of the Governor, documented above, relative to bonds issued in the first term of the governor from the same state captures the variation in yields over time within the same state. However, as discussed in Hypothesis 2, bonds issued by states that have term limits are likely to be associated with higher yields. This captures the cross sectional differences in the yields of bonds issued in the presence of Gubernatorial term limits and those issued without term limits, irrespective of whether the term limits bind i.e., whether it is the last term of the governor.

In this section, we examine whether the presence of gubernatorial term limits has an impact on municipal borrowing in line with Hypothesis 2. Specifically, we create a dummy variable *Governor Term Limit* that takes the value of one for bonds issued if the state had gubernatorial term limits in place that year and zero otherwise. *Governor Term Limit* takes the value of one for all bonds issued from states that had term limits over the entire sample period as well as for years with term limits for states that changed gubernatorial term limit. In our sample, about 58.7% of the bonds were issued in state-years with Governor Term Limits.

We include *Governor Term Limit* in the yield estimation model with all the bond characteristics, macroeconomic, as well as state characteristics and time and state fixed effects as discussed above. The estimated coefficient of *Governor Term Limit* is positive (0.0816) and significant (See Column 1 of Table 8). In line with Hypothesis 2, bond issues from states with gubernatorial term limits are associated with higher yields. Next, we also include the *Last Term* dummy and find that it is significant and its inclusion does not affect the coefficient of *Governor Term Limits* (See Column 2). This suggests that the two effects are independent. Bonds issued in years when states have gubernatorial term limits are perceived to be risky due to the higher fiscal volatility associated with gubernatorial term limits. Further if the bond was issued in the last term of the Governor, there is an additional increase in yield that reflects the risk of the projects undertaken in the last term.

The above two estimations were in the full sample of bonds. However, as we include state fixed effects the coefficient of Governor Term Limits is largely identified of the states that changed term limits over the sample period. In column 3, for robustness, we also estimate the model in a subsample that includes only states with changes to their gubernatorial term limits and we continue to find a significant positive coefficient for *Governor Term Limit* though its magnitude is much smaller.

Though the Governor in the last term cannot run for office again, he may have aspirations for a continued political career. These may involve running for the US Presidency, senate or congress. In these cases, career concerns may mitigate the excess spending seen in the Governor's last term. Last Term of these Governors with ongoing political career should see continued efforts to build political reputation and not be associated with higher or riskier spending. To examine this, we search through newspaper archives and find that of the 81 Governors that had a last term in our sample period, 30 ran for another elected office after their term. We create an indicator variable, *Post Governor* that takes the value of one in the last term of Governors that run for another elected office. Another 9 governors, were appointed by the President as a cabinet member, ambassador or as a head of a federal agency.[15] The indicator variable, *Post Governor Plus*, includes these extended set of post governorship career goals.

The coefficient of *Post Governor* is negative and significant and suggests that aspirations for another elected office limits the overspending of these Governors in their last term (See Model 4). The coefficient of *Post Governor Plus* is also negative and significant (See Model 5). The estimated coefficient of *Post Governor Plus* is -0.078 and almost the same as that for *Last Term* (0.0735). This suggests that when the Governor has further political career aspirations there is no *Last Term* effect, i.e., no riskier or excess spending in the last term. However, bonds issued in the last term of Governors that do not have future aspirations for a political career are associated with a 7.35 basis point higher yield.

Lastly, we examine whether the stringency of the term limits makes a difference. Instead of *Governor Term Limit*, we include three separate indicators for Weak, Moderate and Strong Term Limits to capture the difference in the stringency of the term limits. As seen in Model 6, the coefficients for all three types of term limits are positive and significant. There is some evidence that the effect of Weak Term limits is higher - the estimated coefficient for the Weak form is higher

[15] Two of these governors were not appointed by the president but declared their intention to stand for elected office and then withdrew. Paul Patton announced that he has dropped out of the 2004 US Senate race, and Carroll Campbell announced his intention to run for US Presidency in 1996.

at the 10% level than that for moderate term limits, but it is not different from that of Strong term limits.[16] This is consistent with the findings of Escaleras and Calcagno (2005). The estimated coefficient for moderate and strong term limit are not statistically different from each other. Overall, the results suggest that the presence of gubernatorial term limit are associated with higher borrowing costs for municipalities from these states.

6. Legislative Term limits

The data on legislative term limits is from the National Council of State Legislatures. As seen in Panel A of Table 9, there are 29 states that had no legislative term limits over the sample period of 1990 to 2010. There were three states that had term limits over the entire period. Panel B lists the 18 states that enacted legislative term limits over the sample period of 1990 to 2010. To capture the existence of house term limits we create a dummy variable, referred to as *House Term Limit* that takes the value of one if the bond issued was from a state with legislative term limits in place in that year.

As pointed out earlier, Erler (2007) argues that legislative term limits are exogenous as their adoption is not correlated with the state's economic conditions but rather to the presence of the initiative process which have been in place in states since the early 1900s. In every state with the initiative process, except one, voters have passed some form of legislative term limits. If the adoption of legislative term limits is related to the existence of the initiative process rather than to state fiscal conditions, it can be considered exogenous to municipal financing.

To estimate the effect of legislative term limits on municipal borrowing costs, we control for bond issue characteristics, macroeconomic variables, state characteristics and time and state fixed

[16] The test of the coefficients are not tabulated for brevity.

effects as before. As seen in Column 1 of Table 10, the coefficient of *House Term Limit* is positive and significant.   The estimated coefficient suggests that bonds from states with legislative term limits have yields that are 7 basis points higher than that of bonds from the same states when they did not have legislative term limits.

Erler (2007) argues that legislators are forward looking and will change behavior when the term limits are put in place, even though they may not be immediately binding.   Yakovlev, Tosun and Lewis (2012) argue that given that legislative term limits have been repealed, they would have a credible behavioral effect on the legislators only when they become binding, i.e., when the first cohort of legislators cannot run for office again. The dummy variable *Impact Years* takes the value of one for years when the legislative term limits are binding. Three states which passed legislative term limits prior to our sample period had their first years where term limits become binding that are in our sample period. Note that the three states that repealed the legislative term limits did not have any binding years.   About 29.2% of the bonds issued were from states in years when they had legislative term limits, with 18.6% of these being *Impact Years*.   As seen in Column 2, the coefficient of *Impact Years* is positive and significant. The estimated coefficient of *Impact Years* is qualitatively similar to that of *House Term Limits*, and suggests little difference between the two with respect to municipal borrowing costs.[17]

These estimations include state fixed effects and the coefficient of *House Term Limits* is identified from states that have a change in legislative term limits over the sample period. For robustness, we also estimate the model in a subsample of bonds from states that experience changes in legislative term limits.   As this sample includes bonds from the 18 states with changes in

[17] As bond mature over a long time, bonds issued in years where legislative term limits are not binding nevertheless anticipate the increased government spending that is likely to arise as term limits begin to bind

legislative term limits, the estimated coefficient of some state characteristics are different though the estimated coefficients for bond characteristics are qualitatively similar. We continue to find a significant effect of *House Term Limits* in this subsample as well (See Column 3).

Lastly, we include both gubernatorial and legislative term limits. As seen in Column 4 of Table 10, the coefficients on both *Governor Term Limit* and *Last Term* are significant as before, and the coefficient on *House Term Limit* is also positive and significant at the 1% level. The results suggests that the effect arising from gubernatorial term limits and house term limits are independent of each other and are both significant in impacting municipal borrowing costs.

To shed light on the economic significance of the effect of term limits, we create a variable referred to as *Both Term Limits* that takes the value of one when the state has both gubernatorial and legislative term limits in place. About 28.2% of bonds in our sample were issued when both term limits are in place. The variable, *No Term Limits* is an indicator variable that takes the value of one when the state has no term limits of either kind. About 40.3% of bonds in the sample were issued when neither term limit is present. We find that the coefficient of *Both Term Limits* has a positive and significant value of 0.0653 while the coefficient of *No Term Limits* has a negative and significant value of -0.0634 (see Model 5, Table 10). The difference in borrowing costs between states that have both term limits and states that have neither term limits is 12.87 basis points. For an average municipal bond issue of $35.5 million this entails a difference of $45,688 in interest per bond per year. This difference between the bonds yields from states with both term limits and states with no term limits can increase to 16.37 basis points in years when the governor serves his last term (column 5).

7. Interaction with Party Affiliation

Besley and Case (1995) in their study of gubernatorial term limits and fiscal policy report that states with term limits are significantly more likely to be governed by democrats.[18] They examine and report that the higher taxes and spending in last term of the governor is seen only in states with democratic governors. To understand the potential impact of party affiliation, we create a dummy variable *Democratic Governor* that takes the value of one if the Governor is democratic. We include this variable and its interaction with *Last Term*. As seen in Table 11 column 1, the interaction effect is not significant. We also include the interaction of *Democratic Governor* with *Governor Term limit* and find that it is not significant (Column 2).

To examine the effect of party affiliation on House Term Limit, we create a variable referred to as *Democratic Legislature* that takes a value of one if the Democrats control both the lower and the upper houses of the legislative body. We include this and its interaction with *House Term Limits* (Column 3) and find no significant impact of party affiliation for house term limits as well. In unreported tests, we also find no significant effects if we control for democratic lower or upper house of the legislature. Lastly, we examine the effect of party control. The dummy variable *Same Party* takes the value of one if the same party controls the Governor's office, and both the upper and lower legislatures. As can be seen in Model 4, this does not have a significant effect on municipal yields.

8. Conclusions

We examine and document that both gubernatorial and legislative term limits are associated with higher offering yields on municipal debt. The results hold after controlling for bond characteristics, state economic and demographic characteristics, and state and time fixed effects.

[18] They report that governors are democrats for 61% of all years in states with term limits as opposed to 51% of all years for states with no term limits in their sample.

The results point to the importance of political institutions that provide a framework for state fiscal decisions on municipal borrowing. We hope that the results will inform the discussion on state access to municipal markets and the underlying risks in the municipal debt.

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Appendix: Variable Definition and Data Source

This appendix reports the definition of the variables used in this study and the source of the data. In addition, we describe how various variables are constructed. BEA denotes the Bureau of Economic Analysis; FRED denotes Federal Reserve Economic Data; NBER denotes the National Bureau of Economic Research; SFG denotes the State Government Finance Data from U.S. Census; SDC denotes the Securities Data Company; BLS denotes the U.S. Bureau of Labor Statistics; CSG/BOS denotes the Council of State Government/Book of the States; NGA denotes National Governors Association; NCSL denotes the National Conference of State Legislatures.

Bond Rating: Is the numerical value of S&P ratings (or Moody's ratings if S&P ratings are not available). The highest quality bonds are assigned the value 1, and we add 1 for each increment in credit rating for a maximum of 19 – Source: SDC

Bond Yield: The bond yield to maturity at issuance – Source: SDC

Callable: A dummy variable that takes a value of one if the bond is callable – Source: SDC

Credit Enhancement: A dummy variable that takes the value of one if the bond issue is associated with a credit enhancement – Source: SDC

Debt/GDP: Ratio of state's total outstanding debts to its GDP – Source: SGF, and BEA

Education Rate: Measures the state's level of education (which is the percentage of state population above age 25 that has completed a bachelor's degree or higher) – Source: U.S. Census

General Obligation (GO) Bond: A dummy variable that takes the value of one if the bond is a general obligation bond – Source: SDC

Governor Last Term: A dummy variable that takes the value of one if the serving governor is serving his/her last term and is not eligible for re-election – Source: CSG/NGA

Governor Term Limit: A dummy variable that takes the value of one if the state has gubernatorial term limit –Source: CSG/BOS, and NGA

House Term Limit: A dummy variable that takes the value of one if the state legislature has a term limit – Source: NCSL

Impact Years: A dummy variable that takes the value of one in both the year that state legislators became ineligible to run again, and years beyond – Source: NCSL

Male/Female Ratio: Is the state's male population divided by female population – Source: U.S. Census

Marginal Tax Rates: Is the highest marginal personal state income tax rate – Source: NBER

Matching Treasury Rate: Is the nominal rate on a Treasury bond of similar maturity – Source: FRED.

Maturity: The time to maturity of the bond (measured in years). We used the natural logarithm of this value in our regressions – Source: SDC

Median Age: Is the median age (measured in years) of the state population – Source: U.S. Census

Minority Underwriter: A dummy variable that takes the value of one for bonds for which the lead underwriter is owned by minorities – Source: SDC

***Moderate Term Limit:** A dummy variable that takes the value of one if state allows candidates to serve two consecutive terms and then a lifetime ban thereafter

Negotiated (Nego) Bond: A dummy variable that takes the value of one if the bond was issued through a negotiated deal – Source: SDC

Non-Hispanic White Ratio: Is the fraction of state's population that is non-Hispanic Whites – Source: U.S. Census.

Population: Is the state's total population (in thousands). We use the natural logarithm of this value in our regressions – Source: U.S. Census, and SGF

Proceeds: Offering size, measured in millions of dollars. We use the natural logarithm of this value in our regressions – Source: SDC

Revenue/Expenditure: Ratio of state's total revenue to its total expenditure – Source: SGF

***Strong Term Limit:** A dummy variable that takes the value of one if state does not allow candidates to serve successive terms, and candidates serve a two-term limit over a lifetime

Term Slope: Is the difference between 10-year, and 2-year Treasury rates - Source: FRED

T-note: Is 1-year Treasury note rate – Source: FRED

Underwriter Market Share: Is the percentage of total municipal bond value underwritten by a particular underwriter during the year. We use the natural logarithm of underwriter market share (Underwriter Reputation) in our regressions – Source: SDC

Unemployment Rate: Is the state's unemployment rate – Source: BLS

***Weak Term Limit:** A dummy variable that takes the value of one if state allows candidates to serve two consecutive terms and then must wait four years to be eligible to run again

*****Source: "Does the Gubernatorial Term Limit Type Affect State Government Expenditures?", Public Finance Review, Volume 37 Number 5, 2009 pp 572-595.

Table 1: Summary of Municipal Bond Data

The sample consists of all new municipal bond issues in the US over the period 1990 to 2010 with available data. *Proceeds* is the offering size measured in millions of dollars. *Maturity* is the time to maturity and measured in years. *Bond Yield* is the yield to maturity at issuance. *Bond Ratings* is the numerical value of S&P rating at issuance. *Credit enhancement* is a dummy variable that takes the value of one if the issue has credit enhancement. *Go (Callable) Bond* is an indicator variable that takes the value of one if it is general obligation (callable) bond. *Negotiated Bond* is a dummy variable that takes the value of one if the bond was issued through a negotiated contract. *Underwriter Market Share* is the share of the underwriter in municipal issuance in the year. *Minority Underwriter* is a dummy variable that takes the value of one is the lead underwriter is a minority. *Matching Treasury Rate* is the nominal rate on a Treasury bond of similar maturity. *T-note* is the 1-year Treasury note rate. *Term Slope* is the difference between 10-year and 2-year Treasury rates.

	Mean	Std. Dev.	p50	p25	p75	Min	Max	Obs.
Proceeds	35.559	71.000	9.900	4.390	29.470	0.090	400.000	99325
Maturity	18.286	7.208	19.364	13.058	22.485	1	99	99325
Bond Yield	4.842	1.016	4.825	4.240	5.450	1.230	7.400	99325
Bond Rating	2.273	2.010	1	1	3	1	9	99325
Credit Enhancement	0.597	0.490	1	0	1	0	1	99325
Go Bond	0.625	0.484	1	0	1	0	1	99325
Negotiated Bond	0.571	0.495	1	0	1	0	1	99325
Callable Bond	0.807	0.395	1	1	1	0	1	99325
Underwriter Market Share	2.502	3.523	0.702	0.211	3.116	0.000	12.136	99325
Minority Underwriter	0.017	0.131	0	0	0	0	1	99325
Matching Treasury Rate	5.320	1.238	5.170	4.560	6.290	0.960	8.550	99325
T-note	3.572	1.914	3.620	1.890	5.080	0.320	7.890	99325
Term Slope	1.178	0.904	1.190	0.360	1.970	-0.230	2.520	99325

Table 2: Distribution of Municipal Issuance across States

Table 2 reports the average bond characteristics across states. The sample consists of all municipal bonds issued over the period 1990 to 2010 with adequate data. The states have been arranged in decreasing order by the number of bond issues over the period. Only states with more than 500 bond issues in the sample have been tabulated.

State	Number of Bonds	Maturity (years)	Proceeds ($million)	Yield (%)	Credit Enhancement (%)	Bond Rating
Texas	12,683	19.367	26.527	4.954	49.483	1.725
California	8,439	23.516	52.359	5.175	51.401	2.234
New York	5,946	18.25	62.67	4.974	32.057	2.624
Pennsylvania	5,175	18.691	27.953	4.853	75.535	1.757
Illinois	5,034	15.682	27.236	4.67	39.044	2.057
New Jersey	4,416	16.823	28.316	4.803	39.819	1.963
Michigan	4,063	18.652	20.878	5.007	43.566	2.177
Wisconsin	4,042	12.841	13.174	4.396	27.716	2.506
Minnesota	4,013	15.431	15.997	4.438	19.222	2.87
Florida	2,964	21.4	65.429	5.076	62.184	1.733
Washington	2,744	17.344	44.061	4.844	45.061	2.07
Ohio	2,652	19.268	42.245	4.799	26.269	2.196
Massachusetts	2,584	18.647	45.582	4.789	34.218	2.314
Kentucky	2,118	17.33	16.913	4.798	24.94	3.875
Arizona	1,929	16.106	37.01	4.902	57.514	2.122
Indiana	1,811	17.503	26.066	4.999	38.176	2.628
Missouri	1,751	16.81	22.436	4.591	26.797	2.218
Tennessee	1,723	17.416	29.768	4.869	48.273	2.609
Colorado	1,722	18.518	34.883	4.701	50.824	2.368
Iowa	1,682	14.938	12.369	4.624	16.189	2.976
Connecticut	1,652	17.277	77.911	4.691	35.133	2.328
North Carolina	1,514	18.936	48.056	4.914	43.409	2.375
Alabama	1,510	20.739	24.969	4.919	53.381	1.915
Kansas	1,414	16.636	22.865	4.635	19.699	2.373
Georgia	1,363	18.125	62.764	4.744	48.971	2.332
South Carolina	1,331	16.508	37.021	4.736	42.44	2.38
Oregon	1,322	18.09	30.177	4.796	34.514	2.321
Virginia	1,240	20.59	62.96	4.968	31.131	2.596
Louisiana	1,150	18.784	32.318	5.012	41.788	2.512
Arkansas	865	21.936	14.14	4.648	17.258	3.563
Maryland	854	20.335	70.401	4.964	35.924	2.615
New Mexico	853	14.081	24.786	4.596	37.978	2.739
Mississippi	811	16.771	19.268	4.764	30.484	3.318
Utah	779	16.429	31.763	4.56	42.644	1.653
Oklahoma	756	15.799	33.207	4.575	13.769	2.796
Nevada	699	17.684	68.443	4.9	52.377	2.021

Table 3: Summary of State Characteristics

The table summarizes characteristics for states that issued municipal bonds over the period 1990 to 2010 with adequate data. *Population* is the state's total population in thousands. *Unemployment Rate* is the state's unemployment rate. *Debt/GDP* is the ratio of the state's total outstanding debts to its GDP. *Revenue/Expenditure* is the ratio of the state's total revenue to its total expenditure. *Education Rate* is the percentage of state population above age 25 that has completed a bachelor's degree or higher. *Median Age* is the median age (measured in years) of the state population. *Male/Female Ratio* is the state's male population divided by female population. *Non-Hispanic White Ratio* is the fraction of state population that is Non-Hispanic white. Marginal Tax Rate is the highest marginal personal state income tax rate.

	Mean	Std. Dev.	p50	p25	p75	Min	Max	Obs.
Population	11866	9327	8601	4983	18375	658	36250	99325
Unemployment Rate	5.859	1.729	5.400	4.700	6.700	2.700	11.100	99325
Debt/GDP	0.055	0.030	0.048	0.033	0.072	0.015	0.159	99325
Revenue/Expenditure	0.986	0.082	1.000	0.966	1.035	0.711	1.735	99325
Education Rate	24.665	4.309	24.300	21.640	27.700	15.300	35.040	99325
Median Age	35.358	2.109	35.400	33.680	36.930	30.950	39.890	99325
Male/Female Ratio	0.966	0.024	0.965	0.945	0.988	0.922	1.016	99325
Non-Hispanic White Ratio	0.691	0.149	0.693	0.593	0.826	0.414	0.946	99325
Marginal Tax Rate	4.910	3.283	5.630	2.800	7.080	0.000	11.660	99325

Table 4: State Governor Term Limit by Category

The data is from the Council of State Governments/Book of the States (CSG/BOS), and the National Governors Association (NGA). Gubernatorial term limits are classified as weak if the candidate can serve two consecutive terms and then must wait for 4 years to run again. Moderate term limits states are states where candidates can serve two term limits and then never run again. Strong term limits states are states where candidates cannot serve successive terms and states where candidates are barred from ever holding more than two terms.

Panel A: States with No Change in Gubernatorial term limits over 1990 to 2010

Type of Term Limit	States
No Term Limits	Connecticut, Illinois, Iowa, Minnesota, New Hampshire, New York, North Dakota, Texas, Wisconsin, Vermont
Weak Term Limits	Alabama, Alaska, Indiana, Maine, Nebraska, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, West Virginia
Moderate Term Limits	California, Delaware, Florida, Hawaii, Kansas, Nevada,
Strong Term Limits	Missouri, Virginia
With changes within Term Limit type	Georgia (Weak 1994-2010, Moderate 1990-1993) Kentucky (Moderate 1994-2010, Strong 1990-1994) Louisiana (Moderate 2007-2010, Strong 1990-2006) Maryland (Moderate 1994-2010, Strong 1990-1993) Mississippi (Moderate 1994-2010, Strong 1990-1993) New Jersey (Weak 1994-2010, Moderate 1990-1993) New Mexico (Weak 1992-2010, Strong 1990-1991) North Carolina (Weak 1994-2010, Moderate 1990-1993)

Panel B: States with changes in Gubernatorial Term limits from 1990 to 2010

	No Term Limits	Weak	Moderate
Arizona	1990-1993		1994-2010
Arkansas	1990-1991		1992-2010
Colorado	1990		1991-2010
Idaho	1990-1999, and 2002-2010		2000-2001
Massachusetts	1990-1997, 2000-2001, and 2004-2010		1998-1999, 2002-2003
Michigan	1990-1992		1993-2010
Montana	1990-1992		1993-2010
Rhode Island	1990-1995	1996-2010	
Utah	1990-1993, 2006-2010		1994-2005
Washington	1990-1993, 2004-2010	1994-2003	
Wyoming	1990-1993	1994-2010	

Table 5: Municipal Bond Yields and Governor's Last Term

The table reports OLS regressions where the dependent variable is the offering yield on the municipal bond. We include all municipal debt issued with adequate data requirements over the period 1990 to 2010. *Last Term* is a dummy variable that takes the value of one if the bond issued was affiliated with a state where the governor was serving the last term. Model 1 includes bonds from states that had term limits over the entire sample period. Model 2 includes bonds from states that had no change in gubernatorial term limits over the sample period, i.e., also include bonds that did not have gubernatorial term limits and did not change them. Model 3 includes all bonds from states that had a change in term limits. Model 4 includes all bonds issued over the sample period. All other variables are defined in the Appendix. The t statistics adjusted for state-year clustering are reported in parenthesis below. *,**,*** represent significance at the 10%, 5% and 1% level, respectively.

	Model 1	**Model 2**	**Model 3**	**Model 4**
Last Term	0.0341**	0.0446**	0.0311**	0.0416***
	(2.18)	(2.42)	(2.15)	(2.62)
<u>Bond Characteristics</u>				
Ln(Proceeds)	-0.0000172	0.00396	0.0110**	0.00515*
	(-0.00)	(1.26)	(2.35)	(1.86)
Ln(Maturity)	0.649***	0.641y	0.656***	0.643***
	(23.57)	(28.44)	(20.21)	(32.10)
Bond Rating	0.0687***	0.0620***	0.0700***	0.0633***
	(15.98)	(18.83)	(14.00)	(21.77)
Credit Enhancement	-0.0815***	-0.0782***	-0.0831***	-0.0798***
	(-5.74)	(-8.65)	(-5.36)	(-9.92)
Callable Bond	0.0977***	0.0903***	0.149***	0.0986***
	(5.47)	(7.24)	(9.05)	(8.82)
Go Bond	-0.0104	-0.0229**	-0.0497***	-0.0264***
	(-0.71)	(-2.17)	(-4.56)	(-2.91)
Negotiated Bond	0.0962***	0.0689***	0.0481***	0.0672***
	(9.78)	(8.47)	(3.83)	(9.29)
Minority Underwriter	0.0393**	0.00449	0.161y	0.0126
	(2.18)	(0.35)	(3.14)	(0.96)
Underwriter Reputation	0.00486***	0.00234*	-0.00196	0.00189
	(3.03)	(1.80)	(-0.82)	(1.61)
<u>Macro-Economic Variables</u>				
Matching Treasury	0.359***	0.372***	0.319***	0.365***
	(13.09)	(15.81)	(8.58)	(17.48)
T-note	0.162***	0.203***	0.447***	0.256***
	(2.99)	(4.13)	(8.61)	(6.03)
Term Slope	0.107	0.151	0.582***	0.243***
	(1.25)	(1.87)	(7.39)	(3.49)
<u>State Characteristics</u>				
Debt/GDP	1.585**	1.066**	-0.157	0.839**
	(2.40)	(2.36)	(-0.18)	(2.04)
Revenue/Expenditure	-0.0768	-0.0995	-0.0262	-0.119
	(-0.52)	(-0.79)	(-0.12)	(-0.96)
Ln(Population)	-0.390	-0.519**	0.173	-0.321**
	(-1.50)	(-2.54)	(0.82)	(-1.97)
Unemployment Rate	0.0389***	0.0323***	0.00932	0.0260***
	(3.37)	(2.66)	(1.13)	(2.66)
Marginal Tax Rate	-0.00643	-0.0105	0.00927	-0.00766
	(-0.52)	(-1.24)	(0.52)	(-1.01)

Education Rate	-0.0145	-0.0176	0.0441**	-0.00635
	(-0.94)	(-1.40)	(2.33)	(-0.61)
Median Age	-0.129***	-0.0744***	0.0316	-0.0487**
	(-4.07)	(-3.34)	(1.46)	(-2.39)
Male/Female Ratio	-7.195**	-8.025***	-5.175**	-6.828***
	(-2.41)	(-3.09)	(-2.14)	(-2.99)
Non-Hispanic White Ratio	-0.914	-1.519***	3.061***	-0.651
	(-1.19)	(-3.13)	(2.67)	(-1.51)
Constant	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES
State dummies	YES	YES	YES	YES
Adjusted R-Squared	0.801	0.822	0.847	0.825
Observations	47564	83605	15720	99325

Table 6: Univariate Test for Bonds Issued in the Last Term

The table displays summary statistics for bonds issued when Governor Term Limits bind and when they do not bind. The sample consists of bonds issued from states that had gubernatorial term limits over the entire sample period of 1990 to 2010. The table reports average values of the variables. *Proceeds* is the offering size in millions of dollars. *Maturity* is years to maturity. *Revenue Bond* is an indicator variable that takes the value of one if it is revenue bond. *Negotiated Bond* is a dummy variable that takes the value of one if the bond was issued through a negotiated contract. *Credit Enhancement* is a dummy variable that takes the value of one if the issue has third party credit enhancement. *Bond Ratings* is the numerical value of S&P rating at issuance. There are 28,682 bonds issued when Last Term is zero i.e. term limits do not bind. There are 18,882 bonds issued when Last Term is one, i.e., governor term limit binds. The Column, Test for Difference reports the absolute value of the T statistics for difference in the means of the two groups. . *,**,*** represent significance at the 10%, 5% and 1% level, respectively.

	Last Term = 0	Last Term = 1	Test for Difference
Proceeds	37.74	42.30	6.91***
Maturity	19.16	19.25	1.24
Revenue Bond	0.507	0.502	1.07
Negotiated Bond	0.61	0.65	8.88***
Credit Enhancement	0.36	0.41	11.87***
Bond Rating	2.25	2.36	5.91***

Table 7: Bond Characteristics and Term Limits

The table reports partial results of the yield model estimation that allows bond characteristics to vary with term limits. Each column examines the effect of a different bond characteristic that is displayed on top of the column. Bond Characteristic reports the coefficient of the bond characteristics that is displayed on the top of the column. The estimation included control variables that were not displayed for brevity. The control variables included were *Ln(Proceeds), Ln(Maturity), Bond Rating, Credit Enhancement, Callable Bond, Go Bond, Negotiated Bond, Minority Underwriter, Underwriter Reputation, Matching Treasury, T-note, Term Slope, Debt/ GDP, Revenue/ Expenditure, Ln (Population), Unemployment Rate, Marginal Tax Rate, Education Rate, Median Age, Male/Female Ratio,* and *Non-Hispanic White Ratio*. Year and state fixed effects were also included. The t statistics adjusted for state-year clustering are reported in parenthesis below. *,**,*** represent significance at the 10%, 5% and 1% level, respectively

	Proceeds	**Maturity**	**Revenue Bonds**	**Negotiated Bonds**	**Credit Enhancement**
Last Term	-0.00246	-0.335***	0.0119	-0.0049	0.0436**
	(-0.09)	(-2.79)	(0.57)	(0.36)	(2.39)
Last Term x Bond Characteristics	0.0133	0.129***	0.0434*	0.061***	-0.0148
	(1.63)	(2.91)	(1.87)	(2.89)	(-0.88)
Bond Characteristics	-0.00532	0.600***	-0.007	0.0726***	-0.088***
	(-0.93)	(22.81)	(-0.43)	(6.32)	(-5.34)
Constant	YES	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES	YES
State dummies	YES	YES	YES	YES	YES
Adjusted R-Squared	0.801	0.802	0.801	0.801	0.801
Observations	47564	47564	47564	47564	47564

Table 8: Municipal Bond Yields and Gubernatorial Term Limits

The table reports partial results of an OLS regressions where the dependent variable is the offering yield on the municipal bond. We include all municipal debt issued with adequate data requirements over the period 1990 to 2010. *Governor Term Limit* takes the value of one if the state had gubernatorial term limits when the bond was issued. *Last Term* is a dummy variable that takes the value of one if the bond issued when the governor was serving the last term. Model 3 includes bonds from states that changed gubernatorial term limits over the sample period. *Post Governor* (*Post Governor Plus*) takes the value of one for Governor who after their last term run for another elected office (or had political appointments). Gubernatorial term limits are classified as *Weak* if the candidate can serve two consecutive terms and then must wait for 4 years to run again. *Moderate term limits* states are states where candidates can serve two term limits and then never run again. *Strong term limits* states are states where candidates cannot serve successive terms and states where candidates are barred from ever holding more than two terms. The control variables included *were Ln(Proceeds), Ln(Maturity), Bond Rating, Credit Enhancement, Callable Bond, Go Bond, Negotiated Bond, Minority Underwriter, Underwriter Reputation, Matching Treasury, T-note, Term Slope, Debt/ GDP, Revenue/ Expenditure, Ln (Population), Unemployment Rate, Marginal Tax Rate, Education Rate, Median Age, Male/Female Ratio,* and *Non-Hispanic White Ratio*. Year and state fixed effects were also included. . The t statistics adjusted for state-year clustering are reported in parenthesis below. *,**,*** represent significance at the 10%, 5% and 1% level, respectively

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Last Term		0.0394**	0.0314**	0.0510**	0.0735***	0.0393**
		(2.54)	(2.13)	(2.54)	(3.06)	(2.53)
Governor Term Limit	0.0816***	0.0739***	0.0385**	0.0677***	0.0682***	
	(3.57)	(3.38)	(2.01)	(3.21)	(3.45)	
Post Governor				-0.0434*		
				(-1.70)		
Post Governor Plus					-0.0780***	
					(-3.14)	
Weak Limit						0.0895***
						(3.41)
Moderate Limit						0.0525**
						(2.21)
Strong limit						0.0793**
						(2.12)
Constant	YES	YES	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES	YES	YES
State dummies	YES	YES	YES	YES	YES	YES
Adjusted R-Squared	0.825	0.825	0.847	0.825	0.826	0.825
Observations	99325	99325	15720	99325	99325	99325

Table 9: State House Term Limit

The data on state house term limit is obtain from the National Council of State Legislature (NCSL). House Term Limit is a dummy variable that takes the value of one if the state legislature has a term limit. Impact Years information or data is also obtain from NCSL. We define impact years as a dummy variable that takes the value of one in both the year that state legislators became ineligible to run again, and years beyond.

Panel A: States with No Change in Legislative Term limits over 1990 to 2010

No Term Limits	Alabama, Alaska, Connecticut, Delaware, Georgia, Hawaii, Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Minnesota, Mississippi, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Vermont, Virginia, West Virginia, Wisconsin,
Term Limits	California, Colorado, Oklahoma

Panel B: States with Changes in Legislative Term Limits over 1990 to 2010

	No Term Limit Years	**Term Limit Years**	**Impact Years**
Arizona	1990-1991	1992-2010	2000-2010
Arkansas	1990-1991	1992-2010	1998-2010
Florida	1990-1991	1993-2010	2000-2010
Idaho	1990-1993, 2002-2010	1994-2001	
Louisiana	1990-1994	1995-2010	2007-2010
Maine	1990-1992	1993-2010	1996-2010
Massachusetts	1990-1993, 1997-2010	1994-1996	
Michigan	1990-1991	1992-2010	1998-2010
Missouri	1990-1991	1992-2010	2002-2010
Montana	1990-1991	1992-2010	2000-2010
Nebraska	1990-1999	2000-2010	
Nevada	1990-1995	1996-2010	
Ohio	1990-1991	1992-2010	2000-2010
Oregon	1990-1991, 2002-2010	1992-2001	
South Dakota	1990-1991	1992-2010	2000-2010
Utah	1990-1993, 2004-2010	1994-2003	
Washington	1990-1991, 1998-2010	1992-1997	
Wyoming	1990-1991, 2004-2010	1992-2003	

Table 10: Legislative Term Limits and Municipal Yields

The table reports partial results from an OLS regressions where the dependent variable is the offering yield on the municipal bond. *House Term Limit* is an indicator variable that takes the value of one if the bond was issued when the state had house term limits in place. *Governor Term limit* takes the value of one if the bond issued when the state with governor term limits in place. *Governor Last Term* is a dummy variable that takes the value of one if the bond was issued when the governor was serving the last term. *Both Term Limits* (*Neither Term Limit*) takes the value one for bond issues when both (neither) house and governor term limits are in place. The control variables included were *Ln(Proceeds), Ln(Maturity), Bond Rating, Credit Enhancement, Callable Bond, Go Bond, Negotiated Bond, Minority Underwriter, Underwriter Reputation, Matching Treasury, T-note, Term Slope, Debt/ GDP, Revenue/ Expenditure, Ln (Population), Unemployment Rate, Marginal Tax Rate, Education Rate, Median Age, Male/Female Ratio,* and *Non-Hispanic White Ratio*. Column 3 includes bonds from states that had some change in legislative term limits over the sample period 1990 to 2010. All other variables are defined in the Appendix. The t statistics adjusted for state-year clustering are reported in parenthesis below. *,**,*** represent significance at the 10%, 5% and 1% level, respectively

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
House Term Limit	0.0721***		0.0657***	0.0624***	
	(3.43)		(3.06)	(3.03)	
Impact Years		0.0689***			
		(3.71)			
Governor Term Limit				0.0613***	
				(2.99)	
Governor Last Term				0.0401***	0.0402***
				(2.58)	(2.59)
Both Term Limits					0.0655***
					(2.95)
Neither Term Limits					-0.0580***
					(-2.86)
Constant	YES	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES	YES
State dummies	YES	YES	YES	YES	YES
Adjusted R-Squared	0.825	0.825	0.829	0.825	0.825
Observations	99325	99325	25045	99325	99325

Table 11: Party Affiliation, Term Limits and Municipal Yields

The table reports partial results from an OLS regression where the dependent variable is yield to maturity at offering. The sample includes all municipal bonds issued over the period of 1990 to 2010 with adequate data. *Last Term* takes the value of one bond was issued in the last term of the Governor. *Governor* (*House*) *Term Limits* takes the value of one if the bond was issued when the state had gubernatorial (legislative) term limits. *Democratic Governor* takes the value of one for bond issues when the state governor was a democrat. *Democratic Legislature* takes the value of one if democrat party controls both houses of the legislature. *Same Party Dummy* takes the value of one if the party of the Governor, and the Party in control of both the upper and lower houses is the same. Control variables included but not displayed are *Bond Rating*, dummy for *Credit Enhancement*, *ln(proceeds), Ln(maturity), GO dummy, Negotiated bond Dummy, Callable bond dummy, Minority Underwriter, underwriter reputation, matching treasury, T-note, Term slope, unemployment rate, Debt/GDP, Revenue/ Expenditure, marginal tax rate, Education rate, median age, Male/Female Ratio, Non-Hispanic White Ratio* and *ln(population)*. The t statistics adjusted for state-year clustering are reported in parenthesis below. *,**,*** represent significance at the 10%, 5% and 1% level, respectively

	Model 1	**Model 2**	**Model 3**	**Model 4**
Last Term	0.0517**			0.0396***
	(1.98)			(2.61)
Democratic Governor x Last Term	-0.0260			
	(-0.91)			
Governor Term Limit		0.0910***		0.0558***
		(3.68)		(2.74)
Governor Term Limit x Democratic Gov.		-0.0174		
		(-1.01)		
Democratic Governor	-0.0149	-0.0131		
	(-1.47)	(-0.82)		
House Term Limit			0.0711***	0.0624***
			(3.39)	(3.01)
Democratic legislature			-0.0125	
			(-0.90)	
House Term Limit x Dem. Legislature			0.00526	
			(0.23)	
Same Party Dummy				-0.0159
				(-1.58)
Controls	Yes	Yes	Yes	Yes
Year & State dummies	Yes, Yes	Yes, Yes	Yes, Yes	Yes, Yes
Adjusted R-Squared	0.825	0.825	0.825	0.825
Observations	99325	99325	99325	99325

Why Has Regional Income Convergence in the U.S. Declined?

Peter Ganong and Daniel Shoag*

January 2015

Abstract

The past thirty years have seen a dramatic decline in the rate of income convergence across states and in population flows to wealthy places. These changes coincide with (1) an increase in housing prices in productive areas, (2) a divergence in the skill-specific returns to living in those places, and (3) a redirection of unskilled migration away from productive places. We develop a model in which rising housing prices in wealthy areas deter unskilled migration and slow income convergence. Using a new panel measure of housing supply regulations, we demonstrate the importance of this channel in the data. Income convergence continues in less-regulated places, while it has mostly stopped in places with more regulation.

JEL Codes: E24, J23, J24, R14, R23, R52
Keywords: Convergence, Regulation, Land Use, Migration, Housing Prices

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1 Introduction

The convergence of per-capita incomes across US states from 1880 to 1980 is one of the most striking patterns in macroeconomics. For over a century, incomes across states converged at a rate of 1.8% per year.[1] Over the past thirty years, this relationship has weakened dramatically (see Figure 1).[2] The convergence rate from 1990 to 2010 was less than half the historical norm, and in the period leading up to the Great Recession there was virtually no convergence at all.

During the century-long era of strong convergence, population also flowed from poor to rich states. Figure 2 plots "directed migration": the relationship between population growth and income per capita across states. Prior to 1980, people were moving, on net, from poor places to richer places. Like convergence, this historical pattern has declined over the last thirty years.

We link these two fundamental reversals in regional economics using a model of local labor markets. In this model, changes in housing regulation play an important role in explaining the end of these trends. Our model analyzes two locations that have fixed productivity differences and downward-sloping labor demand. When the population in a location rises, the marginal product of labor (wages) falls. When the local housing supply is unconstrained, workers of all skill types will choose to move to the productive locations. This migration pushes down wages and skill differences, generating income convergence. Unskilled workers are more sensitive to changes in housing prices. When housing supply becomes constrained in the productive areas, housing becomes particularly expensive for unskilled workers. We argue that these price increases reduce the labor and human capital rebalancing that generated convergence.

The model's mechanism can be understood through an example. Historically, both janitors and lawyers earned considerably more in the tri-state New York area (NY, NJ, CT) than

[1]See Barro and Sala-i Martin [1992], Barro and Sala-i Martin [1991], and Blanchard and Katz [1992] for classic references.

[2]Figure 1 plots convergence rates (change in log income on initial log income) for rolling twenty-year windows. The standard deviation of log per capita income across states also fell through 1980 (sigma convergence), and then held steady afterward. The end of this type of convergence demonstrates that the estimated decline in convergence rates is not due to a reduction in the variance of initial incomes relative to a stationary shock process.The strong rate of convergence in the past as well as the decline today do not appear to be driven by changes in measurement error. When we use the Census measure of state income to instrument for BEA income, or vice-versa, we find similar results. The decline also occurs at the Labor Market Area level, using data from Haines [2010] and U.S. Census Bureau [2012]. We report additional results connected to these measures in the Appendix. The decline of convergence has been observed at the metro-area level in Berry and Glaeser [2005]. See also chapter 2 of Crain [2003] and Figure 6 of DiCecio and Gascon [2008].

their colleagues in the Deep South (AL, AR, GA, MS, SC). This was true in both nominal terms and after adjusting for differences in housing prices.[3] Migration responded to these differences, and this labor reallocation reduced income gaps over time.

Today, though nominal premiums to being in the NY area are large and similar for these two occupations, the high costs of housing in the New York area has changed this calculus. Though lawyers still earn much more in the New York area in both nominal terms and net of housing costs , janitors now earn *less* in the NY area after housing costs than they do in the Deep South.[4] This sharp difference arises because for lawyers in the NY area, housing costs are equal to 21% of their income, while housing costs are equal to 52% of income for NY area janitors. While it may still be "worth it" for skilled workers to move to productive places like New York, for unskilled workers, New York's high housing prices offset the nominal wage gains.

We build on research showing that differences in incomes across states have been increasingly capitalized into housing prices (Van Nieuwerburgh and Weill [2010], Glaeser et al. [2005b] Gyourko et al. [2013]). In this paper, we show that the returns to living in productive places net of housing costs have fallen for unskilled workers but have remained substantial for skilled workers. In addition, we show that skilled workers continue to move to areas with high nominal income, but unskilled workers are now moving to areas with *low* nominal income but high income net of housing costs. Each of these stylized facts represents the aggregate version of the lawyers and janitors example above.

To better understand the causes and consequences of housing price increases, we construct a new panel measure of land use regulation. Our measure is a scaled count of the number of decisions for each state that mention "land use," as tracked through an online database of state appeals court records. We validate this measure of regulation using existing cross-sectional survey data. To the best of our knowledge, this is the first national panel measure of land use regulations in the US.[5]

Using differential regulation patterns across states, we report five empirical findings that

[3]In 1960, wages were 42% and 85% higher in NY than in the Deep South for lawyers and janitors respectively. After adjusting for housing costs (12 times monthly rent of .05 of home value), these premia were 41% and 68%.

[4]In nominal terms, the wages of lawyers and janitors are 45% and 32% higher in NY respectively in 2010. After adjusting for housing prices, these premia are 37% and -6%.

[5] Prior work has examined housing price and quantity changes to provide suggestive evidence of increasing supply constraints (Sinai [2010], Glaeser et al. [2005a], Glaeser et al. [2005b], Quigley and Raphael [2005], and Glaeser and Ward [2009]).

connect housing supply limits to declines in migration and income convergence. Tight land use regulations weaken the historic link between high incomes and new housing permits. Instead, income differences across places become more capitalized into housing prices. With constrained housing supply, the net migration of workers of all skill types from poor to rich places is replaced by skill sorting. Skilled workers move to high cost, high productivity areas, and unskilled workers move out. Finally, income convergence persists among places unconstrained by these regulations, but it is diminished in areas with supply constraints.

To assess whether these patterns reflect a causal relationship, we conduct three tests designed to address omitted variable bias and possible reverse causality. First, we repeat our analysis using a placebo measure of all court cases, not just those restricted to the topic of land use. In contrast to our results for land use cases, we find no impact on the outcomes of interest using this measure. Second, we use a state's historical tendency to regulate land use as measured by the number of cases in 1965 and study the differential impact of broad national changes in the regulatory environment after this date.[6] We find that income convergence rates fell after 1985, but only in those places with a high latent tendency to regulate land use. We repeat this exercise using another predetermined measure of regulation sensitivity based on geographic land availability from Saiz [2010] at both the state and county levels. Again, we find income convergence declined the most in areas with supply constraints.

In this paper, we highlight a single channel – labor mobility – which can help explain both income convergence through 1980 and its subsequent disappearance from 1980 to 2010. Much of the literature on regional convergence has focused on the role of capital, racial discrimination, or sectoral reallocations.[7] We build on an older tradition of work by economic historians (Easterlin [1958] and Williamson [1965]) as formalized by Braun [1993], in which directed migration drives convergence. Similarly, much of the existing literature on recent regional patterns in the US emphasizes changes in labor demand from skill-biased technological change and its place-based variants (Autor and Dorn [2013], Diamond [2012], Moretti [2012b]). Our explanation, which is complementary to these other channels, emphasizes the role of housing supply constraints. In Section 5, we discuss thse alternate channels and their inability to fully account for the data in the absence of housing supply constraints.

The remainder of the paper proceeds as follows. In Section 2, we develop a model to ex-

[6]Many authors use a region's historical features interacted with national changes. For example, Bartik [1991] uses historical industry shares, Card [2009] uses historical ethnicity shares, and Autor and Dorn [2013] use historical occupation shares.

[7]See Barro and Sala-i Martin [1992], Caselli and Coleman [2001], Michaels et al. [2012], and Hseih et al. [2013].

plore the role of labor migration and housing supply in convergence. Section 3 demonstrates that this model is consistent with four stylized facts about migration and housing prices. Section 4 introduces a new measure of land use regulation and directly assesses its impact on convergence, Section 5 considers alternative forces at work during this period, and Section 6 concludes.

2 A Simple Model of Regional Migration, Housing Prices, and Convergence

In this section, we develop a simple model to structure our study of the interaction between directed migration, housing markets, and income convergence. The model builds upon a long line of papers in urban economics following the spatial equilibrium framework of Rosen [1979], Roback [1982], and Blanchard and Katz [1992]. It combines elements from Braun [1993] and Gennaioli et al. [2013b], who solves a dynamic model of migration and regional convergence, and Gennaioli et al. [2013a], who study a static regional model with heterogeneous skill types.

Our model considers two locations within a national market: a more productive North and a less productive South. Tradable production employs the local labor supply and has decreasing returns to scale.[8] As a consequence of this assumption, more workers in a location drives down average wages. We solve a similar model without decreasing returns in production in Appendix B. Workers are endowed with a skill level, and skilled and unskilled labor are imperfect substitutes in the production of tradables.

Workers in each location consume two goods: non-tradable housing and a tradable numeraire. All workers must consume a baseline, non-utility producing amount of housing in their respective location. This non-homotheticity, which we implement using a Stone-Geary utility function, ensures that housing accounts for a smaller share of skilled workers' consumption baskets.

Next, we consider the interregional allocation of labor. We begin from initial productivity levels such that real wages are lower in the South. Once we allow migration, labor inflows into the North drive down wages for all skill types due to decreasing returns in production. Conversely, wages rise in the South as labor becomes more scarce. The positive impact on

[8]We view this assumption as a reduced form representation of a more complicated process. An alternative way of motivating downward-sloping labor demand could use constant returns to scale in production, each region producing a unique good, and a taste for variety in consumption.

wages in the South and negative impact in the North generate interregional convergence in incomes. If there is a shock that causes the cost of new construction to rise, however, housing prices rise in North, and migration flows become smaller and biased towards skilled workers. Because fewer people move to the North – and because the people who move there are more skilled – income convergence slows. We demonstrate these effects in an illustrative simulation below and in calibration exercises in Appendix A.

Our interpretation of the data relies on two crucial features of the model:

1. Regional labor demand slopes downward. A few examples from the economic history literature help illustrate this concept. First, Acemoglu et al. [2004] study labor supply during and after World War II. States which had more mobilization of men had increased female labor force participation. After the war, both males and females in these places earned lower wages. Second, Hornbeck [2012] studies the impact of a major negative permanent productivity shock, the Dust Bowl. He finds that out-migration is the primary factor adjustment which allowed wages to partially recover. Third, Margo [1997] studies the impact of a positive productivity shock: the Gold Rush. At first, wages soared, but as people migrated in to California, wages declined. We present two methods of deriving this downward sloping labor demand in the paper (Appendix B contains a version without decreasing returns in production), and while our results do not depend on the derivation, they do rely upon the concept. While the extent of this effect is an open question, many papers find evidence for downward-sloping labor demand and our interpretation of the data is consistent with this view.[9]

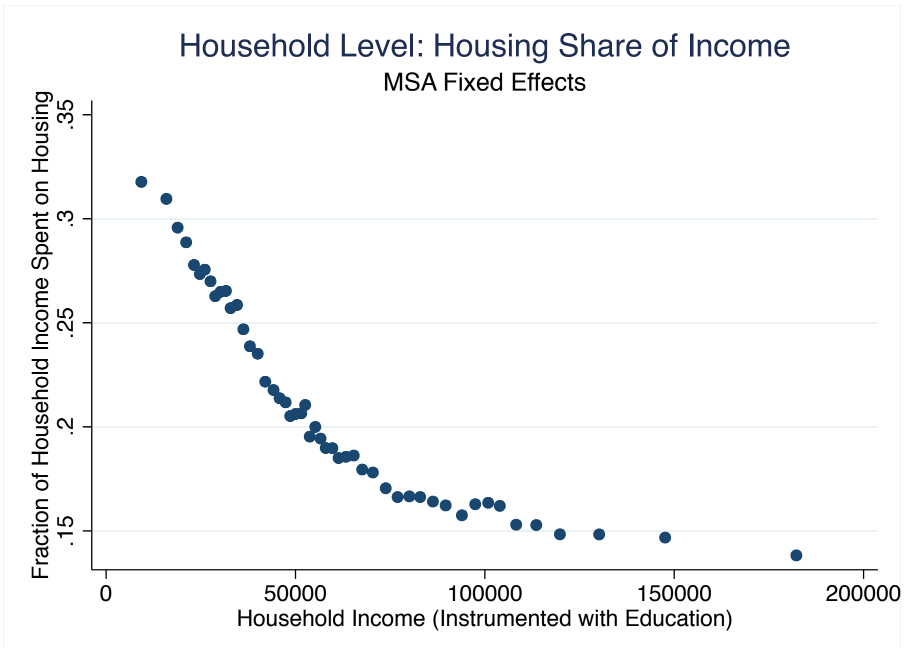
2. Housing is an inferior good *within* a city; meaning that within a labor market, low-skill workers spend a disproportionate share of their income on housing.[10] Many studies have estimated Engel curves for housing, and some find elasticities slighly below one.[11] These estimates generally differ from the parameter of interest in our model in two ways. First, they often express housing as a share of consumption rather than as a share of income (Diamond [2012]). Second, they estimate Engel curves across labor markets rather than within labor markets. These differences mute the non-homotheticity of housing demand due to the positive correlation between income and savings rates, and

[9]See Iyer et al. [2011], Boustan et al. [2010], Cortes [2008], and Borjas [2003].

[10]In fact, our model requires the weaker assumption that *land* within a labor market is an inferior good. The structural value of housing can be treated as non-housing consumption in our framework. The literature that has estimated the income elasticity of land consumption robustly shows income elasiticites below 1 even in the national cross-section (Glaeser et al. [2008]). Glaeser and Gyourko [2005] and Notowidigdo [2013] provide indirect evidence of non-homotheticity in migration patterns.

[11]See Harmon [1988] for an example. Similarly, Davis and Ortalo-Magné [2011] demonstrates that expenditure shares on housing are relatively flat when not adjusting for skills.

due to the positive correlation between incomes and house prices across cities. Below we plot the relevant *within*-city Engel curve using housing as a share of household income and instrumenting for household income with education to address measurement error (Ruggles et al. [2010]). As is evident in the figure, there is a considerable degree of non-homotheticity within labor markets when measuring housing as a share of income. We calibrate our model to match this degree of non-homotheticity in Appendix A.



Note: This figure plots the relationship between the share of household income spent on housing and average household income in the 2010 ACS, conditional on MSA-level fixed effects. Annual income is volatile, meaning that the baseline non-homothetic cross-sectional relationship between housing share and annual income might not reflect the true relationship between housing share and permanent income. To address this issue, we instrument for household income using the education level of its prime age members (25-65). We construct predicted income for each household by summing the average wages associated with the detailed education level of all the household's prime age members. To make this non-homothetic relationship easier to see, we then divide the sample into 50 bins based on household predicted income and plot the average housing share for each bin, controlling for the MSA fixed effects. This data presentation technique is widely used (see Chetty, Friedman, and Rockoff 2013 for an example). Housing expenditure is computed as twelve times monthly rents or 5% of housing costs. Housing shares above 100% and below zero are excluded.

We now describe our model for each state's economy, before turning to the model's interregional dynamics.

2.1 Within-state equilibrium

Each location consists of three markets: a market for labor, a housing market, and a goods market that clears implicitly.

Individual Decisions: Goods Demand and Indirect Utility There are n_{jkt} agents are endowed as either skilled or unskilled in production $k \in \{s, u\}$, and have utility in state $j \in \{N, S\}$ at every date t of

$$\max_{\{c_{jkt}, h_{jkt}\}} \sum_t e^{-rt} ln(u_{jkt})$$

$$\text{where } u_{jkt} = c_{jkt}^{\beta} \left(h_{jkt} - \bar{H}\right)^{1-\beta}$$

$$\text{subject to } c_{jkt} + p_{jt} h_{jkt} = w_{jkt} + \pi_t \quad (1)$$

Workers' preferences take the Stone-Geary functional form with a baseline housing requirement $\bar{H}$ that is common for both skilled and unskilled workers. This functional form generates non-homothetic housing demand.[12] To keep things simple, we assume inelastic labor supply and abstract from intertemporal markets by imposing a static budget constraint.[13] Workers receive the local wage w_{jkt} for their skill type k and the price of housing relative to tradables is p_{jt}. Profits from both the housing sector and the tradable sector in North and South (π_t) are rebated lump-sum nationally. We can therefore write each agent's indirect utility as a function of the wage, price and preference parameters:

$$v_{jkt}(w_{jkt}, p_{jt}) = ln\left(\left(w_{jkt} + \pi_t - p_{jt}\bar{H}\right)\beta^{\beta}\left(\frac{1-\beta}{p_{jt}}\right)^{1-\beta}\right)$$

Labor Market Next, we turn to the production of tradables. State-level production is given by

$$Y_{jt} = A_j \left(n_{jut}^{\rho} + \theta n_{jst}^{\rho}\right)^{\frac{1-\alpha}{\rho}}$$

where n_{jk} is the number of people of type k residing in state j.[14] We normalize $A_S = 1$ throughout, and assume $A_N > 1$. This term can encompass capital differences, natural advantages, institutional strengths, different sectoral compositions, amenities, and agglomeration benefits. Assuming labor earns its marginal product, we have:

[12] See Mulligan [2002] and Kongsamut et al. [2001] for other examples of papers using Stone-Geary preferences.

[13] We allow for endogenous labor supply in a calibration exercise in Appendix A.

[14] This widely used form of imperfect substitution ensures an interior solution for skill ratios in equilibrium.

$$w_{jut} = A_j\,(1-\alpha)\left(n_{jut}^{\rho} + \theta n_{jst}^{\rho}\right)^{\frac{1-\alpha-\rho}{\rho}} (n_{jut})^{\rho-1} \tag{2}$$

$$w_{jst} = A_j\,(1-\alpha)\,\theta\left(n_{jut}^{\rho} + \theta n_{jst}^{\rho}\right)^{\frac{1-\alpha-\rho}{\rho}} (\theta n_{jst})^{\rho-1} \tag{3}$$

Equilibrium in each these markets is given by the wage such that $l_{jkt}^{demand}(w_{jkt}) = n_{jkt}$.

Housing Market Define the quantity of housing in place j at time t as H_{jt}. Every state is endowed with a housing supply at time zero equal to the demand of the initial population. Regulations can only affect new construction. Because they are designed to minimize the amount of cumulative development, we model them as imposing a convex cost as a function of the existing housing stock, where η, the measure of regulatory constraints, governs the elasticity of supply in growing regions. The marginal cost per unit of construction is

$$c(H_{jt}, H_{jt-1}) = \begin{cases} 0 & H_{jt} < H_{jt-1} \\ H_{jt}^{1/\eta} & H_{jt} \geq H_{jt-1} \end{cases}$$

All housing has a fixed maintenance cost to be habitable which we normalize to 1. So long as a city is growing, the price of all housing is equal to marginal cost of construction plus maintenance, so prices are:

$$p_{jt} = \begin{cases} 1 & if\ H_{jt} \leq H_{jt-1} \\ 1 + H_{jt}^{1/\eta} & if\ H_{jt} > H_{jt-1} \end{cases} \tag{4}$$

Regulations affect the dynamics of the system only in places where the population would otherwise be increasing. Demand for housing for each individual is equal to $\bar{H}+(1-\beta)\left(\frac{w_{jkt}+\pi_t}{p_{jt}}\right)$, and therefore aggregate demand is

$$H_{jt} = n_{jut}\left(\bar{H} + (1-\beta)\left(\frac{w_{jut}+\pi_t}{p_{jt}}\right)\right) + n_{jst}\left(\bar{H} + (1-\beta)\left(\frac{w_{jst}+\pi_t}{p_{jt}}\right)\right) \tag{5}$$

We model regulations as affecting the elasticity of supply rather as a direct cost shock. This choice is motivated by empirical evidence that regulations affect the relationship between income and prices and not merely the price itself (see Figure 8 and Table 2). This choice is also consistent with the existing empirical work on regulations and housing (Saiz [2010]and Saks [2008]), and the dominant interpretation in the legal literature (Ellickson [1977]).

Equilibrium Taking $\{n_{jut}, n_{jst}\}$ as given, prices $\{w_{jut}, w_{jst}, p_{jt}\}$ and allocations $\{c_{jkt,}H_{jkt}\}$ that satisfy equations 1-5 constitute an equilibrium in the housing and labor markets. This equilibrium also allows us to write indirect utility as a function of the local population

$(v_{jkt}(n_{jut}, n_{jst}))$.

2.2 Migration and Dynamics

Having characterized the equilibrium within a location, we turn to cross-location dynamics. Normalizing the national population of each skill type to 1, we define $\Delta_{kt} = v_{Nkt}(n_{Nut}, n_{Nst}) - v_{Slt}((1 - n_{Nut}), (1 - n_{Nst}))$ as the flow utility gains to living in the North. Note that when land supply is perfectly elastic ($\eta \to \infty$), Δ_{kt} does not depend on the skill type k.[15] We can now define the present discounted value of migrating from South to North as:

$$q_k\left(t\right) = \sum_{\tau=t}^{\infty} e^{-r\tau}\Delta_{k\tau} \tag{6}$$

These expressions depend upon exogenous parameters and shocks, as well as two state variables n_{Nut} and n_{Nst}.

Given these gains to migration, how many people migrate each period? We follow Braun [1993] in assuming that the migration rate is proportional to the present-discounted value of migrating:

$$\Delta ln(n_{Nkt}) - \Delta ln(n_{Skt}) = \psi q_k(t) \tag{7}$$

This equation holds exactly for i.i.d. migration cost draws from a specific distribution derived in Appendix C, or viewed as a linear approximation of a more general class of processes.

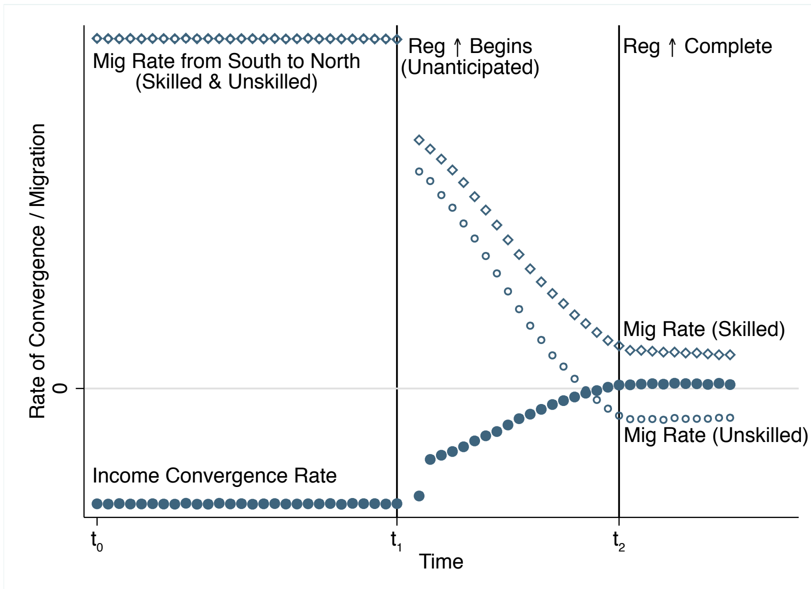
The equations represented in (6) and (7) constitute a dynamic system in terms of two endogenous variables and exogenous shocks and parameters. To illustrate the dynamics of the system, we consider a numeric example. We plot the dynamics in a simulation where (1) the population of skilled and unskilled workers are evenly divided between North and South, (2) the housing supply in the North is completely elastic ($\eta \to 0$), and where (3) the productivity parameter A_N is significantly greater than 1. Given these assumptions, the initial population in the South exceeds the steady-state population values.

The figure below illustrates the dynamics of the system from these conditions until time t_1.[16] When the housing supply in the North is completely elastic, the relative gains to migration are independent of skill type, and hence both high and low productivity workers migrate away from the South at the same constant rate. This directed migration makes labor

[15] This holds under the normalization that $\bar{H} = \pi$.

[16] This graph is meant to illustrate the model's dynamics. To do this, we set $\theta = 1.7$, $\alpha = 0.33$, ρ=0.9, β=0.25, H=0.25, $A_n = 2$, $\psi = 0.005$, and r=0.05. We then simulated a falling housing supply elasticity by having $1/\eta$ ascend from a value near zero to 0.25.

more scarce in the South and more plentiful in the North, which yields a constant rate of convergence in per capita incomes between the regions. Additionally, if there were a larger fraction of unskilled workers in the South, then migration would have driven convergence by equating average human capital levels as well.



At date t_1, the elasticity of housing supply, η, begins to fall and reaches a new, permanently lower level at time t_2. This unanticipated shock increases housing prices in the growing North, and alters the value of living in the North in the future. Both skilled and unskilled migration rates fall, but they do not fall to the same degree. Skilled workers continue to find it worthwhile to move from South to North, but the increase in housing prices actually makes the North relatively unattractive to unskilled workers who begin to move in the opposite direction. The joint effect is that, by t_2, there is no more net migration from South to North and no further convergence in incomes per capita. Instead, migration flows lead to skill-sorting and segregation by skill type.

This model lays out a theory that can account for the changing migration and convergence patterns reported in the beginning of the paper. We assess the validity of this explanation in two ways; we first present stylized facts that suggest housing markets have played a key role in altering migration patterns, and then we introduce a new measure of housing supply restrictions to test this model directly.

3 Motivating Facts on Housing Prices and Migration

In this section, we highlight four stylized facts on the evolution of the flows of and returns to migration in the U.S. These facts motivated the model laid out in the previous section and its emphasis on the elasticity of housing supply.

Fact 1: Differences in Housing Prices Have Grown Relative to Differences in Incomes

In the last fifty years, there has been a shift in the relationship between prices and incomes across states. Figure 3 plots the relationship between log income and log housing prices in 1960 and 2010. Each observation is a state's mean income and median house value from the Census. In 1960, housing prices were 1 log point higher in a state with 1 log point higher income. By 2010, the slope had doubled, with housing prices 2 log points higher in a state where income was 1 log point higher.

Fact 2: Housing Prices Have Lowered the Returns to Living in Productive Places For Unskilled Workers

We test for changing returns by examining the relationship between unconditional average income in a state and skill-group income net of housing prices (Ruggles et al. [2010]).[17] With i indexing households and j indexing state of residence, we regress:

$$\underbrace{Y_{ij} - P_{ij}}_{\text{Income-Housing Cost}} = \alpha + \beta_{unskilled} \underbrace{Y_j}_{\text{Nominal Income}} \times (1 - S_{ij}) + \beta_{skilled} Y_j \times S_{ij} + \eta S_{ij} + \gamma X_{ij} + \varepsilon_{ij}$$

where Y_{isj} is household wage income, P_{ij} is a measure of housing costs defined as 12 times the monthly rent or 5% of house value for homeowners, and S_{ij} is the share of the household that is skilled, and Y_j is the mean nominal wage income in the state.[18]

Figure 4 shows the evolution of $\beta_{skilled}$ and $\beta_{unskilled}$ decade by decade. These coefficients measure the returns by skill to living in a state that is one dollar richer. For example,

[17] Ideally, we would have a cost index for the price of all goods and services and use this to deflate income. Moretti [2012a] finds a strong positive correlation between housing prices and the price of other consumer goods. Unfortunately, we are unaware of any regional price indices going back to 1940.

[18] Income net of housing cost is a household-level variable, while education is an individual-level variable. We conduct our analysis at the household level, measuring household skill using labor force participants ages 25-65. A person is defined as skilled if he or she has 12+ years of education in 1940, and 16+ years or a BA thereafter. The household covariates X_{ij} are the size of the household, the fraction of household members in the labor force who are white, the fraction who are black, the fraction who are male, and a quadratic in the average age of the adult household members in the workforce.

$\beta_{unskilled}$ is 0.88 in 1940, meaning that for unskilled workers, income net of housing costs was \$0.88 higher in states with \$1.00 higher nominal income. $\beta_{unskilled}$ shows a secular decline from 1970 forward. The decade-specific coefficients on $\beta_{skilled}$ show a different pattern. In 1940 and 1960, skilled and unskilled households had similar returns to migrating. By 2010, income net of housing costs is three times more responsive to nominal income differences by state for skilled households than for unskilled households. The returns to living in high income areas for unskilled households have fallen dramatically when housing prices rose, even as they have remained stable or grown for skilled households.[19]

Fact 3: Migration Flows Respond to Skill-Specific Gains Net of Housing Prices

Next, we examine the extent to which people moved from low to high income places. We estimate income in both nominal terms and using the income net of housing cost measure developed above. We estimate net migration using the Census question "where did you live 5 years ago?", which was first asked in 1940 and last asked in 2000. We use the most detailed geographies available in public use microdata: State Economic Areas in 1940 (467 regions) and migration PUMAs in 2000 (1,020 regions).

In Figure 5, we examine migration patterns from 1935 to 1940. As is evident from the graphs, both skilled and unskilled adults moved to places with higher nominal income.[20] The same relationship holds true for income net of housing cost.[21] In Figure 6, we examine migration patterns from 1995 to 2000. Although skilled adults are still moving to high unconditional nominal income locations, unskilled adults are actually weakly migrating *away*

[19] In the Appendix, we report the results of two robustness checks. First, to reduce the bias arising from the endogeneity of state of residence, we also provide instrumental variables estimates using the mean income level of the household workers' state of birth as an instrument. To be precise, we estimate $Y_{is} - P_{is} = \alpha + \beta_{unskilled}\hat{Y}_j \times (1 - S_{ij}) + \beta_{skilled}\hat{Y}_j \times S_{ij} + \eta S_{ij} + \gamma X_{ij} + \varepsilon_{ij}$, using $Y_{j,birth}$ and $Y_{j,birth} \times S_{js}$ as instruments for the two endogenous variables $\hat{Y}_j \times (1 - S_{ij})$ and $\hat{Y}_j \times S_{ij}$. Second, we demonstrate that housing costs have differentially changed housing prices in high nominal income places for low-skilled workers.

[20] Migration and education are person-level variables, while income net of housing cost is a household-level variable. We conduct our analysis at the individual level, merging on area-by-skill measures of income net of housing cost. To construct area-by-skill measures, we define households as skilled if the adult labor force participants in said household are skilled, and as unskilled if none of them are skilled. See notes to Figure 5 for details. The specifications shown in Figures 5 and 6 involve some choices about how to parameterize housing costs and which migrants to study. In the Appendix, we report four robustness checks: doubling housing costs for the income net of housing cost measure, excluding migrants within-state, using only whites, and using a place of birth migration measure. In 1940, all slopes are positive, and most are statistically significant. In 2000, all slopes are positive and statistically significant for skilled workers. For unskilled workers, the coefficients broadly fit the patterns in Figure 6, although only sometimes are statistically significant.

[21] These results are similar to work by Borjas [2001], who finds that immigrants move to places which offer them the highest wages.

from these locations.[22] This finding sharply contrasts with the results from the earlier period in which there was directed migration for both groups to high nominal income areas. It is an apparent puzzle that unskilled households would be moving away from productive places. However, this seeming contradiction disappears when we adjust income to reflect the group-specific means net of housing prices. High housing prices in high nominal income areas have made these areas prohibitively costly for unskilled workers. Changes in observed migration patterns are consistent with the changes in the returns to migration shown above.

Fact 4: Migration Used to Generate Substantial Human Capital Convergence Across Regions

We now examine the effect of migration flows on aggregate human capital levels. We present evidence that the transition from directed migration to skill sorting appears to have substantially weakened human capital convergence due to migration. We follow the growth-accounting literature (e.g. Denison [1962], Goldin and Katz [2001]) and estimate a Mincer regression in the IPUMS Census files. Under the assumption of a fixed national return to schooling, a state's skill mix and these coefficients can be used to estimate its human capital.[23] We construct predicted income as $\widehat{Inc}_k$ for each education level k and $Share_{kj}$ as the share of people in human capital group k living in state j. A state-level index is Human Capital$_j \equiv \sum_k \widehat{Inc}_k \times Share_{kj}$. Our research design exploits the fact that the Census asks people about both their state of residence and their state of birth. We can then compute the change in the human capital index due to migration as

$$\Delta HC_j \equiv \underbrace{\sum_k \widehat{Inc}_k Share_{kj,residence}}_{\text{Realized Human Capital Allocation}} - \underbrace{\sum_k \widehat{Inc}_k Share_{kj,birth}}_{\text{No-Migration Counterfactual}}$$

Next, we take the baseline measure of what human capital would have been in the absence of migration ($HC_{j,birth}$) and examine its relationship with how much migration changed the

[22] Young et al. [2008] similarly show that from 2000 to 2006, low-income people migrated out from New Jersey, while high-income people migrated in.

[23] Formally, we estimate the specification $\log Inc_{ik} = \alpha_k + X_{ik}\beta + \varepsilon_{ik}$ where Inc_{ik} is an individual's annual income, and X_{ik} includes demographic covariates using data from the 1980 Census. We construct predicted income as $\widehat{Inc}_k = exp(\hat{\alpha}_k)$. Skill level k is defined as seven possible completed schooling levels (0 or NA, Elementary, Middle, Some HS, HS, Some College, College+). X_{ik} includes a dummy for Hispanic, a dummy for Black, a dummy for female and four age bin dummies. There is a substantial literature showing that the South had inferior schooling quality conditional on years attained (e.g. Card and Krueger [1992]). Thus this measures is, if anything, likely to underestimate the human capital dispersion across states.

skill composition of the state (ΔHC_j). Specifically, we regress

$$\Delta HC_j = \alpha + \beta HC_{j,birth} + \varepsilon_j$$

Figure 7 shows the results of this regression for different years in the U.S. Census. We focus our analysis on people ages 25 to 34 to focus on people who have completed their education but are likely to have migrated recently.[24] We estimate a slope of $\hat{\beta} = -0.33$ in the 1960 Census. Of the human capital dispersion by state of birth, migration of low human capital workers to high human capital places was sufficient to eliminate 33% of the disparities in human capital. By 2010, migration would have eliminated only 8% of the remaining disparity.[25]

4 A Panel Measure of Housing Regulations

These stylized facts suggest that changes in housing prices were an important contributor to changing migration and convergence patterns. The model formalized this idea and highlighted the importance of changes in the elasticity of housing supply in growing regions. In this section, we explore the role of regulations directly. We develop a new measure of housing supply regulations based on state appeals court records. Past empirical work has shown tight links between prices and measures of land use regulation in the cross-section, and these regulations are a good proxy for the parameter η in the model.[26] This new measure is, to the best of our knowledge, the first panel of housing supply regulations covering the United States and we validate it against existing cross-sectional regulation measures.[27] We use this measure to test for the entire causal chain of the model by showing that housing supply constraints reduce permits for new construction, raise prices, lower net migration, slow human capital convergence and slow income convergence.

[24] To the extent that people migrate before age 25 (or their parents move them somewhere else), we may pick up older migration flows. Nevertheless, this statistic still has a well-defined interpretation as the amount of human capital convergence due to migration within a cohort.

[25] This figure shows that migration contributed to convergence in human capital levels. Looking at convergence in average human capital levels, including native-born residents human capital investment decisions, we do not see the same decline in human capital convergence for the same aged sample. This occurs in part because the fraction of natives completing high school rose sharply among low human capital Southern states in the 1970's and 1980's, while this fraction was already high for the rest of the country.

[26] Examples include Glaeser et al. [2005a], Katz and Rosen [1987], Pollakowski and Wachter [1990], Quigley and Raphael [2005], and Rothwell [2012] using US data. See Brueckner and Sridhar [2012] for work on building restrictions in India.

[27] In a similar spirit, Hilber and Vermeulen [2013] analyze a panel of land use regulations in the UK.

4.1 Measuring Land Use Regulations

Our measure of land use regulations is based upon the number of state appellate court cases containing the phrase "land use" over time. The phrase "land use" appears 42 times in the seminal case *Mount Laurel* decision issued by the New Jersey Supreme Court in 1975. We also show similar results for the phrase "zoning" in the Appendix. Municipalities use a wide variety of tactics for restricting new construction, but these rules are often controversial and any such rule, regardless of its exact institutional origin, is likely to be tested in court. This makes court decisions an omnibus measure which capture many different channels of restrictions on new construction. We searched the state appellate court records for each state-year using an online legal database and produce counts of land use cases in per capita terms.

One immediate result from constructing this measure is that the land use cases have become increasingly common over the past fifty years. Figure 8 displays the national regulation measure over time, which exhibits strong secular growth. Growth is particularly rapid from 1970, when it stood at about 25% of its current level, to 1990, when it reached about 75% of its present day level.

We validate our measure against the existing cross-sectional measures that focus on supply constraints. The first survey, from the American Institute of Planners in 1975, asked 21 land use-related questions of planning officials in each state (The American Institute of Planners [1976]).[28] To build a summary measure, we add up the total number of yes answers to the 21 questions for each state. As can be seen in Figure 8, the 1975 values of our measure are strongly correlated with this measure. Similarly, our measure is highly correlated with the 2005 Wharton Residential Land Use Regulation Index (WRLURI).[29] Finally, state-years with high levels of regulation show increased capitalization of income into housing prices.

4.2 Why Did Land Use Regulations Change?

Since Ellickson [1977]'s seminal article, it has been widely accepted that municipalities' land use restrictions serve to raise property values for incumbent homeowners.[30] In this section, we examine the institutional and demographic factors which may have led such regulations

[28]Saks [2008] also uses this survey as a measure of land use regulations.

[29]To construct state-level measures, we weighted the metro estimates in Gyourko et al. [2008] by 1960 population and imputed from neighbors where necessary.

[30]Blanchflower and Oswald [2013] demonstrate the link between homeownership and land use regulation empirically.

to become more widespread and more effective in constraining supply across an entire region.

Many land use scholars point to a landmark shift toward new stringencies in regulations in the 1960's and 1970's. Fischel [2004] argues that in the wake of racial desegregation, land use restrictions allowed suburban residents to keep out minorities using elevated housing prices, and that environmentalism provided a sanitized language for this ideology. He writes "I submit that neighbour empowerment and double-veto systems, in conjunction with local application of environmental laws, changed metropolitan development patterns after 1970." In a book on land use regulation, Garrett [1987] writes

> A changing public attitude toward growth and development within many local communities emerged in the early 1960s. Two factors were simultaneously responsible for this change. First, there was an increasing concern over environmental issues, and it was apparent that certain types of economic development were detrimental to the environment. Second, economic analysis began to demonstrate that all forms of economic development did not generate a positive fiscal impact in every community.

Along similar lines, the American Land Planning Law textbook (Taylor and Williams [2009]) write that, after a period in the 1900's during which courts typically held the application of restrictions to particular tracts of land to be invalid, the courts "went to the other extreme, tending to uphold anything for which there was anything to be said." Our statistical regulation measure is broadly consistent with this argument, although the change in the intellectual climate described above somewhat preceded the run-up in our measure – the flow of new land use cases rose sharply from 1970 to 1990.

Because land use rules are administered at the local level, there are no seminal Supreme Court cases which marked this new era of jurisprudence. Among state cases, scholars typically cite *Mount Laurel vs. National Association for the Advancement of Colored Persons* (NAACP) as among the most important. Philadelphia suburb Mount Laurel, at the time composed primarily of single family houses, adopted rules which required that developers of multi-family units provide in leases that (1) no school-age children may occupy a one-bedroom unit and (2) no more than two children may occupy a two-bedroom unit. In addition, should a development have more than 0.3 children per unit on average, the developers were required to pay any additional tuition costs. The NAACP sued, and in 1975, the New Jersey Supreme Court ruled in its favor, finding that each community had to provide its "fair share" of "low- and moderate-income housing."

While the NAACP won the case, Mount Laurel and like-minded suburbs won the war. Mount Laurel's new planning ordinance rezoned only 20 of its 14,300 acres, choosing locations such that "the new zones had serious physical difficulties and restrictions created by the ordinance that rendered their actual development for low-cost housing virtually impossible" (Garrett [1987]). In 1977, the state Supreme Court issued a new ruling in the *Oakwood at Madison* decision, which substantially rolled back its prior decision, finding instead that that courts were not competent to determine what constituted a "fair share". These cases led to the "Mount Laurel Doctrine," wherein judges began to play a continuing role in monitoring local zoning policies, but the sea change had already occurred in New Jersey. From 1970 to 2010, its urban population grew at an annual rate of 0.4%, less than half the national average for this period.[31]

New state and regional environmental restrictions on land use, detailed in a White House report titled "The Quiet Revolution in Land Use Control", added another constraint on new construction. These restricions played a crucial role in preventing construction on a metro-wide level, an argument highlighted by Ellickson [1977]. In a Tiebout model where consumers choose locations, if some municipalities restrict construction as Mount Laurel did, and other places respond by issuing more permits, then the aggregate impact on new units and average prices could be zero. For example, in the East Bay region in California, while many municipalities restricted construction, the coastal city of Emeryville adopted developer-friendly policies, yielding much higher-density units. In 1969, the California Legislature gave the San Francisco Bay Conservation and Development Commission the power to require permits from anyone seeking to develop land along the shoreline (Bosselman and Callies [1971]). The Commission then blocked a plan by Emeryville to fill the Bay and construct large developments there.[32] The East Bay has remained an attractive place to live, but with no municipality willing to allow new construction, housing prices across the East Bay have soared in recent years.

Local variation in regulations is not randomly assigned; it is the product of substantial work by local governments and regulatory bodies. There is some recent work on the political economy of the regulations. Kahn [2011] shows that in California, cities which vote Democratic tend to issue fewer housing permits. Hilber and Robert-Nicoud [2013] and Schleicher [2013] develop political economy stories where changes in the share of developed land, and in the structure of city politics, respectively, cause changes in land use policies.

[31] Urban population is defined as population living in a Primary Metropolitan Statistical Area.

[32] A change in town leadership in the election of 1987 also led to a slowdown in new development. Nevertheless, Emeryville today still has some of the highest-density construction in the East Bay and this new regional authority further limited Tiebout competition.

In our empirical analysis, we first examine the relation between regulation and regional economic outcomes. Then, cognizant of the fact that regulations do not arise randomly, we address concerns about causality by studying the heterogeneity of states' responses to the national change in the regulatory environment described above. We test whether this aggregate change had a different impact on the convergence rates of states with larger or smaller historical tendencies to regulate land use, and for states with more or less severe geographic limits on development. We also consider the main alternative interpretations of the data in Section 5, and find that housing supply constraints are required to make sense of the data.

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4.3 Testing the Model using a Panel Measure of Regulations

Having established that our regulation measure is a good proxy for housing supply constraints, we test its direct effect on the convergence relationship. Before turning towards regressions, we first demonstrate the effect of land-use regulations on convergence graphically. Figure 9 shows differential convergence patterns among the high and low regulation states. The convergence relationship within the low regulation states remains strong throughout the period. Conceptually, we can think of this group of states as reflecting the model prior to the change in regulations, with within-group reallocations of people from low-income states to high-income states. In contrast, the convergence coefficients among states with tight regulations display a pronounced weakening over time (although convergence reappears briefly among high-regulation states during the recent recession). As a robustness check, we divide the states according to a measure of their housing supply elasticity based upon land availability and the WRLURI constructed by Saiz [2010]. Again, we find that convergence continues among states without supply constraints, but has stopped primarily in states with constraints.

We now turn towards regressions and explore the effect of regulations more rigorously on the entire convergence mechanism described above. It is not obvious what functional form should be used to scale court cases into a regulation measure. We adopt a flexible and transparent specification – ranking state-years by their land use cases per capita:

$$Reg_{s,t} = Rank\{\frac{LandUseCases_{st}}{Pop_{st}}\}$$

We rescale these values to create a variable ranging from zero for the least regulated state-year to one for the most regulated state-year.[33] Regulations are rising over time, from an average of 0.15 in 1950 to 0.64 in 1990.

Our baseline specifications are of the following form:

$$Y_{s,t} = \alpha_t + \alpha_t Reg_{s,t} + \beta Inc_{s,t} + \beta_{\text{high reg}} Inc_{s,t} \times Reg_{s,t} + \varepsilon_{s,t} \tag{8}$$

The coefficients of interest, β and $\beta_{\text{high reg}}$, measure the effect of lagged income in low and high regulation state-years and are reported in Table 2.[34]

First, we examine housing supply. Absent land use restrictions, places with higher income will face greater demand for houses and will permit at a faster rate. Accordingly, the base coefficient on income in column 1 is positive, indicating that places with 10% higher incomes had a .5% higher annual permitting rate. The interaction term $\beta_{\text{high reg}}$ is negative and similar in size: in the high-regulation regime there is no correlation between income and permits for new construction. This reduction in housing supply in high-income places means that housing prices should rise in those places. In column 2, we show that at baseline there is a positive correlation between income and housing prices (with 1% higher income associated with 0.8% higher prices), but that the slope of the relationship doubles in high regulation state-years. Income differences are increasingly capitalized into prices.[35]

Columns 3 and 4 explore migration responses to this change in prices. In our model, states with high income per capita will draw migrants when regulation is low, consistent with the baseline coefficient in column 3 that shows 0.17% higher annual population growth

[33] We conduct robustness tests on alternate scaling of the regulation measure in the appendix. We also explore the robustness of the relationship between declining income convergence and regulations in alternate regression models in Appendix Table 6. Specifically, this table reports the following specifications in the correspondingly numbered columns: (1) Our baseline convergence relationship; (2) A specification where the regulation variable is interacted with a dummy for greater than median income. This follows our model in assuming that regulations only bind in growing locations; (3) A specification that controls for the percent of the population with a BA and the interaction of this share with initial income. This specification, like Section 5.1, is designed to show the robustness of the regulation result to controls for skill-biased technological change; (4) A specification with log income squared, accounting for potential nonlinearity in convergence; (5) A specification that includes Census division fixed effects interacted with regulations to account for differential regulation growth across regions; (6) A specification that includes year fixed effects interacted with initial income, which allows for different baseline convergence rates across time. In all of these models, the relationship between tighter regulation and slower convergence remains statistically significant.

[34] This specification follows the literature in not including state fixed effects. See Barro [2012] for a discussion of how state/country fixed effects can lead to misleading convergence results in short panels.

[35] Our findings that increases in regulation raise capitalization are similar to those by Hilber and Vermeulen [2013] for the UK. Similarly, Saks [2008] and Glaeser et al. [2006] find in the US that employment demand shocks are capitalized into prices rather than quantities in the high regulation regime. However, see Davidoff [2010] for a dissenting view about the impact of regulations on housing prices using cross-sectional data. Davidoff writes "Unfortunately, a panel of regulations is not available, so there is no way to determine if time series changes in regulations are associated with changes in supply."

in places with 10% higher incomes. When income differences are capitalized into prices, the incentive to move is diminished, and directed migration slows. The positive interaction coefficient shows that directed migration almost completely disappears in the state-years with high regulation. We also examine how the composition of migration responds to income, using the change in the log of the human capital measure from Section 3. When housing supply is elastic, the negative baseline coefficient in column 4 indicates that migration undoes any initial human capital advantage held by productive places. The interaction coefficient is positive, indicating that human capital convergence slows among high regulation observations.

Finally, Column 5 brings this analysis full circle by directly looking at the effect of high regulations on the convergence relationship. The uninteracted coefficient (-2.0) captures the strong convergence relationship that exists absent land use restrictions shown in the early years in Figure 1. However, the interaction coefficient is large and positive (1.3). This finding indicates that the degree of convergence among states in periods of high regulation is significantly diminished.

One potential concern is that our measure is picking up changes in the overall regulatory or legal climate, rather than a change which is specific to land use. As a placebo test, we repeat the analysis above substituting placebo measure

$$RegPlacebo_{s,t} = Rank\{\frac{Cases_{st}}{Pop_{st}}\}$$

This measure also exhibits secular growth, from an average of 0.30 in 1950 to 0.66 in 1990. This means that if our results above were due to changes in the overall state-level regulatory climate or due to time trends, then we should expect them to also appear as part of this placebo test. Instead, however, we find that the interaction coefficients on $RegPlacebo_{s,t}$ are small in magnitude and not statistically significant.

Table 2 tightly links the theory from Section 2 to the observed data. The first row of coefficients describe a world where population flows to rich areas, human capital converges across places, and regional incomes converge quickly as in the model before the regulatory shock. The second row of coefficients is consistent with the high regulation regime described in the model after the shock, with increased capitalization, no net migration, and much less income convergence.

4.4 Identification from National Changes and Preexisting Regional Differences

This section analyzes evidence in favor of a causal relationship between land use regulations and convergence. In the 1970s there was a dramatic change in the prevalence of land use regulations in the US, as described by land use scholars in Section 4.2. Though our regulation measure is lower across the board prior to the 1970s, states nevertheless differed in their legal cultures regarding land use and in their natural supply constraints. This heterogeneity made some states more likely to be affected by change in the national climate towards land use regulations. Many other authors use a similar identification strategy of using historical differences across places and studying national changes in industry, ethnic composition or occupations (Bartik [1991], Card [2009], and Autor and Dorn [2013]).

We estimate specifications of the form

$$\Delta Inc_{s,t} = \alpha_t + \alpha_t LatentConstraint_s + \beta Inc_{s,t} + \beta_{\text{constrained}} Inc_{s,t} \times LatentConstraint_s + \varepsilon_{s,t}$$

where $LatentConstraint_s$ are measures of a state's susceptibility to regulations that are fixed across time. We split the sample into a pre-period, with twenty year windows from 1940-1960 through 1965-1985, and a post-period, with twenty year windows from 1965-1985 through 1990-2010. Statistically, this takes the form of testing whether $\beta_{\text{constrained}}$ is the same in the pre and the post period. Before turning to preexisting measures, we first demonstrate the result of this test when using a recent cross section of regulations. Columns 1 and 2 demonstrate that states with high and low-regulation in 2005 had similar convergence rates in the first half of the sample, but that convergence slowed in high-regulation states after these restrictions were enacted. A potential concern raised above is that changes in skill composition, demographics or industrial patterns raised regulations and independently affected migration and convergence patterns. To gauge the importance of this bias, Columns 3 and 4 re-estimate this relationship controlling for a wide variety of state level measures of industry and skill composition from Autor and Dorn [2013] and show similar results.[36]

Controlling for potentially confounding covariates does not address the possibility of reverse causality through unobserved channels. Although regulation was low across the board in 1965, there is still cross-sectional variation in our measure for that year. This variation in permissiveness to laws regarding land use is predictive of subsequent increases in regulation,

[36]Specifically, we control for their measures of the share of workers in routine occupations, the college to non-college population ratio, immigrants as a share of the non-college population ratio, manufacturing employment share, the initial unemployment rate, the female share, the share age 65+, and the share earning less than the 10 year ahead minimum wage. We aggregate their data to the state level via population weighting.

and the correlation between the measures in 1965 and 2005 is 0.47. Though this measure is correlated with eventual regulation outcomes, variation in this measure cannot be plausibly explained by a subsequent shock affecting migration and convergence. Nevertheless, we find that states with low and high regulation values displayed similar convergence behavior in the first half of the sample. In the second half, once these latent tendencies had been activated in the form of high regulations, these states experience a sizeable drop in their degree of income convergence.

Finally, we classify counties based upon the geographic availability of developable land using data from Saiz [2010].[37] This measure can not be affected by any shock altering migration or convergence, yet it too should predict the severity of supply constraints after a nationwide rise in building restrictions. Again, the table demonstrates that counties with low geographic land availability did not display different convergence behavior in the past. In the period with tight building restrictions, however, these counties also experience a reduction in their rates of income convergence.

We interpret these results as consistent with a change in housing supply constraints over time, with a latent tendency to regulate that was higher among states with more land use cases in 1965.[38] Table 3 shows that if housing supply restrictions did not affect income convergence, then regulations must be correlated with a non-related convergence-ending shock, and this new shock must also be correlated with both states' geography and historical legal structures. Moreover, such an explanation would have to explain why neither feature influenced convergence rates prior to the period of high land use regulation. Although it is possible to generate such an explanation, articulating such a story is sufficiently complicated that we feel the weight of the evidence supports a role for housing supply restrictions.

5 Other Factors Affecting Convergence

Our analysis thus far has explored the role that housing regulations have played in changing skill-specific labor mobility and income convergence. Of course, other factors are likely to

[37]Saiz [2010] produces a metro-area level measure of developable land. Using data from the Census, we build a consistent series for median household income at the county-level. While the unit of observation is the county, we cluster our standard errors at the metro area level.

[38]One alternative interpretation is that our 1965 empirical measure detects fixed, heterogeneous elasticities across places. This interpretation is inconsistent with the secular increase in land use cases shown in Figure 8. It is also inconsistent with sustained income convergence and directed migration observed in the data from 1880 to 1980. If the North had substantial barriers to new construction before 1980, then its population could not have grown so rapidly beforehand.

affect both patterns, and in this section, we consider how these forces relate to the results in the previous section.

5.1 Skill Biased Technological Change

Conceptually, skill-biased technological change (SBTC) could slow the rate of convergence for several reasons.

Consider an increase in the skill premium. This change would have two effects on convergence rates. It mechanically widens the income gaps between richer, more educated states and poorer, less educated ones. Additionally, in our model, it raises the returns to migration for skilled workers living in low-income states. The change in the returns to migration is complementary to our supply constraints story – both forces serve to make migration to rich places more heavily weighted towards skilled workers. As for the magnitude of the mechanical effect, Autor et al. [2008] estimate that the college-high school premium rose from 0.40 in 1980 to 0.64 in 2000. The share of people with a BA (henceforth "share BA") in 1980 had a standard deviation of 3 percentage points across states, and the mechanical increase in the skill premium would have reduced the annual convergence rates by roughly 0.18. The observed change in annual convergence rates was 1.11, meaning that the mechanical effect of SBTC provides a partial but incomplete account for the change.

Finally, it is possible that as skills have become more important, incomes of everyone in high share BA places would rise due to agglomeration externalities. We know from the work of Gennaioli et al. [2013a] that human capital levels play a central role in determining the level of regional development (see also Moretti [2012b], Glaeser and Saiz [2004], Berry and Glaeser [2005]). Under this theory, incomes would grow more quickly in these places, slowing convergence. One testable prediction which differentiates this story (a demand shock in productive areas) from our housing supply constraints story comes from skill-specific migration patterns. A positive demand shock should *raise* in-migration rates for all workers. If this demand shock mostly affected skilled workers, then it should raise the migration rate for skilled workers. In contrast, a negative housing supply shock predicts sharply falling in-migration by low-skill workers and a smaller decline in in-migration for skilled workers. Although information-economy cities such as San Francisco, Boston and New York offer high nominal wages to all workers (typically in the top quintile nationally), after adjusting for housing costs all three cities offer below average returns to low-skill workers (typically in the bottom decile). In Table 4, we examine the flows of unskilled and skilled workers in 1980 and 2010 to high skilled states as measured in 1980. This period and independent variable were chosen to be consistent with the literature on skill agglomerations.

There has been a marked shift in the composition of migration to high share BA places. From 1980 to 2010, there was a large decrease in the in-migration rate of low-skilled workers to high share BA states, and no change or a small decline in the in-migration rate of skilled workers to high share BA states. These results suggest that rising share BA in areas with a high initial share of BAs documented by other researchers may partially be the result of out-migration by unskilled workers and increased domestic human capital production, rather than increasing in-migration by skilled workers. Overall, SBTC and its place-specific variants are complementary with the supply constraints story developed here. When supply is constrained, increases in demand for skilled labor serve to further slow convergence.

5.2 Different Steady States: Convergence Has Already Happened

Income gaps across states are smaller today than they were in the past. Perhaps differences in incomes today reflect steady-state differences. While possible, two pieces of evidence are inconsistent with this suggestion. First, a close examination of Figure 1 shows that from 1940 to 1960 there was within-group convergence among the rich states as well as among the poor states. The income differences between Connecticut and Illinois or Mississippi and Tennessee in 1940 are smaller than the differences between Connecticut and Mississippi in 1990, and yet there was substantial within-group convergence from 1940 to 1960 and much less from 1990 to 2010. Second, our analysis with the regulation measure (e.g. Figure 9) shows substantial within-group convergence in the low regulation group, suggesting that existing income differences today are sufficiently large and transitory as to make convergence possible.

5.3 Racial Migration Patterns

In parts of the previous analysis, we did not distinguish between the income convergence and migration patterns of different racial groups. A possible interpretation of the migration patterns we observe over this period might attribute them to black mobility for non-economic motives. If changes in racial discrimination were correlated over time and across places with changing land use regulations, then our results may falsely attribute a causal role to housing prices in ending convergence. To check this possibility, we re-create the top two panels of Figures 1, 2, and 9 using income and population growth rates for whites only. These results (presented in Appendix A.3) show that outcomes for whites closely follow the aggregate pattern.

5.4 Land Constraints, Productive Land and Physical Capital

Our analysis abstracted from considerations about the role of land and physical capital and in this section, we consider these factors briefly.

While there are certainly technological and physical constraints to urban growth, we believe that regulatory constraints have been the primary barrier to new construction. Our view is based on two sets of facts: growth has fallen in some wealthy areas very heterogeneous densities, and there is a strong correlation between growth slowdowns and our measure of regulations.

Perhaps the most striking example of a growth slowdown comes from the Primary Metropolitan Statistical Area (PMSA) formed by Bergen and Passaic counties in New Jersey, which are located directly across the Hudson River from New York City. Starting from a density of about 1,700 people per square mile in 1940, this area's population grew at a rate of over 2% a year. Then, having reached a density of about 3,200 people per square mile in 1970, over the next thirty years, its population grew by 0.04% at an annual rate. Perhaps 3,200 people per square mile is a technological cutoff to feasible density, or Americans have a strong preference for density to be less than this value. However, the data show a pattern of low population growth rates among urban areas with very heterogeneous densities. Annual population growth from 1990 to 2010 was 0.5% or lower in the PMSAs of Jersey City (with density of 11,800 people per square mile in 1990), San Francisco (density: 1,600), and Boston (density: 1,600). If Bergen-Passiac's density were the natural limit, then we would have expected to see continued growth in San Francisco and Boston. Further, while there might be heterogeneity in natural density limits across places, it seems unlikely that these limits would be naturally correlated with both the time and cross-sectional pattern of regulations. Thus, while the baseline migration and convergence facts might be consistent with heterogeneous, fixed supply curves, this evidence suggests policy-driven supply changes.

Our analysis also abstracted from the role of land in production, but it is straightforward to incorporate this factor as a complement in production by setting $Y_{jt} = A_j \times \left(n_{jut}^{\rho} + \theta n_{jst}^{\rho}\right)^{\frac{1-\alpha-\beta}{\rho}} Land^{\beta}$. If regulations reduced the availability of residential and productive land, then the marginal product of labor would fall in areas with tighter restrictions. Given that the rise in regulations is correlated with income, this would increase the speed of convergence. We have shown that convergence has actually slowed considerably, meaning that the countervailing forces described in our model must be sufficient to overcome this channel.

Past work, most notably Barro and Sala-i Martin [1992], has also explored the role of physical capital accumulation in convergence. Empirical measures of the state-level capital stock are quite difficult to obtain.[39] One alternative measure of the returns to capital comes from regional interest rates. Landon-Lane and Rockoff [2007] report that regional interest rates largely converged by the end of World War II, relatively early in the time period of our study. This makes changes in the accumulation of physical capital a less likely candidate to explain changes in post-war convergence we study.

5.5 Amenities

In addition to differing in their productivity and housing supply, locations also differ in the non-productive amenities they offer workers. The value of these amenities have surely changed over time (Diamond [2012]), yet in the absence of housing supply constraints, amenity shocks alone are unlikely to explain the changing convergence patterns we observe. To see this, note that the model in Section 2 can be modified to accommodate these differences or shocks to these consumption amenities by rewriting the per-period utility function $u_{jkt} = c_{jkt}^{\beta} \left(h_{jkt} - \bar{H}\right)^{1-\beta} + amenity_{jt}$. The model can then map changes in a region's amenities into changes in migration patterns, housing prices, and rates of income convergence.[40]

Consider, first, a positive amenity shock in the more productive North. Such a shock raises the benefit of migrating from South to North. While this shock would raise housing prices in the North, it would also increase migration and speed income convergence, which is inconsistent with the data in our paper. Alternately, consider a positive amenity shock in the less productive South. This shock would indeed reduce migration rates from South to North and do so disproportionately for unskilled workers. By reducing the population in the North, however, it would predict a relative decline in housing prices in that region, rather than the increase that we see in the data. Therefore, while amenities are certainly important for understanding migration patterns, an amenity shock to North or South in our model produces testable predictions inconsistent with the data.

There is also little evidence that weather-related amenities can explain the changes in migration patterns documented here. Research by Glaeser and Tobio [2007] suggests that

[39] Garofalo and Yamarik [2002] constructed indirect state-level capital estimates by combining state-level industry employment composition with national industry-level capital-labor ratios.

[40] These dynamics are presented in an illustrative simulation in Appendix A.4.

population growth in the South since 1980 is driven by low housing prices rather than good weather. Though average January temperature is predictive of population growth, it is not correlated with high housing prices. Moreover, the relationship between temperature and population growth has remained stable or declined in the post-war period.

6 Conclusion

For more than 100 years, per-capita incomes across U.S. states were strongly converging and population flowed from poor to wealthy areas. In this paper, we claim that these two phenomena are related. By increasing the available labor in a region, migration drove down wages and induced convergence in human capital levels.

Over the past thirty years, both the flow of population to productive areas and income convergence have slowed considerably. We show that the end of directed population flows, and the decline of income convergence, can be explained in part by a change in the relationship between income and housing prices. Although housing prices have always been higher in richer states, housing prices now capitalize a far greater proportion of the income differences across states. In our model, as prices rise, the returns to living in productive areas fall for unskilled households, and their migration patterns diverge from the migration patterns of the skilled households. The regional economy shifts from one in which labor markets clear through net migration to one in which labor markets clear through skill-sorting, which slows income convergence. We find patterns consistent with these predictions in the data.

To identify the effect of these price movements, we introduce a new panel instrument for housing supply. Prior work has noted that land use regulations have become increasingly stringent over time, but panel measures of regulation were unavailable. We create a proxy for these measures based on the frequency of land use cases in state appellate court records. First, we find that tighter regulations raise the extent to which income differences are capitalized into housing prices. Second, tighter regulations impede population flows to rich areas and weaken convergence in human capital. Finally, we find that tight regulations weaken convergence in per capita income. We see this same link between rising regulations and declining convergence using a "shift-share" Bartik-like approach as well. Indeed, though there has been a dramatic decline in income convergence nationally, places that remain unconstrained by land use regulation continue to converge at similar rates.

These findings have important implications not only for the literature on land use and regional convergence, but also for the literature on inequality and segregation. A simple back of the envelope calculation shown in the Appendix finds that cross-state convergence accounted for approximately 30% of the drop in hourly wage inequality from 1940 to 1980 and that had convergence continued apace through 2010, the increase in hourly wage inequality from 1980 to 2010 would have been approximately 10% smaller. The U.S. is increasingly characterized by segregation along economic dimensions, with limited access for most workers to America's most productive cities and their amenities. We hope that this paper will highlight the role land use restrictions play in supporting this segregation.

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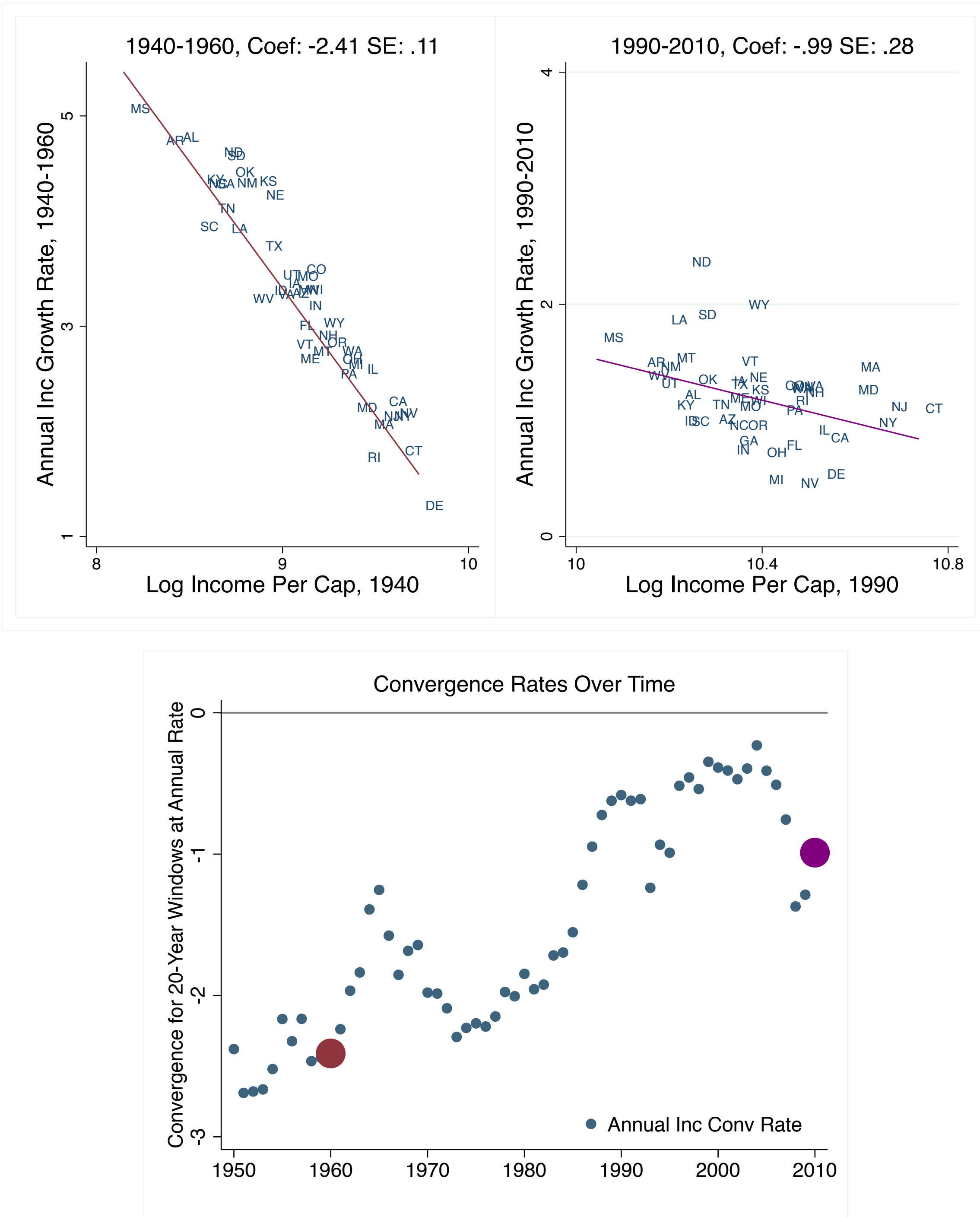
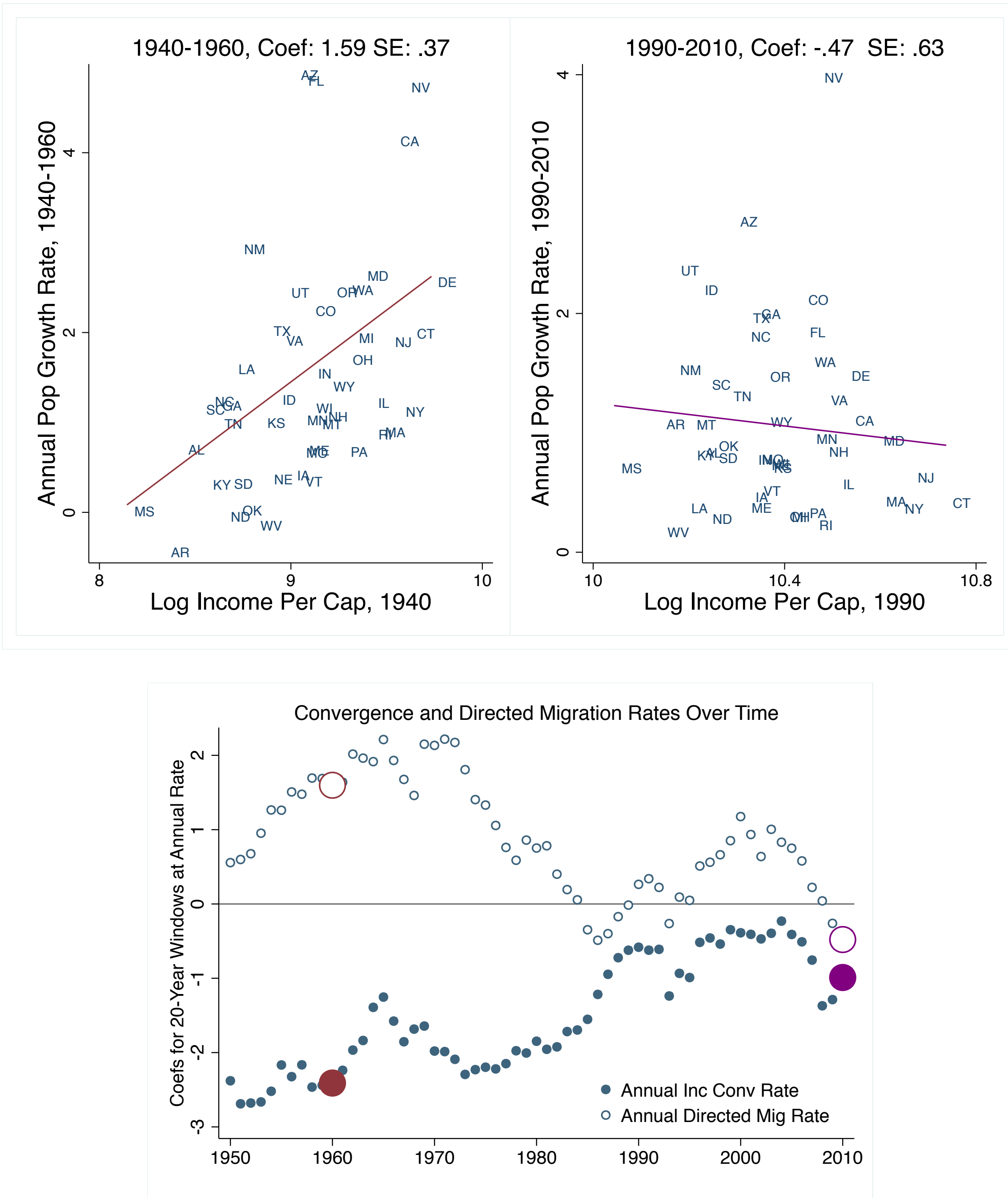
FIGURE 1
The Decline of Income Convergence



Notes: The y-axis in the first two panels is the annual growth rate of income per capita. The third panel plots coefficients from 20-year rolling windows. The larger red and purple dots correspond to the coefficients from the top two panels. Income data from the Bureau of Economic Analysis [2012]. Alaska, Hawaii, and DC are omitted here, and in all subsequent figures and tables.

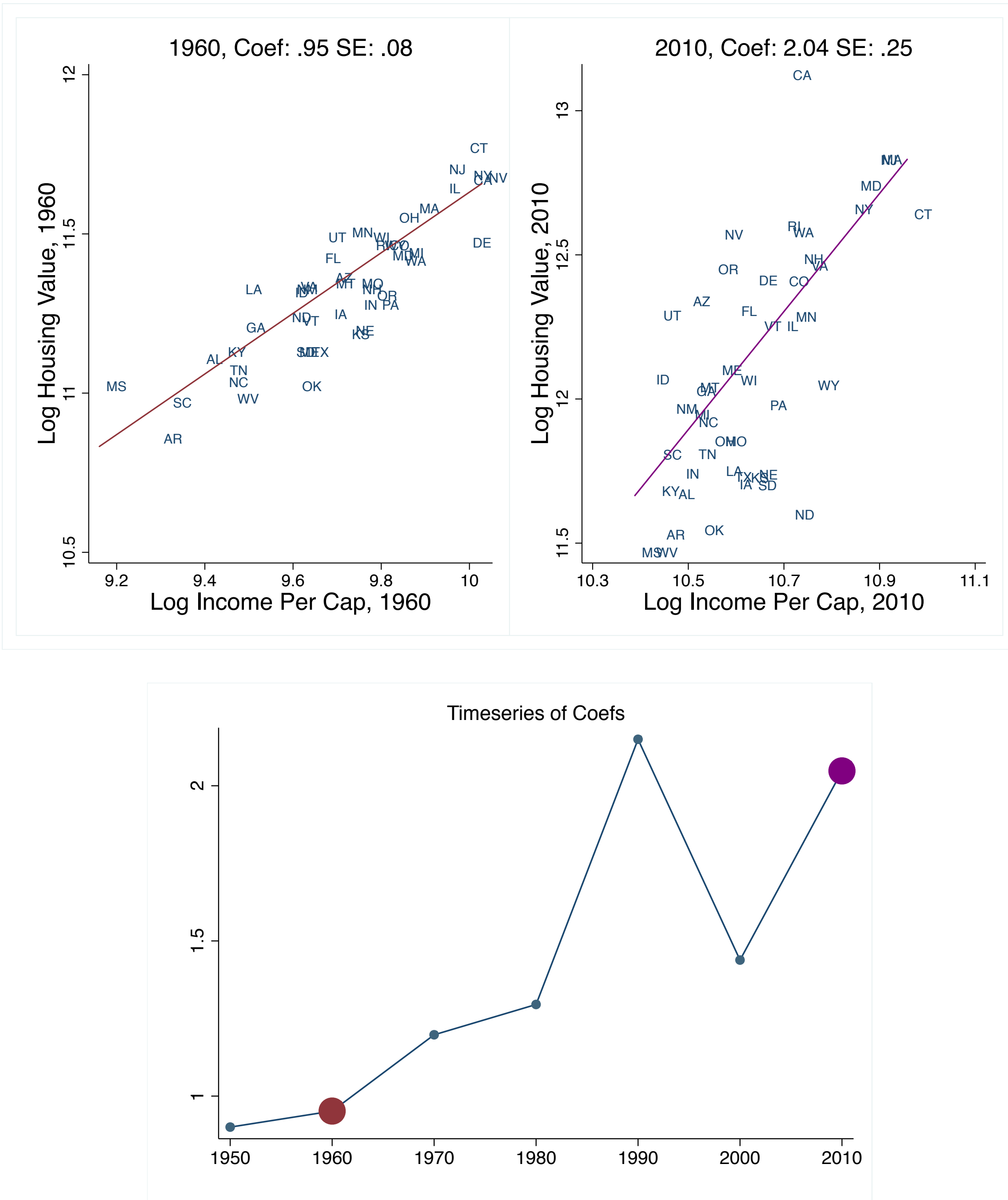
FIGURE 2
The Decline of Directed Migration



Notes: The y-axis in the first two panels is the annual growth rate of log population. The third panel plots coefficients from 20-year rolling windows for population changes and income changes. The larger red and purple dots correspond to the coefficients from the top two panels.

FIGURE 3

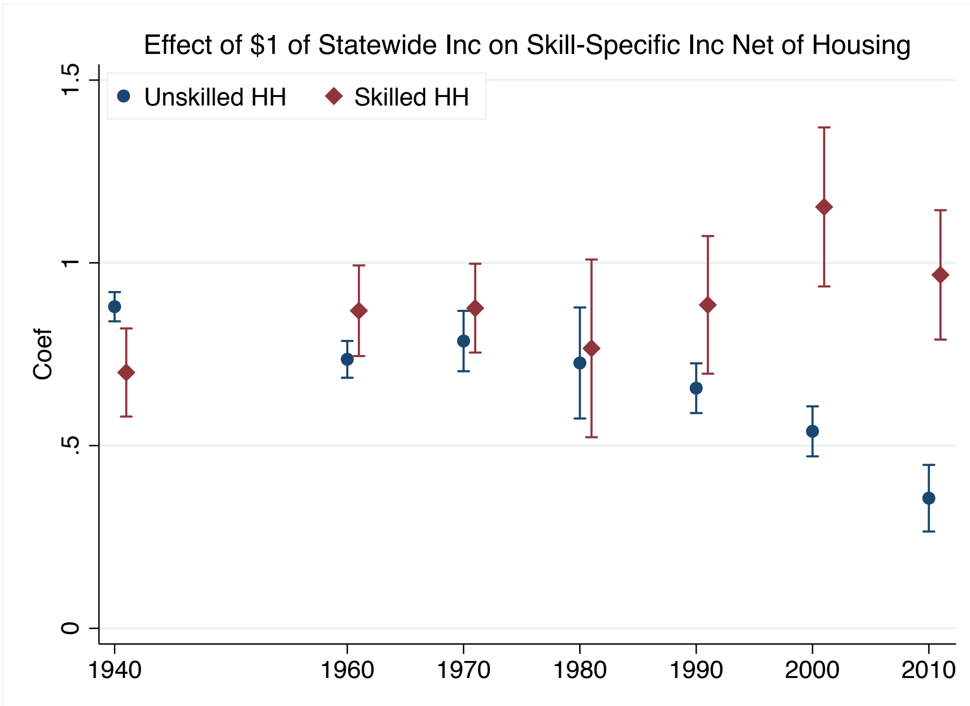
Rising Prices in High Income States



Notes: The first two panels regress median housing value on income per capita at the state level. The third panel plots coefficients from 20-year rolling windows. The larger red and purple dots correspond to the coefficients from the first two panels.

FIGURE 4

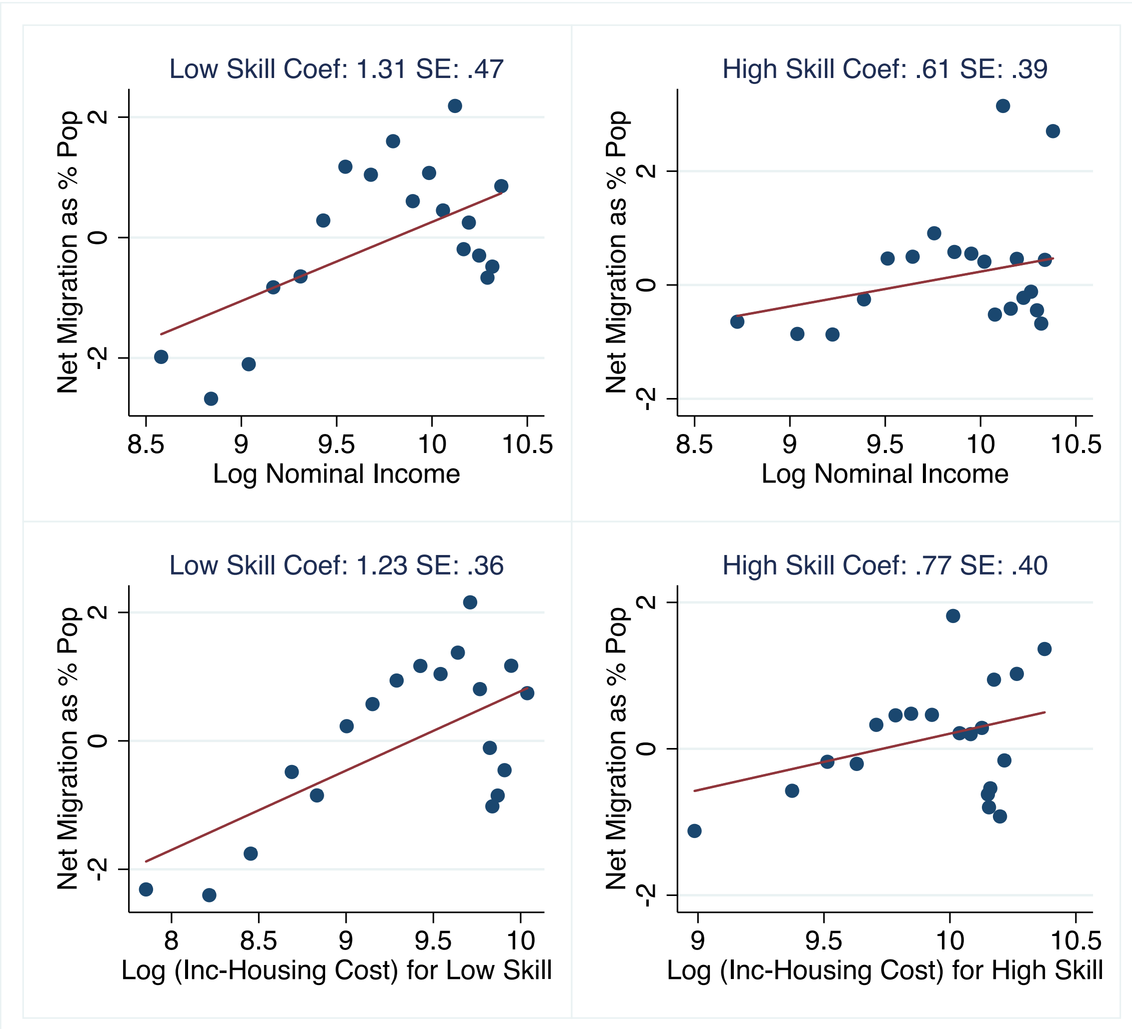
Returns to Migration: Skill-Specific Income Net of Housing Cost



Notes: This figure plots the relationship between unconditional mean household income and mean skill-specific income net of housing costs for several decades. The regression in each year is $Y_{ij} - P_{ij} = \alpha + \beta_{unskilled} Y_j \times (1 - S_{ij}) + \beta_{skilled} Y_j \times S_{ij} + \eta S_{ij} + \gamma X_{ij} + \varepsilon_{ij}$ for households with at least one labor force participant aged 25-65. See Section 3.2 for details. We report 95% confidence intervals for $\beta_{unskilled}$ and for $\beta_{skilled}$. Housing costs are defined as 5% of house value for homeowners and 12X monthly rent for renters. No coefficient is reported from 1950 because the IPUMS USA sample for this year does not include housing cost data. High-skilled households are defined as households in which all adult workers have 12+ years of education in 1940 or 16+ years of education thereafter and low-skilled households are defined as households in which no worker adult worker has this level of education. Mixed skill-type households, which range from 2%-14% of households, are dropped from the regression sample, but not from the construction of unconditional state average income. The modest non-linearity amongst high-income places apparent in the 1940 results is due to Chicago and New York, both of which are very large cities that were hit hard by the Great Depression and failed to attract as many migrants as predicted. Standard errors are clustered by state.

FIGURE 5

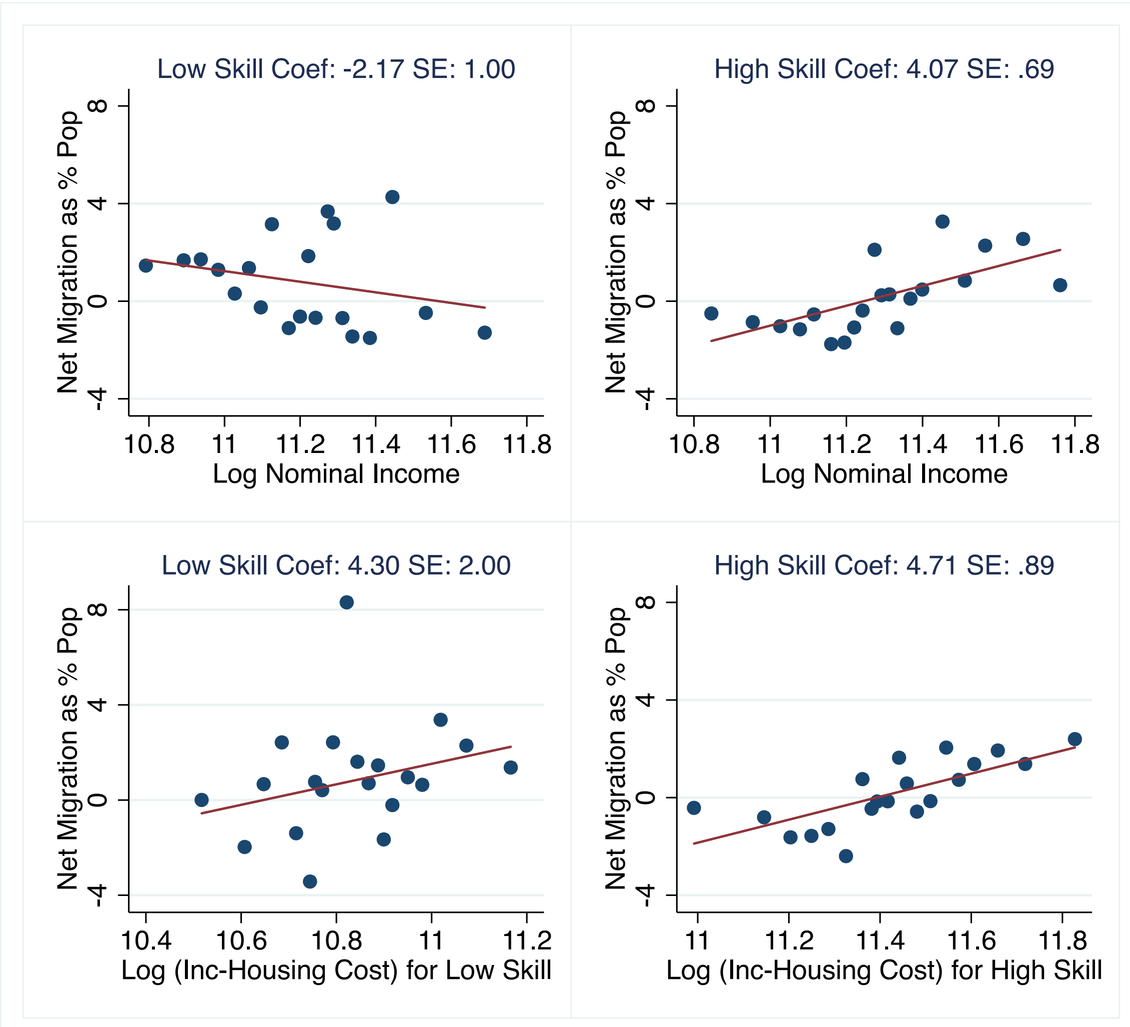
Net Migration Flows by Skill Group: Nominal Income vs. Income Net of Housing Cost, 1935-1940



Notes: These panels plot net migration over a five-year horizon as a fraction of the population ages 25-65 for 466 State Economic Areas (SEA) in the 1940 IPUMS Census extract. Each panel stratifies the SEAs into 20 quantiles by income, weighting each SEA by its population, and then computes the mean net migration within each quantile. The two top panels plot net migration as a function of the log household wage income in the destination SEA, for individuals with less than 12 years of education (left) and those with 12+ years (right). The two bottom panels plot the migration rates for these skill groups against the log skill-group mean value of household wage income net of housing costs. Housing costs are defined as 5% of house value for homeowners and 12X monthly rent for renters. All x-axis variables are computed for non-migrating households with at least one labor force participant aged 25-65.

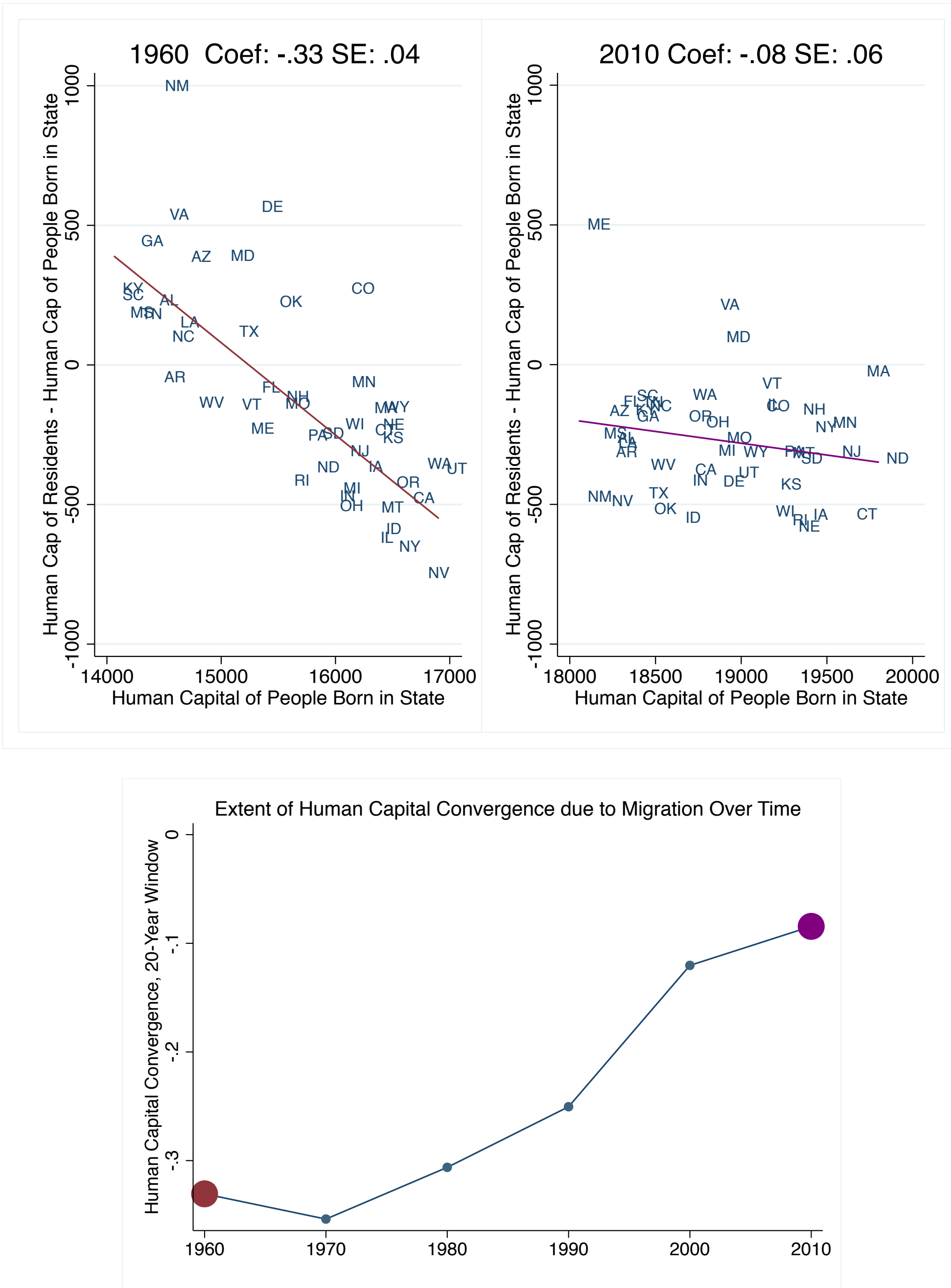
FIGURE 6

Net Migration Flows by Skill Group: Nominal Income vs. Income Net of Housing Cost, 1995-2000



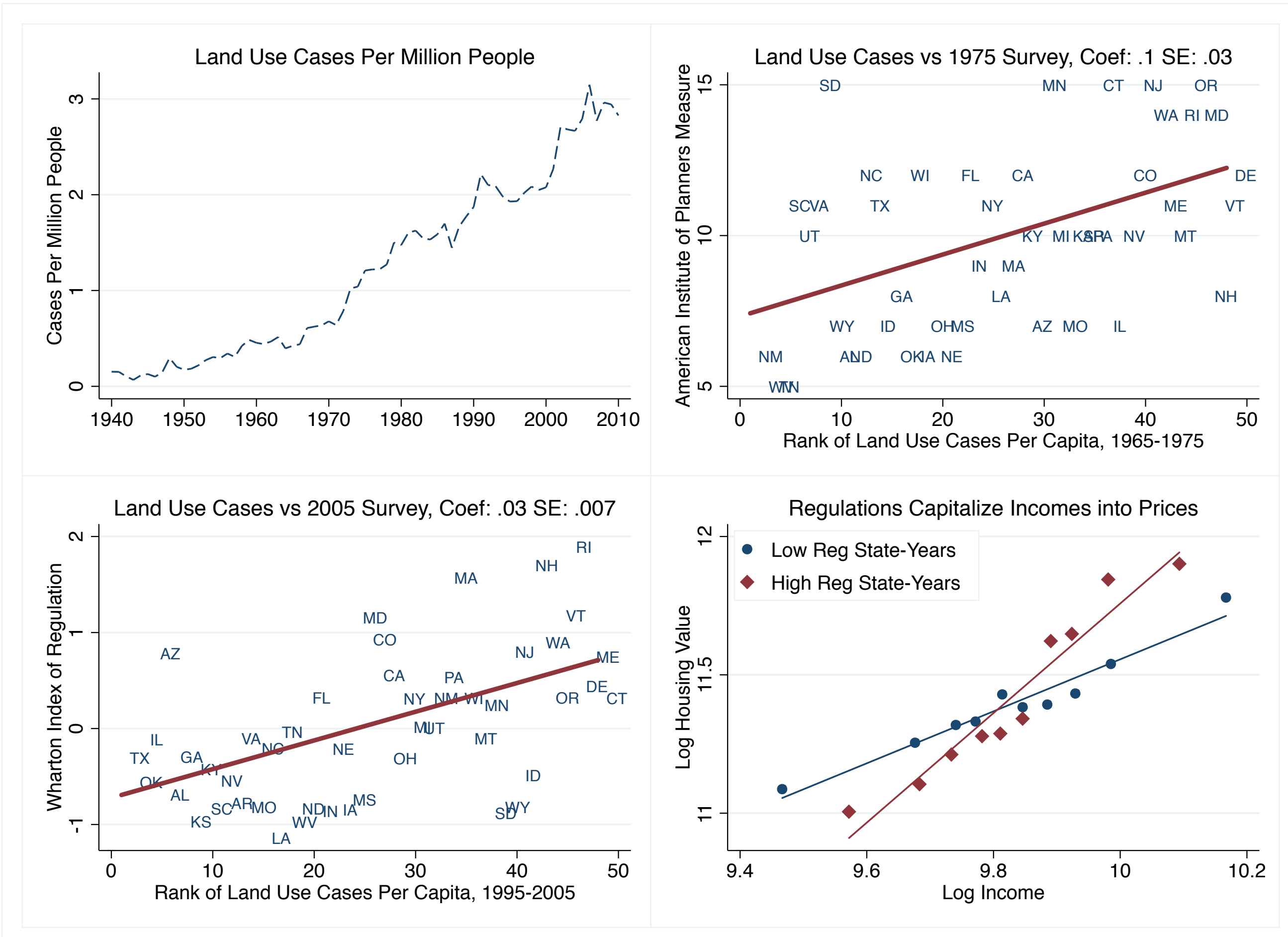
Notes: These panels plot net migration over a five-year horizon as a fraction of the population ages 25-65 for 1,020 3-digit Public Use Microdata Area (PUMA) in the 2000 IPUMS 5% Census extract. Each panel stratifies the PUMAs into 20 quantiles by income, weighting each PUMA by its population, and then computes the mean net migration within each quantile. The two top panels plot migration rates as a function of log household wage income in the PUMA, for individuals with less than a bachelor's degree (left) and with at least a bachelor's (right). The two bottom panels plot the migration rates for these skill groups against the skill-group mean value of household wage income net of housing costs. Housing costs are defined as 5% of house value for homeowners and 12X monthly rent for renters. All x-axis variables are computed for non-migrating households with at least one labor force participant aged 25-65.

FIGURE 7
The Decline of Human Capital Convergence



Notes: Human capital index is estimated by regressing $\log Inc_{ik} = \alpha_k + X_{ik}\beta + \varepsilon_{ik}$ in the 1980a Census, where α_k is a set of seven education indicators, and then constructing Human Capital$_j = \sum_k exp(\hat{\alpha}_k) \times Share_{kj}$. We separately estimate the human capital index by state of residence and by state of birth, to develop a no-migration counterfactual. The top panels show figures from a regression of $HumanCap_{j,res} - HumanCap_{j,birth} = \alpha + \beta HumanCap_{j,birth} + \varepsilon_j$ in 1960 and 2010. Sample is people ages 25-34, see Section 3 for details. The bottom panel plots a time-series of coefficients. The larger red and purple dots correspond to the coefficients from the first two panels.

FIGURE 8
Regulation Measure: Timeseries and Validity



Notes: The top left panel plots the number of cases containing the phrase "land use" in the state appeals court databases in per capita terms.

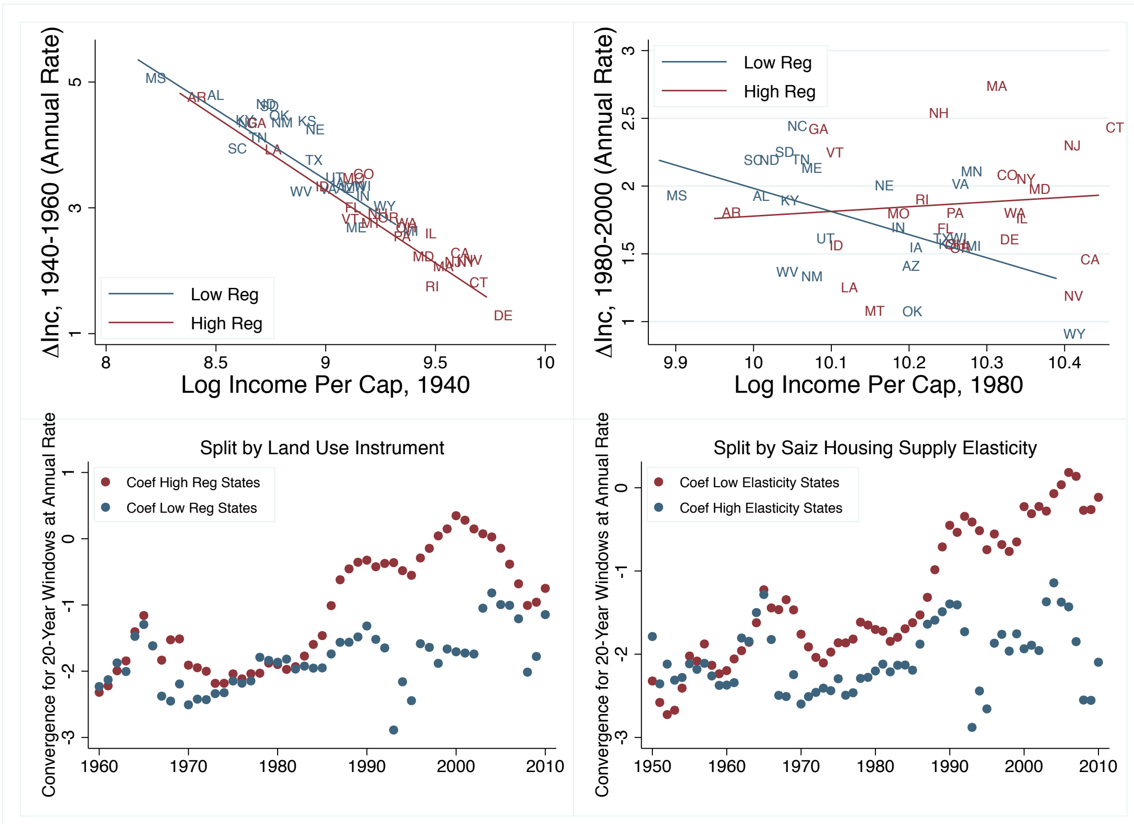
The top right panel plots the relationship between the 1975 values of the regulation measure introduced in the text and the sum of affirmative answers to the regulation questions asked in the 1975 American Institute of Planners Survey of State Land Use Planning Activities.

The lower left panel plots the relationship between the 2005 values of the regulation measure introduced in the text and the 2005 Wharton Residential Land Use Regulatory Index.

The lower right panel plots deciles of log income with year fixed effects on the x-axis and conditional means for housing prices for each decile on the yaxis.

FIGURE 9

Income Convergence by Housing Supply Elasticity



Notes: The top panels show income convergence for two different twenty-year periods, labeling states according to their estimated regulation levels in 1965. Blue states have below median housing supply regulation and red states above median regulation.

The bottom left panel depicts the coefficients from $\Delta Inc_{s,t} = \alpha_t + \beta Inc_{s,t-20} + \varepsilon_{s,t}$ over rolling twenty year windows. The regressions are estimated separately for two equally sized groups of states, split by their 1965 measure of land use regulations from the legal database. The bottom right panel splits states by their measure of housing supply elasticity in Saiz [2010]. We weight the time-invariant MSA-level measures from Saiz by population to produce state-level estimates and impute a value for Arkansas based on neighboring states.

TABLE 1
Summary Statistics

	1940		1960		1980		2000	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Personal Income Per Capita ($000, 2012 $)	8.83	3.18	16.34	3.15	26.63	3.63	38.41	5.95
Population (Million)	2.73	2.69	3.72	3.80	4.69	4.76	5.83	6.26
Median House Price ($000, 2012 $)	39.7	15.4	85.2	18.6	129.4	32.1	152.3	44.5
Regulation Measure (land use cases per capita*10^6)	0.17	0.56	0.32	0.50	2.18	2.59	3.77	6.15

Sources: IPUMS Census extract, BEA Income estimates, and an online database of state appellate court documents.
Notes: n=48 states, excluding Alaska, Hawaii, and DC. Dollar amounts are in real 2012 dollars deflated using the Lindert and Sutch price index (2006).

TABLE 2

Impacts of Regulation on Permits, Prices, Migration, and Convergence

	Annual Construction $Permits_t$ % of Housing Stock	Log House $Price_t$	ΔLog $Population_{t,t+20}$ Annual Rate in %	Δ Log Human Capital	Δ Log Income Per $Cap_{t,t+20}$ Annual Rate in %
	(1)	(2)	(3)	(4)	(5)
Regulation Measure: Rank of Land Use Cases Per Capita scaled [0,1]					
Log Inc Per Cap_{it}	5.039**	0.774***	1.688**	-0.0434***	-2.034***
	(2.106)	(0.105)	(0.637)	(0.00744)	(0.102)
	-5.868**	0.833***	-1.875***	0.0400**	1.304***
Log Inc Per Cap_{it} *Reg_{it}	(2.290)	(0.255)	(0.608)	(0.0157)	(0.393)
Year*Reg FEs	Y	Y	Y	Y	Y
R^2	0.217	0.891	0.142	0.249	0.811
N	1,536	384	2,448	288	2,448
Placebo Measure: Rank of Total Cases Per Capita scaled [0,1]					
Log Inc Per Cap_{it}	1.313	0.984***	1.017	-0.0292*	-1.707***
	(1.627)	(0.148)	(0.813)	(0.0157)	(0.206)
	-1.029	0.269	0.380	0.000479	0.202
Log Inc Per Cap_{it} *Reg_{it}	(2.396)	(0.267)	(2.616)	(0.0295)	(0.400)
Year*Reg FEs	Y	Y	Y	Y	Y
R^2	0.164	0.871	0.179	0.191	0.791
N	1,536	384	2,448	288	2,448

Notes: The table reports the coefficients β and β_{reg} from regressions of the form: $\ln y_{it}=\alpha_t+\alpha_t reg_{it}+\beta \ln y_{it}+ \beta_{reg} \ln y_{it} reg_{it}+\varepsilon_{it}$. The regulation measure is rank of land use cases per capita and its construction is described in the text. The dependent variables are new housing permits from the Census Bureau, the median log housing price from the Census, population change, the change in log human capital of people ages 25-34 due to migration, and the change in log per-capita income. Construction of the human capital index is described in Section 3. For columns (1), (3), and (5), where we have annual data, the regulation measure is constructed using cases per capita. For columns (2) and (4), where we have decennial data, the regulation measure is constructed using average cases per capita over the last ten years. Standard errors clustered by state. *** p<0.01, ** p<0.05, * p<0.1

TABLE 3

Latent Tendency to Regulate, Geographic Land Availability, and Convergence

	Δ Log Income Per $Cap_{t,t+20}$ (Annual Rate in %)							
Year	Pre	Post	Pre	Post	Pre	Post	Pre	Post
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Inc Per Cap_t	-1.93***	-1.80***	-2.47***	-3.06***	-2.05***	-1.97***	-2.49***	-1.20***
	(0.11)	(0.33)	(0.20)	(0.57)	(0.15)	(0.47)	(0.06)	(0.08)
Log Inc Per Cap_t * Constraint	0.22	2.01***	0.14	2.00***	0.20	1.91***	-0.09	0.71***
	(0.27)	(0.66)	(0.25)	(0.68)	(0.27)	(0.69)	(0.10)	(0.17)
pre interaction = post interaction (pval)		0.002		0.005		0.003		<0.001
Year*Constraint Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Controls	--		Autor-Dorn Skill Measures		--		--	
R^2	0.84	0.45	0.87	0.60	0.84	0.46	0.72	0.91
N	1,248	1,200	1,248	1,200	1,248	1,200	8,413	9,194
Unit of Observation	State	State	State	State	State	State	County	County
Constraint Measure	Land Use Cases Per Capita, 1996-2005		Land Use Cases Per Capita, 1996-2005		Land Use Cases Per Capita, 1956-1965		Share of Land Unavailable (Saiz, 2010)	

Notes: This table uses time-invariant measures of the housing supply elasticity, while Table 2 used time-varying measures of the elasticity. The table reports the coefficients β and $\beta_{constraint}$ from regressions of the form $\Delta lny_{it,t+20}=\alpha_1+\alpha_2 Constraint_i+\beta lny_{it}+ \beta_{Constraint} lny_{it}$ x $Constraint_i+\varepsilon_i$. The pre period is 20-year windows ending in 1960 through 1984. The post period is 20-year windows ending in 1985 through 2010. The constraint measures are all in quintiles normalized such that 0 means least constrained and 1 means most constrained. The constraint measures are: the number of land use cases per capita 1996-2005 in columns (1)-(4), the number of land use cases per capita 1956-1965 in (5)-(6), and land availability constructed from Saiz (2010) in columns (7)-(8). The availability measure assumes that all land is available for construction in non-urban counties. Columns (3)-(4) control for skill measures in Autor and Dorn (2013): the share of workers in routine occupations, the college to non-college population ratio, immigrants as a share of the non-college population ratio, manufacturing employment share, the initial unemployment rate, the female share, the share age 65+, and the share earning less than the 10 year ahead minimum wage. We aggregate their data to the state level via population weighting.

Standard errors clustered by state for columns (1)-(6) and by metro area for columns (7)-(8) in parentheses. *** p<0.01, **

TABLE 4

Migration By Skill Group and Share BA

Panel A: Total Migration (Extensive + Intensive Margin)

	# Residents - # Born in State as % of Total State Pop			
	Low-Skill (1)	High-Skill (2)	Total Mig (2) + (1)	Difference (2)-(1)
1980 Census, n=48				
Share BA, 1980	2.624***	0.762***	3.386***	-1.862***
	(0.479)	(0.131)	(0.550)	
2010 American Community Survey, n=48				
Share BA, 1980	0.490**	0.614***	1.104***	0.124
	(0.235)	(0.138)	(0.354)	
Coef 2010 - Coef 1980	-2.134***	-0.148	-2.282***	

Panel B: Choice of Destination | Decision to Leave Birth State (Intensive Margin)

	# Migrants to state j from state of birth j' - Pop j / (Pop National - Pop j')		
	Low-Skill (1)	High-Skill (2)	Difference (2)-(1)
1980 Census, n=2256			
Share BA, 1980	0.116*	0.173***	0.057**
	(0.0608)	(0.0460)	
2010 American Community Survey, n=2256			
Share BA, 1980	-0.0297	0.129***	0.149***
	(0.0400)	(0.0326)	
Coef 2010 - Coef 1980	-0.136**	-0.044	

Notes: This table examines differences by skill group and over time in migration to high BA states.
Panel A measures net migration of 25-44 year olds relative to state of birth as a share of the state's total population. There is one observation per state, and robust SE are in parentheses. This measure is attractive because it captures both the decision to migrate and the choice of destination, but it is sensitive to differential trends in domestic BA production.
Panel B corrects for this issue and focuses on choice of destination among those who choose to migrate within the 48 continental states. Each observation is a state of origin by state of destination pair. We examine whether people who migrate are disproportionately attracted to states with high share BA. We normalize each observation by subtracting the ratio of the population of the destination state to the population of all states (dropping the population of the state of origin). Observations are weighted by the total number of migrants from the origin state, and the standard errors are clustered by destination.
Share BA is calculated using people ages 25-65. Low-skill is defined as having less than a BA. High skill is defined as having a BA or higher. *** p<0.01, ** p<0.05, * p<0.1

A Calibration

In this section we extend the model to allow for a more realistic calibration and the simulation of additional shocks. Specifically, we add elastic labor supply and non-productive, time-varying amenities to the individuals decision problem. Given that the reminder of model matches the model presented in the text, we do not reproduce those equations here. Further variations on the model, such as a setup with regionally differentiated goods and constant returns in production, are avaliable online.

A.1 Individual Decisions

Once again, agents are either skilled or unskilled $k \in \{u, s\}$, and have utility in state $j \in \{N, S\}$ of

$$U = \max_{\{c_{jkt}, l_{jkt}\}} c_{jkt}^{\beta} \left(h_{jkt} - H\right)^{1-\beta} - \frac{\xi l_{jkt}^{1+\frac{1}{\epsilon}}}{1 + 1/\epsilon} + amen_{jt}$$

$$\text{subject to } c_{jkt} + p_{jt} h_{jkt} = w_{jkt} l_{jkt} + \pi_t$$

Labor supply is now elastic and governed by the elasticity parameter ϵ. Non-productive amenities, $amen_{jt}$ can vary over time, but are not skill specific.[41] The first order condition on labor supply implies:

$$l_{jkt} = \left(\beta^{\beta} \left(\frac{1-\beta}{p_{jt}}\right)^{1-\beta} w_{jkt}\right)^{\epsilon}$$

Profits from both the housing sector and the tradable section in North and South are again rebated lump-sum nationally. We can therefore write each moment's indirect utility as a function of the wage, price and these parameters:

$$v_{jkt}(A, n_{jlt}, n_{jht}, amenity_{jt}) = \left(w_{jkt} + \pi_t - p_{jt} H\right) \beta^{\beta} \left(\frac{1-\beta}{p_{jt}}\right)^{1-\beta} - \frac{\left(\beta^{\beta} \left(\frac{1-\beta}{p_{jt}}\right)^{1-\beta} w_{jkt}\right)^{1+\epsilon}}{1 + 1/\epsilon} + amen_{jt}$$

A.2 Calibration

Despite the simplicity of the model, there are a large number of parameters to calibrate. Thankfully, many of them can be inferred from the data or sourced from the literature. We set θ, the premium for skilled versus unskilled workers, equal to 1.7. This is representative of the BA/non-BA relative wages in data, holding race and gender constant. We set the elasticity of subsitution between skilled and unskilled workers, ρ, equal to 0.6 as in Card [2009]. The initial share of skilled workers living in the North is set to 0.69, and the initial share of unskilled workers is set to 0.63. This matches

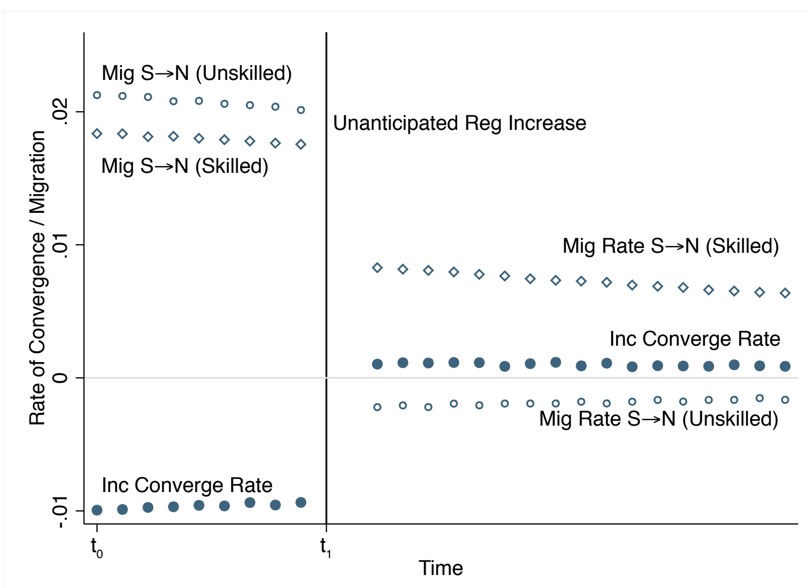
[41] Recent work, such as Diamond [2012], has looked at the impact of time-varying, skill-specific amenity shocks.

the population distribution in 1950, when splitting states in to "North" and "South" at the median based on per capita incomes. The total population of each skill type is normalized to one.

We use the two parameters of the utility function, $\bar{H}$ and β, to match the Engel-curve for housing estimated in Section 2. This entails setting $\beta = .06$ and $\bar{H} = .25$ in Appendix. This parameter choice means that we can analyze whether the nonhomotheticity we observe for housing within labor markets is large enough to generate the changes we see in migration for the observed change in housing prices. The discount rate r , treating each period as one year, and the labor share of production $(1 - \alpha)$ are set to 0.05 and 0.65 as in much of the literature. The elasticity of labor supply ϵ is set to 0.6 as in Chetty [2013]. We set A, the relative productivity parameter, equal to 1.8. This is consistent with a fraction of 85% of the population residing in the North in the steady state given equalized skill distributions.

Finally, we are left to calibrate the moving cost parameter ψ, the elasticity parameter η, and the size of the elasticity shock. We initially set η equal to 0.4, which generates roughly a 1 to 1 relationship between log prices and log per capita income, matching the relationship in the data for 1950 and 1960 as reported in Figure 3. The parameter ψ is set equal to .002 to match the speed of directed migration observed prior to the explosion of land use regulations.

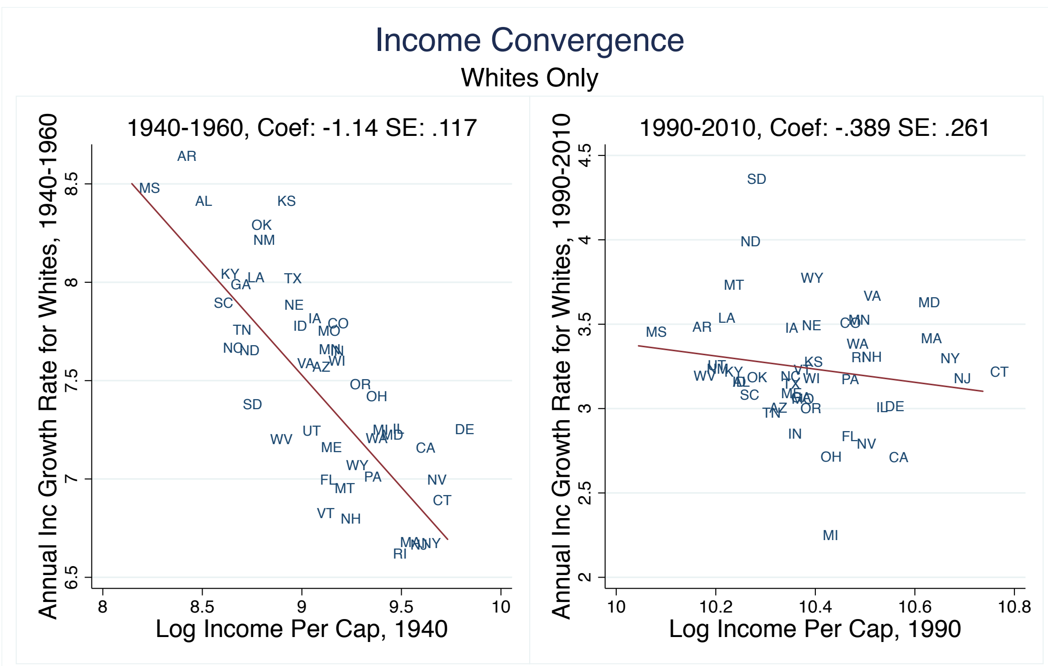
We simulate a shock that lowers η to 0.4 to 0.135 after 10 periods. This drop is calibrated to match the change in the log price to log income ratio, which in the data (Figure 3) rises to 2 from 1. The dynamics of the system to this shock displayed below.

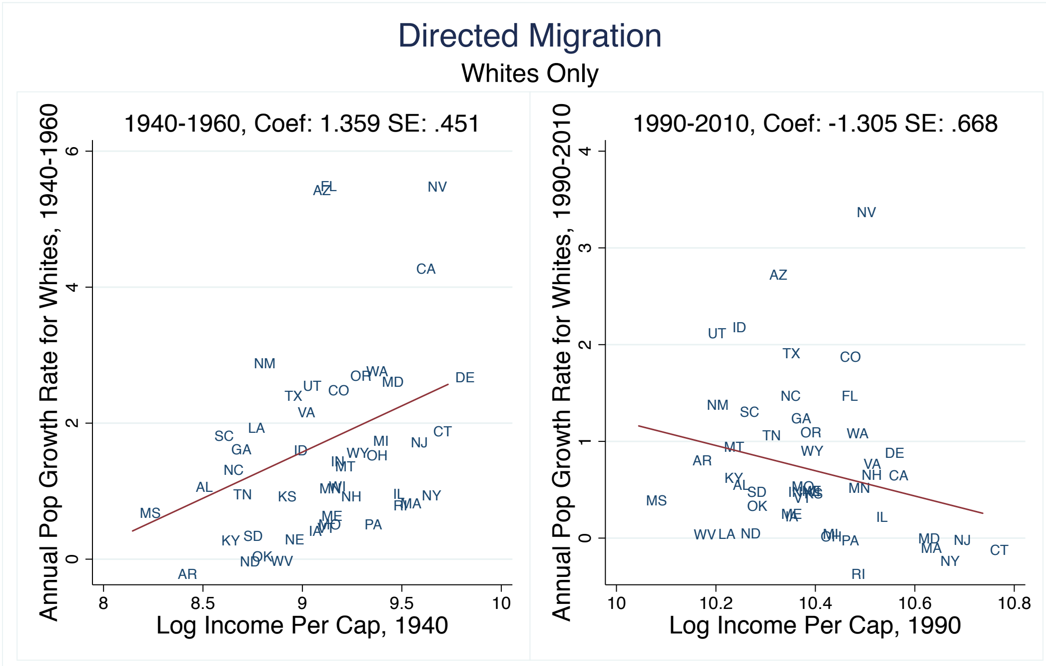


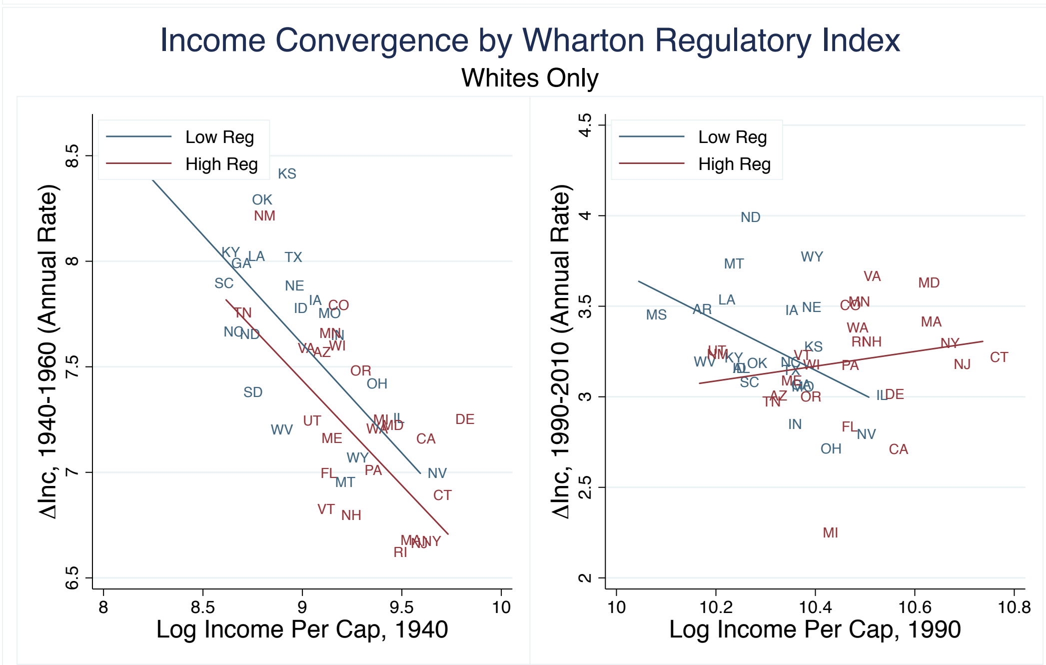
The figure shows that, before the shock, total directed migration averaged slightly less than 2% per year as in the data. Both skilled and unskilled workers migrate from South to North, with unskilled workers actually moving at a slightly faster rate due to initial skill imbalances. The convergence rate before the shock is slightly less than 1% per year. The rate in the data is closer to 2% per year, meaning that under this calibration, the migration mechanism can account for roughly 50% of convergence prior to the regulatory shock.

When a shock calibrated to match changing price ratios hits, both directed migration and income convergence cease as in the data. The rate of income convergence falls roughly 1%, similar to the change in the rate of beta-convergence reported in Figure 1. Thus, while the migration channel can only account for half of the level of convergence, changes in migration can account for roughly 100% of the change. The cessation of total directed migration masks different trends for skilled and unskilled workers. Skilled workers continue to move from South to North at a reduced, but still significant rate. Unskilled migration, which had previously exceeded skilled migration, stops completely. Thus net migration has turned into skill-sorting across locations as in the data.

A.3 Income Convergence and Directed Migration of Whites

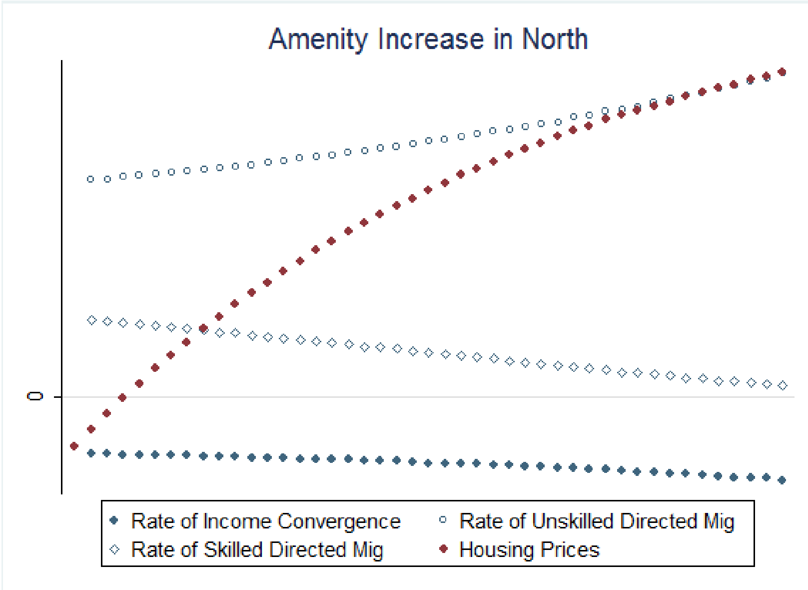






Notes: The horizontal axis in each panel is the log of state per capita income reported by the BEA. In the top and bottom panels, the vertical axis plots the average annual per capita income growth rate for whites in the state using data from Census and ACS extracts. We measure annual per capita income using the mean wage income for workers ages 25 through 65. In the middle row of panels, the vertical axis plots the average annual population growth rate for whites in the state. The bottom panel colors states based on the population weighted value of their housing supply elasticity as measured in Saiz [2010]. Blue states have above median elasticity and red states have an elasticity below the median.

A.4 Amenity Changes



This plot shows the impact of an amenity increase in the North, using the model in Section 2. See Section 5.5 for an extended discussion of these results.

Other papers cited in notes to appendix tables: Tolbert and Sizer [1996], U.S. Census Bureau [2012], Haines [2010], Ferrie [2003], Fishback et al. [2006], Lindert and Sutch [2006].

B Constant Returns to Scale in Production

B.1 Downward-Sloping Product Demand, Population Flows, and Convergence

In Section 2, we developed a model where downward-sloping labor demand came from the assumption of a production function that had decreasing returns to scale in labor. Here we show that downward-sloping labor demand can also come from a production function with constant returns to scale ($Y = AL$), combined with elastic product demand and monopolistic competition. Previous drafts (avaliable on request from the authors) have derived this result in a model with multiple skill types.

B.1.1 Individual Decisions: Labor Supply and Product Demand

Individuals i in the region "home" consume a basket of differentiated good $\{x_j\}$ from each region $j \in [0,1]$. Individuals solve the following problem, taking the local price for labor w and the national price for products $\{p_j\}$ as exogenous

$$U = \left(\int x_{ij}^{\rho}\right)^{\frac{1}{\rho}} - \frac{l_i^{1+\frac{1}{\varepsilon}}}{1+\frac{1}{\varepsilon}} + \lambda\left(w_i l_i - \int p_j x_{ij} dj\right)$$

$$\frac{\partial U}{\partial x_j} = \left(\left(\int x_{ij}^{\rho}\right)^{\frac{1-\rho}{\rho}}\right) x_{ij}^{\rho-1} - \lambda p_j = 0$$
$$\frac{\partial U}{\partial l} = -l_i^{1/\varepsilon} + \lambda w_i = 0$$

$$\frac{\left(\left(\int x_{ij}^{\rho}\right)^{\frac{1-\rho}{\rho}}\right) x_{ij}^{\rho-1}}{p_j} = \frac{l_i^{1/\varepsilon}}{w_i} \Rightarrow$$

$$l_i^{supply}(w) = w_i^{\varepsilon}\left(\frac{x_{ij}^{\rho-1}}{p_j}\left(\left(\int x_{ik}^{\rho} dk\right)^{\frac{1-\rho}{\rho}}\right)\right)^{\epsilon} \tag{9}$$

Equation (9) holds for all markets $j \in [0,1]$. We now apply the standard Dixit- Stiglitz solution techniques to derive the demand for any individual good j in terms of its own price p_j, household income $w_i l_i$ and the aggregate price index P. The first order conditions imply that an individual's consumption of two goods must have the following ratio:

$$\frac{x_{ik}}{x_{ij}} = \left(\frac{p_k}{p_j}\right)^{-\sigma} \Rightarrow x_{ik} = x_{ij}\left(\frac{p_k}{p_j}\right)^{-\sigma}$$
$$p_k x_{ik} = p_k x_{ij}\left(\frac{p_k}{p_j}\right)^{-\sigma}$$
$$\text{Integrating} \int p_k x_{ik} dk = \int p_k x_{ij}\left(\frac{p_k}{p_j}\right)^{-\sigma} dk$$
$$w l_i = x_{ij} p_j^{\sigma} \underbrace{\int p_k^{1-\sigma} dk}_{P^{1-\sigma}}$$

$$x_{ij} = p_j^{-\sigma} \frac{w_i l_i}{P^{1-\sigma}} \tag{10}$$

Recall that l_i is actually $l_i^*(w)$ from equation (9) which governed labor supply. We now substitute in for the labor supply elasticity above, to write an individual's demand for good x_j as:

$$x_{ij}^{Demand}(p, w, \xi, P) = \frac{p_j^{-\sigma} w_i^{1+\varepsilon}}{P^{1-\sigma}} \xi_i \tag{11}$$

where ξ_i is a scaling of household marginal utility.

B.1.2 Firm Decisions: Product Supply and Labor Demand

We assume that each region has a single firm j, which takes the national demand curve and local wages as exogenous. As before, we suppress the notation for the location of the home firm throughout. Firms produce using the constant returns to scale production function $q_j = AL_j$. The firm serves the national market but hires labor locally (L_j) at wage w_j.

$$\max_{p_j,l_j,q_j} p_j q_j(p_j) - w_j L_j$$

$$\text{subject to (1) } q_j = \underbrace{\frac{p_j^{-\sigma}}{P^{1-\sigma}} \int w_i^{1+\varepsilon} \xi_i \mu_i di}_{national\ demand} \text{ and (2) } L_j = q_j / A$$

$$\iff \max_{p_j} p_j^{1-\sigma} \frac{\int w_i^{1+\varepsilon} \xi_i \mu_i di}{P^{1-\sigma}} - \frac{w_j}{A} (p_j^{-\sigma} \frac{\int w_i^{1+\varepsilon} \xi_i \mu_i di}{P^{1-\sigma}})$$

$$\iff \max_{p} \left(p_j^{1-\sigma} - \frac{w_j}{A} p_j^{-\sigma} \right) \frac{\int w_i^{1+\varepsilon} \xi_i \mu_i di}{P^{1-\sigma}}$$

$$\Rightarrow FOC: p_j = \frac{\sigma}{\sigma - 1} \frac{w_j}{A}$$

Having derived the optimal prices, we can determine output by substituting the price FOC back in to equation (11) for consumer demand:

$$x_{ij}^{demand} = \frac{p_j^{-\sigma} w_i^{1+\varepsilon}}{P^{1-\sigma}} \xi_i$$

We can integrate over all the individuals i to calculate an aggregate demand curve for good j:

$$x_j^{demand} = \left(\frac{\sigma}{\sigma - 1} \frac{w_j}{A} \right)^{-\sigma} \frac{\int w_i^{1+\varepsilon} \mu_i \xi_i di}{P^{1-\sigma}}$$

Inverting the production function $q = AL$ gives a company's labor demand as a function of wages and downward-sloping demand for their good.

$$L^{Demand}(w) = \frac{\left(\frac{\sigma}{\sigma-1} \frac{w_j}{A} \right)^{-\sigma} \frac{\int w_i^{1+\varepsilon} \xi_i \mu_i di}{P^{1-\sigma}}}{A} = A^{\sigma-1} \left(\frac{\sigma}{\sigma - 1} \right)^{-\sigma} w_j^{-\sigma} \frac{\int w_i^{1+\varepsilon} \xi_i \mu_i di}{P^{1-\sigma}} \tag{12}$$

B.1.3 Labor Market Equilibrium

Recall that labor supply is given by the individual labor supply decision (equation (9)) times the share of individuals μ_j in the regional market.

$$L^{Supply}(w) = \mu_j w_j^{\varepsilon} \xi_j \tag{13}$$

Now we can equate labor supply from equation (13) and demand from equation (12) to solve for the market-clearing wage

$$\begin{aligned} L^D(w) &= L^S(w) \\ \Rightarrow \mu_j w_j^{\varepsilon} \xi_j &= A^{\sigma-1} \left(\frac{\sigma}{\sigma - 1} \right)^{-\sigma} w_j^{-\sigma} \frac{\int w_i^{1+\varepsilon} \mu_i \xi_i di}{P^{1-\sigma}} \end{aligned}$$

Recall from equation (9) that

$$\xi = \left(\frac{x_{ij}^{\rho-1}}{p_{ij}} \left(\left(\int x_{ik}^{\rho} dk \right)^{\frac{1-\rho}{\rho}} \right) \right)^{\varepsilon}$$

Recall equation (10), that consumer i's demand for good j is $x_{ij} = p_j^{-\sigma} \frac{wl_i}{P^{1-\sigma}}$. Plugging the demand equation into the marginal utility expression gives

$$\begin{aligned}
\xi &= \left(p_j^{-\sigma(\rho-1)} \left(\frac{wl_i}{P^{1-\sigma}} \right)^{\rho-1} \left(\left(\int \left(p_j^{-\sigma} \frac{wl_i}{P^{1-\sigma}} dj \right)^{\rho} \right)^{\frac{1-\rho}{\rho}} \right) \right)^{\varepsilon} \\
&= \left(p_j^{-\sigma(\rho-1)} \left(\frac{wl_i}{P^{1-\sigma}} \right)^{\rho-1} \left(\frac{wl_i}{P^{1-\sigma}} \right)^{1-\rho} \left(\int p_j^{-\rho\sigma} dj \right)^{\frac{1-\rho}{\rho}} \right)^{\varepsilon} \\
&= \left(p_j^{-\sigma(\rho-1)} \left(\int p_j^{-\rho\sigma} dj \right)^{\frac{1-\rho}{\rho}} \right)^{\varepsilon}
\end{aligned}$$

This shows that ξ is a function of prices which are exogenous from the perspective of the home region, meaning that it cancels from both sides of the labor-market clearing condition. This means we can solve for the market-clearing wage in terms of exogenous parameters.

$$w_j^{\text{Market-clearing}} = A^{\frac{\sigma-1}{\varepsilon+\sigma}} P^{\frac{\sigma-1}{\varepsilon+\sigma}} \mu_j^{\frac{-1}{\sigma+\varepsilon}} \left(\frac{\sigma}{\sigma-1} \right)^{-\sigma/(\sigma+\varepsilon)}$$

With the market-clearing wage, we can go back to the individual labor supply condition (equation (8)) to solve for per capita income

$$w^* l^* = w_j^{1+\varepsilon} \xi_i = A^{\frac{(\sigma-1)(1+\varepsilon)}{\epsilon+\sigma}} P^{\frac{(\sigma-1)(1+\varepsilon)}{\epsilon+\sigma}} \mu^{\frac{-(1+\varepsilon)}{\sigma+\varepsilon}} \left(\frac{\sigma}{\sigma-1} \right)^{-\sigma(1+\varepsilon)/(\sigma+\varepsilon)} \xi_i \qquad (14)$$

B.1.4 Comparative Static

We are interested in the impact of a population change in the home region on local per-capita incomes, or mathematically, $\partial w^* l^* / \partial \mu$. A, P, σ, ξ and ε are exogenous parameters or functions of nation-wide variables. From equation (14) we have an elasticity of per capita income with respect to population of :

$$\varepsilon_{\text{population}}^{\text{per cap income}} = \frac{-(1+\epsilon)}{\sigma+\epsilon}$$

where $0 < \mu < 1, \varepsilon > 0$, and $\sigma > 1$. We can interpret this elasticity intuitively. When the labor supply elasticity is high, inflows have a bigger impact on income because a small increase in labor supply greatly bids down the price of labor. When a monopolistic region faces a less elastic demand curve ($\sigma \sim 1$), then it will not increase production much in response to a migration-induced decrease in the cost of labor. As a result, incomes will fall to a greater degree if the demand curve is more inelastic (σ is lower). In this way, monopolistically competitive markets can provide a microfoundation for the result of downward-sloping labor demand.

C Distribution of Migration Costs

C.1 The Path of Income and Population Over Time

For this exercise, we abstract from different skill types, and focus on a single skill model. As before, output in an area is a function of the local population:

$$Y = An^{1-\alpha}$$

The parameter α governs the elasticity of both per capita income and the exponential of indirect utility with respect to population. Further, let A be the ratio of relative productivity in $North$ relative to $South$. Here we use notation N for the Northern rich region and S for the Southern poor region. We then have per capita incomes:

$$y_{Nt} = An_{Nt}^{-\alpha} \text{ and } y_{St} = n_{St}^{-\alpha}$$

Let x be the share of people leaving place S for place N. The gap in per capita income growth rates between North and South is

$$\begin{aligned} \Delta dln\left(y\right) &= dln\left(y_{Nt}\right) - dln\left(y_{St}\right) \\ &= -\alpha\left(ln\left(\frac{n_{Nt}}{n_{Nt-1}}\right)\right) - \alpha\left(ln\left(\frac{n_{St}}{n_{St-1}}\right)\right) \\ &= -\alpha\left(ln\left(\frac{n_{Nt-1}+xn_{St-1}}{n_{Nt-1}}\right) - ln\left(\frac{(1-x)n_{St-1}}{n_{St-1}}\right)\right) \\ &= -\alpha\left(ln\left(1+\frac{xn_{St-1}}{n_{Nt-1}}\right) - ln\left(1-x\right)\right) \end{aligned}$$

The convergence rate is the gap in per capita growth rates divided by the gap in levels. We set this to a negative constant κ.

$$\frac{\Delta dln\left(y\right)}{\Delta ln(y_{t-1})} = \frac{-\alpha\left(ln\left(1+\frac{xn_{St-1}}{n_{Nt-1}}\right) - ln\left(1-x\right)\right)}{ln(A) - \alpha ln\left(\frac{n_{Nt-1}}{n_{St-1}}\right)} = \underbrace{\kappa}_{convergence}$$

Given this constant, we can solve for x:

$$-\alpha\left(ln\left(\frac{1+\frac{xn_{St-1}}{n_{Nt-1}}}{1-x}\right)\right) = \kappa\left(ln(A\left(\frac{n_{St-1}}{n_{Nt-1}}\right)^{\alpha})\right)$$

$$e^{-\alpha}\left(\frac{1+\frac{xn_{St-1}}{n_{Nt-1}}}{1-x}\right) = e^{\kappa}A\left(\frac{n_{St-1}}{n_{Nt-1}}\right)^{\alpha}$$

$$x\frac{n_{St-1}}{n_{Nt-1}} = e^{\kappa+\alpha}A\left(\frac{n_{St-1}}{n_{Nt-1}}\right)^{\alpha}(1-x) - 1$$

$$x\left(\frac{n_{St-1}}{n_{Nt-1}} + e^{\kappa+\alpha}A\left(\frac{n_{St-1}}{n_{Nt-1}}\right)^{\epsilon}\right) = e^{\kappa+\alpha}A\left(\frac{n_{St-1}}{n_{Nt-1}}\right)^{\epsilon} - 1$$

$$x = \frac{e^{\kappa+\alpha}A\left(\frac{n_{St-1}}{n_{Nt-1}}\right)^{\alpha} - 1}{\left(\frac{n_{St-1}}{n_{Nt-1}} + e^{\kappa+\alpha}A\left(\frac{n_{St-1}}{n_{Nt-1}}\right)^{\alpha}\right)}$$

Because $A\left(\frac{n_{St-1}}{n_{Nt-1}}\right)^{\alpha} = \frac{Y_{Nt-1}}{Y_{St-1}}$, we can rewrite this as

$$x = \frac{e^{\kappa+\alpha}\left(\frac{Y_{Nt-1}}{Y_{St-1}}\right) - 1}{e^{\kappa+\alpha}\left(\frac{Y_{Nt-1}}{Y_{St-1}}\right) + A^{\frac{-1}{\alpha}}\left(\frac{Y_{Nt-1}}{Y_{St-1}}\right)^{\frac{1}{\alpha}}}$$

Finally, define Y_{N0} as income in the North and Y_{S0} as income in the South at $t = t_0$. Then

$$x_t^* = x = \frac{e^{\kappa+\alpha}\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{\kappa(t-t_0)}\right)-1}{e^{\kappa+\alpha}\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{\kappa(t-t_0)}\right)+A^{\frac{-1}{\alpha}}\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{\kappa(t-t_0)}\right)^{\frac{1}{\epsilon\alpha}}}$$

We need optimal migration from the South to produce this fraction of the Southern population moving North for each time t. Below, we derive conditions under which this fraction is declining over time. It is intuitive that the share of the Southern population moving would fall over time, because as migration rates should fall as the benefit to moving falls. Still, the ratio between the amount of directed migration and the initial income gap will be constant, so that income convergence continues at constant rate.

C.2 Individual Migration Decisions

Consider an agent in the South deciding whether to move to the North today or stay in the South, with the possibility of moving in the future, valued at $\tilde{V_{T+1}}$. This agent discounts the future at rate r. In each period, agents draw i.i.d. moving costs $\lambda \sim F$. Define $\lambda_T^* = F^{-1}(x_T^*)$. The agent will move if

$$\begin{aligned} \text{Gain to Moving at T} - \text{Flow Cost} \quad &> \quad \text{Benefit to Moving Later} \\ \sum_{t=T}^{\infty} e^{-rt}\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{\kappa(t-t_0)} - \lambda_T \quad &> \quad e^{-\rho r T}\tilde{V_{T+1}} \end{aligned}$$

At x_T^*, the agent is indifferent between moving and staying. This implies that

$$\lambda_T^* \equiv F^{-1}(x_T^*) = \underbrace{\sum_{t=T}^{\infty} e^{-rt}\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{\kappa(t-t_0)}}_{Gains\,to\,moving\,at\,T} - \underbrace{e^{-rT}\tilde{V_{T+1}}}_{Benefit\,to\,Staying}$$

The benefit to waiting is that expected future migration costs are lower. We know at each period how likely it is that the agent would choose to move in all future periods. So we can integrate up the value the agent gets from eventually winding up in Productiveville. The difference between that and the value of moving today is the expected savings in moving costs. This defines the distribution of moving costs for the part of the distribution hit covered by the sequence $\{x_t^*\}_{t=0}^{\infty}$.

$$\underbrace{\sum_{t=T}^{\infty}\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{-(r+\kappa)t+\kappa t_0}}_{Excess\,Gains\,to\,moving\,at\,T} - \underbrace{\sum_{t=T+1}^{\infty}\left(\prod_{j=T}^{t}(1-x_j^*)\right)x_t^*\sum_{t_2=t}^{\infty}\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{-(r+\kappa)t_2+\kappa t_0}}_{Excess\,Gains\,From\,Moving\,Eventually} = \underbrace{F^{-1}(x_T^*) - E[Future\,MC\,|T]}_{Cost\,to\,moving\,now - Eventual\,Moving\,Cost}$$

$$= F^{-1}(x_T^*) - \sum_{t=T+1}^{\infty}\prod_{j=T}^{t}(1-x_j^*)\int_0^{F^{-1}(x_t^*)}\lambda\cdot f(\lambda)\cdot d\lambda$$

C.3 Finding An Interior Solution

To finish the proof, we need to show that $\frac{dx_t^*}{dt} < 0$ for $t > 0$. Because income gaps between North and South are falling, this implies that we need the fraction of Southern residents leaving each period to be declining. This ensures that the dynamic problem described above has an interior solution. Recall from the previous section that

$$x_t^* = \frac{e^{\kappa+\alpha}\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{\kappa(t-t_0)}\right)-1}{e^{\kappa+\alpha}\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{\kappa(t-t_0)}\right)+A^{\frac{-1}{\alpha}}\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{\kappa(t-t_0)}\right)^{\frac{1}{\alpha}}}$$

$$
\begin{aligned}
\frac{dx_t^*}{dt} &= \underbrace{\frac{e^{\kappa+\alpha}\left(\frac{Y_{N0}}{Y_{S0}}\right)\kappa e^{\kappa(t-t_0)}}{e^{\kappa+\alpha}\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{\kappa(t-t_0)}\right)+A^{\frac{-1}{\alpha}}\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{\kappa(t-t_0)}\right)^{\frac{1}{\alpha}}}}_{P1} \\
&- \underbrace{\frac{x_t^*}{\left(e^{\kappa+\alpha}\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{\kappa(t-t_0)}\right)+A^{\frac{-1}{\alpha}}\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{\kappa(t-t_0)}\right)^{\frac{1}{\alpha}}\right)}}_{P2}\times \\
&\underbrace{\left(e^{\kappa+\alpha}\left(\frac{Y_{N0}}{Y_{S0}}\right)\kappa e^{\kappa(t-t_0)}+\frac{A^{\frac{-1}{\alpha}}\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{\kappa(t-t_0)}\right)^{\frac{1}{\alpha}}\left(\frac{Y_{N0}}{Y_{S0}}\right)\kappa e^{\kappa(t-t_0)}}{\alpha\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{\kappa(t-t_0)}\right)}\right)}_{P3}
\end{aligned}
$$

$$
\frac{dx_t^*}{dt}<0 \iff P1 < P2 \times P3
$$

Cancelling terms, we can rewrite that as:

$$
\kappa e^{\kappa+\alpha} < \kappa x_t^* \times \underbrace{\left(e^{\kappa+\alpha}+\frac{A^{\frac{-1}{\alpha}}\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{\kappa(t-t_0)}\right)^{\frac{1}{\alpha}}}{\alpha\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{\kappa(t-t_0)}\right)}\right)}
$$

Define $\eta = 1+\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{\kappa(t-t_0)}$.

$$
\begin{aligned}
\kappa e^{\kappa+\alpha} &< \kappa x_t^* \times \left(e^{\kappa+\alpha}+\frac{A^{\frac{-1}{\alpha}}}{\alpha\epsilon}\eta^{\frac{1-\alpha}{\alpha}}\right) \\
e^{\kappa+\alpha} &> \frac{e^{\kappa+\alpha}\eta-1}{e^{\kappa+\alpha}\eta+A^{\frac{-1}{\alpha}}\eta^{1/\alpha}}\times\left(e^{\kappa+\alpha}+\frac{A^{\frac{-1}{\alpha}}}{\alpha}(\eta)^{\frac{1-\alpha}{\alpha}}\right) \\
\Rightarrow \left(e^{\kappa+\alpha}\right)^2\eta+e^{\kappa+\alpha}A^{\frac{-1}{\alpha}}\eta^{1/\alpha} &> \left(e^{\kappa+\alpha}\right)^2\eta-e^{\kappa+\alpha}+e^{\kappa+\alpha}\eta\frac{A^{\frac{-1}{\alpha}}}{\alpha}(\eta)^{\frac{1-\alpha}{\alpha}}-\frac{A^{\frac{-1}{\alpha}}}{\alpha}(\eta)^{\frac{1-\alpha}{\alpha}} \\
\Rightarrow e^{\kappa+\alpha}\left(A^{\frac{-1}{\alpha}}\eta^{1/\alpha}+1-\frac{A^{\frac{-1}{\alpha}}}{\alpha}(\eta)^{\frac{1}{\alpha}}\right) &> -\frac{A^{\frac{-1}{\alpha}}}{\alpha}(\eta)^{\frac{1-\alpha}{\alpha}} \\
\Rightarrow e^{\kappa+\alpha} &> -\frac{A^{\frac{-1}{\alpha}}}{\alpha}(\eta)^{\frac{1-\alpha}{\alpha}}\setminus\left(1-\frac{\alpha-1}{\alpha}A^{\frac{-1}{\alpha}}(\eta)^{\frac{1}{\alpha}}\right)=\eta^{\frac{1-\alpha}{\alpha}}\setminus\left((1-\alpha)\eta^{\frac{1}{\alpha}}-\alpha A^{\frac{1}{\alpha}}\right)
\end{aligned}
$$

Plugging back in for η gives

$$
e^{\kappa+\alpha} > \frac{\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{\kappa(t-t_0)}\right)^{\frac{1-\alpha}{\alpha}}}{\left((1-\alpha)\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)e^{\kappa(t-t_0)}\right)^{\frac{1}{\alpha}}-\alpha A^{\frac{1}{\alpha}}\right)}
$$

We need this to be true at both $t=t_0$ and $t=\infty$. At $t=t_0$, $e^{\kappa(t-t_0)}=e^0=1$, and at $t=\infty$, $e^{-\infty}=0$.

This gives us the conditions:

$$\begin{aligned}
e^{\kappa+\alpha} &> \max\{\frac{\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)\right)^{\frac{1-\alpha}{\alpha}}}{\left((1-\alpha)\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)\right)^{\frac{1}{\alpha}}-\alpha A^{\frac{1}{\alpha}}\right)}, \frac{1}{\left(1-\alpha-\alpha A^{1/\alpha}\right)}\} \\
&= \frac{\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)\right)^{\frac{1-\alpha}{\alpha}}}{\left((1-\alpha)\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)\right)^{\frac{1}{\alpha}}-\alpha A^{\frac{1}{\alpha}}\right)} \\
\kappa &> \log\frac{\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)\right)^{\frac{1-\alpha}{\alpha}}}{\left((1-\alpha)\left(1+\left(\frac{Y_{N0}}{Y_{S0}}\right)\right)^{\frac{1}{\alpha}}-\alpha A^{\frac{1}{\alpha}}\right)}-\alpha
\end{aligned}$$

So as long as this combination of α, A, and $1+\left(\frac{Y_{N0}}{Y_{S0}}\right)$ are sufficiently small, then there exists some moving cost distribution F such that convergence occurs at a constant rate.

APPENDIX TABLE 1

σ Convergence, IV Estimates of Convergence and Labor Market Area Convergence

	1950	1960	1970	1980	1990	2000	2010
Panel A: Cross-Sectional Standard Deviation of Income							
BEA Log Inc Per Cap	0.236	0.199	0.155	0.137	0.150	0.150	0.138
Panel B: Additional Convergence Regressions							
$\Delta \ln y_{it}$ (Annual Rate in %) = $\alpha+\beta_t \ln y_{it-1}+\varepsilon_{it}$							
	20 year period ending in…						
OLS BEA	1950	1960	1970	1980	1990	2000	2010
Coefficient	-2.38	-2.41	-1.98	-1.85	-0.58	-0.39	-0.99
Standard Error	0.16	0.11	0.16	0.15	0.31	0.46	0.29
OLS Census							
Coefficient	--	-1.82	-2.33	-2.42	-0.36	-0.26	-1.33
Standard Error	--	0.13	0.16	0.12	0.33	0.50	0.32
IV BEA with Census							
Coefficient	--	-2.46	-1.65	-1.59	-0.37	-0.22	-1.23
Standard Error	--	0.12	0.22	0.25	0.32	0.46	0.42
IV Census with BEA							
Coefficient	--	-1.81	-2.42	-2.37	-0.48	-0.27	-0.84
Standard Error	--	0.12	0.18	0.14	0.38	0.59	0.27
Panel C: Convergence at Labor Market Area Level							
$\Delta \ln var_{it}$ (Annual Rate in %) = $\alpha+\beta_t \ln y_{it-1}+\varepsilon_{it}$							
	20 year period ending in…						
Income Convergence	1950	1960	1970	1980	1990	2000	2010
Coefficient	--	-0.97	-1.69	-2.13	-0.21	0.23	-0.26
Standard Error	--	0.19	0.10	0.13	0.18	0.26	0.16

Notes: Panel A. This panel reports the standard deviation of log income per capita across states. This corresponds to the σ convergence concept in Barro and Sala-i-Martin (1992).
Panel B. Figure 1 calculates convergence coefficients using data on personal income from the BEA. That specification is biased in the presence of classical measurement error. We address the bias issue by instrumenting for the BEA measure using an alternative Census measure and vice versa. The Census measure is log wage income per capita for all earners, except in 1950 where it is only household heads. The first stage F-statistics range from 189 to 739. Classical measurement error is not an issue in these IV regressions, and the convergence coefficients display a similar time-series pattern.
Panel C. This panel replicates the "OLS Census" specification from this table at the Labor Market Area (LMA) level, with each LMA weighted by its population. We construct a panel of income and population at the Labor Market Area (LMA) level. LMAs are 382 groups of counties which are linked by intercounty commuting flows and partition the United States (Tolbert and Sizer, 1996). LMA income is estimated as the population-weighted average of county-level income. The income series uses median family income from 1950-2000 from Haines (2010) and USACounties (2012). In 1940 and 2010, the series is unavailable. In 1940, we use pay per manufacturing worker from Haines (2010). Pay per manufacturing worker which had a correlation of 0.77 with median family income in 1950, a year when both series were available. In 2010, we use median household income from USACounties (2012), which had a correlation of 0.98 with median family income in 2000, a year when both series were available.

APPENDIX TABLE 2

Directed Migration From Poor to Rich States and Labor Market Areas

	ΔY_{it} (Annual Rate in %) = $\alpha+\beta_t \ln y_{it}+\varepsilon_{it}$						
	20 year period ending in…						
	1950	1960	1970	1980	1990	2000	2010
Y: Δ Log Pop_{it}, State Level							
Baseline, State-Level							
Coefficient	0.56	1.60	2.13	0.75	0.26	1.18	-0.48
Standard Error	0.27	0.37	0.60	0.78	1.03	1.05	0.64
Y: Net Migration (Birth-Death Method), State Level							
Coefficient	1.16	2.68	2.92	1.14	0.78	1.06	-0.49
Standard Error	0.19	0.36	0.59	0.77	0.97	1.02	0.58
Y: Net Migration (Survival Ratio Method), State Level							
Coefficient	1.29	2.04	2.20	0.67	0.05	--	--
Standard Error	0.23	0.35	0.58	0.77	0.92	--	--
Y: Δ Log Pop_{it}, Labor Market Area Level							
Coefficient	--	1.82	1.73	-0.02	-0.88	0.17	0.13
Standard Error	--	0.31	0.26	0.32	0.42	0.41	0.25

Sources: BEA Income estimates, Ferrie (2003) and Fishback et al. (2006)

Notes: Robust standard errors are shown below coefficients. Birth-death method uses state-level vital statistics data to calculate net migration as $ObservedPop_t$ - (Pop_{t-10} + $Births_{t,t-10}$ + $Deaths_{t,t-10}$). Survival ratio method computes counterfactual population by applying national mortality tables by age, sex, and race to the age-sex-race Census counts from 10 years prior. Both published series end in 1990, and we use vital statistics to construct the birth-death measure through 2010. See notes to Appendix Table 1 for details on construction of the Labor Market Area sample.

APPENDIX TABLE 3

Returns to Living in a High Income State by Skill

	1940	1960	1970	1980	1990	2000	2010
Panel A. Returns to Migration (OLS)							
	Income Net of Housing Costs						
Average State Income X Unskilled	0.880***	0.736***	0.786***	0.726***	0.657***	0.539***	0.356***
	(0.0204)	(0.0257)	(0.0421)	(0.0775)	(0.0347)	(0.0349)	(0.0465)
Average State Income X Skilled	0.700***	0.869***	0.876***	0.766***	0.885***	1.153***	0.967***
	(0.0615)	(0.0633)	(0.0620)	(0.124)	(0.0961)	(0.111)	(0.0903)
N	255,391	306,576	339,412	2,116,772	2,924,925	3,142,015	694,985
Panel B: Returns to Migration (IV for State of Residence with State of Birth)							
	Income Net of Housing Costs						
Average State Income X Unskilled	0.932***	0.776***	0.859***	0.772***	0.667***	0.488***	0.258***
	(0.0298)	(0.0381)	(0.0559)	(0.0937)	(0.0362)	(0.0358)	(0.0518)
Average State Income X Skilled	0.719***	0.740***	0.775***	0.418***	0.889***	1.196***	0.872***
	(0.0622)	(0.0814)	(0.0998)	(0.138)	(0.113)	(0.136)	(0.131)
N	255,391	306,576	339,412	2,116,772	2,924,925	3,142,015	694,985
Panel C: Differential Impacts of Housing Costs in High-Income States (OLS)							
	Log Housing Costs						
Log Average State Income X Unskilled	1.138***	1.076***	1.449***	1.755***	2.632***	2.249***	2.329***
	(0.0902)	(0.0957)	(0.160)	(0.437)	(0.284)	(0.281)	(0.284)
Log Average State Income X Skilled	1.657***	0.878***	1.274***	1.347***	2.338***	1.540***	1.802***
	(0.139)	(0.103)	(0.0935)	(0.250)	(0.285)	(0.247)	(0.238)
N	235,121	296,484	324,017	1,951,058	2,615,879	2,788,921	606,001

Notes: All standard errors are clustered by state. *** p<0.01, ** p<0.05, * p<0.1

Panel A. This panel reports the coefficients β_1 and β_2 from the regression $Y_i - P_i = \alpha + \gamma Skill_i + \beta_1 Y * (1 - Skill_i) + \beta_2 Y * Skill_i + \theta X_i + \varepsilon_i$, where Y_i and P_i measure household wage income and housing costs respectively, Y measures average state income and X_i are household covariates. Household $Skill_i$ is the fraction of household adults in the workforce who are skilled, defined as 12+ years of education in 1940 and 16+ years thereafter. Household covariates are the size of the household, the fraction of adult workers who are black, white, and male, and a quadratic in the average age of adult household workers. Housing costs P_i are defined as 5% of house value or 12 times monthly rent for renters. 1950 is omitted because household-level rent data are unavailable.

Panel B. The IV regressions replicate panel A, but instrument for average state income and its interaction with household skill using the average income of the state of birth of adult household workers. The first stage F-statistics in these regressions exceed 80.

Panel C. This panel reports the coefficients β_1 and β_2 from the regression $\log(P_i) = \alpha + \gamma Skill_i + \beta_1 \log(Y) * (1 - Skill_i) +$

$\beta_2 \log(Y) * Skill_i + \theta X_i + \varepsilon_i$

APPENDIX TABLE 4

Migration Flows by Skill Group: Nominal vs. Real Income

	Dep Var: 5-Year Net Migration as Share of Total Pop				
	Baseline (1)	Double Housing Cost (2)	Exclude In-State Mig (3)	Only Whites (4)	Mig Measure Birth State (5)
Panel A: Low-Skill People, 1940					
Log Nominal Income	1.313***	--	1.049**	1.007**	1.086**
	(0.470)	--	(0.438)	(0.443)	(0.443)
Log Group-Specific Income Net of Housing	1.236***	1.109***	1.017***	0.980***	0.995***
	(0.364)	(0.274)	(0.350)	(0.352)	(0.338)
Panel B: High-Skill People, 1940					
Log Nominal Income	0.611	--	0.617	0.585	0.475
	(0.392)	--	(0.419)	(0.387)	(0.411)
Log Group-Specific Income Net of Housing	0.773*	0.899**	0.905*	0.821*	0.701
	(0.400)	(0.337)	(0.462)	(0.415)	(0.513)
Panel C: Low-Skill People, 2000					
Log Nominal Income	-2.173**	--	-2.456***	-2.377***	0.281
	(1.006)	--	(0.792)	(0.757)	(8.453)
Log Group-Specific Income Net of Housing	4.309**	6.042***	-0.357	1.725	-11.99
	(2.007)	(2.140)	(1.167)	(1.418)	(11.51)
Panel D: High-Skill People, 2000					
Log Nominal Income	4.077***	--	1.786***	2.894***	19.32***
	(0.694)	--	(0.611)	(0.649)	(5.373)
Log Group-Specific Income Net of Housing	4.715***	3.634***	1.937***	3.593***	14.06***
	(0.894)	(1.280)	(0.701)	(0.874)	(4.567)

Note: Each cell represents the results from a different regression. The table regresses 5 year net-migration rates on average income and skill-specific income net of housing. Low-skill is defined as having less than 12 years of education in 1940 and less than a BA in 2000. In 1940, the unit of observation is State Economic Area, with n=455 to 466, depending on specification. In 2000, the unit of observation is three-digit Public Use Microdata Areas, with n=1,020. The baseline case reproduces the results in Figures 5 and 6. The second column shows the effect of doubling the housing costs described in the text to control for non-housing price differences across places. The third column excludes intra-state migrants in calculating net-migration rates. The fourth column excludes non-white migrants in calculating net-migration rates. The final measure calculates migrants as the number of residents residing outside their state of birth. Additional details are presented in the text. Standard errors clustered by state. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

APPENDIX TABLE 5

Impacts of Alternate Regulation Measures on Permits, Prices, Migration, and Convergence

	Annual Construction Permits_t % of Housing Stock	Log House Price_t	ΔLog $\text{Population}_{t,t+20}$ Annual Rate in %	Δ Log Human Capital	Δ Log Income Per $\text{Cap}_{t,t+20}$ Annual Rate in %
	(1)	(2)	(3)	(4)	(5)
"Land Use" Cases Per Capita, Continuous & Winsorized @ 90th Percentile, scaled [0,1]					
Log Inc Per Cap_t	2.042	0.907***	1.297**	-0.0370***	-1.804***
	(1.232)	(0.0882)	(0.607)	(0.00756)	(0.108)
Log Inc Per Cap_t * Continuous Reg	-2.868*	0.809***	-2.132**	0.0298	1.765***
	(1.466)	(0.247)	(0.821)	(0.0218)	(0.563)
N	1,536	384	2,448	288	2,448
"Land Use" Cases Per Capita, Above/Below Median					
Log Inc Per Cap_t	3.200**	0.903***	1.381**	-0.0367***	-1.884***
	(1.551)	(0.0784)	(0.585)	(0.00715)	(0.0956)
Log Inc Per Cap_t * Binary Reg	-2.984**	0.633***	-1.043**	0.0310***	1.113***
	(1.380)	(0.175)	(0.441)	(0.0103)	(0.244)
N	1,536	384	2,448	288	2,448
"Zoning" Cases Per Capita, Rank scaled [0,1]					
Log Inc Per Cap_t	5.955***	0.683***	2.507***	-0.0277**	-2.179***
	(2.165)	(0.114)	(0.690)	(0.0136)	(0.141)
Log Inc Per Cap_t * Zoning Reg	-7.246***	1.032***	-3.646***	-0.00683	1.294***
	(2.456)	(0.255)	(1.064)	(0.0276)	(0.453)
N	1,536	384	2,448	288	2,448
Year*High Reg FEs	Y	Y	Y	Y	Y

Notes: The table reports the coefficients β_1 and β_2 from regressions of the form:

$\Delta \ln y_{it}=\alpha_t+\alpha_t reg_{it}+\beta_1 \ln y_{it}+ \beta_2 \ln y_{it} \times reg_{it}+\varepsilon_{it}$.

We use three regulation measures: (1) land use cases per capita (not the rank), scaled from zero to the 90th percentile of positive observations (2) whether land use cases per capita are above or below median, and (3) the rank of cases mentioning the word "zoning". The dependent variables are new housing permits from the Census Bureau, the median log housing price from the Census, population change, the change in log human capital due to migration, and the change in log per-capita income. Standard errors clustered by state. *** p<0.01, ** p<0.05, * p<0.1

APPENDIX TABLE 6

Robustness Tests

	Δ Log Income Per $Cap_{t-20,t}$ (Annual Rate in %)					
	(1)	(2)	(3)	(4)	(5)	(6)
Log Inc Per Cap_{t-20}	-2.034***	-1.968***	-2.442***	-11.04***	-1.109***	
	(0.102)	(0.107)	(0.0876)	(3.108)	(0.197)	
Log Inc Per Cap_{t-20}* Reg_{it}	1.304***		0.640**	0.585*	0.516*	0.370**
	(0.393)		(0.312)	(0.313)	(0.275)	(0.140)
Log Inc Per Cap_{t-20}*1(Inc >Med)$_{t-20}$* Reg_{it}		2.002**				
		(0.799)				
Share BA $_{t-20}$			-19.48			
			(21.54)			
Log Inc Per Cap_{t-20} *Share BA $_{t-20}$			2.400			
			(2.003)			
Log Inc Per Cap_{t-20} ^2				0.478***		
				(0.165)		
Reg_{it}						-3.451**
						(1.354)
Fixed Effect	Year x Reg	Year x Reg	Year x Reg	Year x Reg	Year x Reg Census Division x Reg	Year x Inc
R^2	0.811	0.817	0.874	0.817	0.851	0.820
N	2,448	2,448	288	2,448	2,448	2,448

Column 1 reports the baseline convergence relationship from Table 2. Column 2 interacts the regulation variable with a dummy for state per capita income greater than the median. This follows our model in assuming that regulations only bind in growing locations. Column 3 includes controls for the percent of the population with a BA and the interaction of this share with initial income. This specification, like Section 5.1, is designed to show the robustness of the regulation result to controls for skill-biased technological change. Column 4 includes a control for initial log income squared, accounting for potential nonlinearity in convergence. Column 5 includes Census division fixed effects interacted with regulations to account for differential regulation growth across regions. Column 6 includes year fixed effects interacted with initial income, which allows for different baseline convergence rates across time. In all of these models, the relationship between tighter regulation and slower convergence remains statistically significant. Standard errors are clustered by state, and the construction of the variables is discussed in the text.
*** p<0.01, ** p<0.05, * p<0.1

APPENDIX TABLE 7

Share of Unavailable Land
(Aggregated from Saiz 2010)

UT	0.698	CO	0.202
FL	0.553	MI	0.200
CA	0.532	MD	0.193
WV	0.523	DE	0.188
LA	0.507	OH	0.180
VT	0.447	AL	0.174
OR	0.427	AR	0.170
NV	0.415	AZ	0.162
WA	0.389	NM	0.156
CT	0.376	MT	0.146
ID	0.354	RI	0.139
NY	0.347	WY	0.137
ME	0.346	KY	0.133
NH	0.339	NC	0.122
MA	0.338	GA	0.113
WI	0.333	IN	0.103
IL	0.326	SD	0.101
VA	0.299	TX	0.101
MS	0.279	MO	0.089
NJ	0.274	IA	0.050
SC	0.250	ND	0.043
TN	0.236	OK	0.043
PA	0.211	KS	0.040
MN	0.209		

These data are drawn from Saiz (2010). County level estimates were weighted by population in 1960 to arrive at state-level averages. These data are used in Table 3 in the text.

APPENDIX TABLE 8

Inequality Impacts of Convergence and its Demise

Panel A: Inequality Counterfactual without Convergence (1940-1980)

	Std Dev of Log Hourly Earnings -- Full-time Males	
	State[a]	Total[b]
1940	0.300	0.781
1950	0.227	0.672
1960	0.183	0.580
1970	0.147	0.600
1980	0.106	0.618
Convergence (1940-1980)[c]	65%	
1980 No Convergence Counterfactual: SD [Y + Ystate1940*(1-0.35)		0.674
Inequality		
1980 Observed - 1940 Observed		-0.163
1980 No Convergence Counterfactual - 1940 Observed		-0.107
Share of Inequality Accounted for By Convergence		34%

Panel B: Inequality Counterfactual if Convergence Continued (1980-2010)

	Std Dev of Log Hourly Earnings -- Full-time Males	
	State	Total
1980	0.106	0.618
1990	0.125	0.622
2000	0.098	0.643
2010	0.115	0.678
2010 Convergence Counterfactual: SD [Y - Ystate1980*(1-0.35)][e]		0.674
Inequality		
2010 Observed - 1980 Observed		0.060
2010 Convergence Counterfactual - 1980 Observed		0.056
Share of Inequality Accounted for By End of Convergence		8%

Sample uses hourly earnings for men ages 18-65 with nonallocated positive earnings, who worked at least 40 weeks last year and at least 30 hours per week in the Census. Sample is winsorized at the 1st and 99th percentile in order to limit the influence of outliers.

a. Population-weighted standard deviation of mean state-by-year log hourly earnings.

b. Standard deviation of log hourly earnings. Conceptually, this measure includes both state-level and residual variation in earnings.

c. Convergence = 1-SDState1980/SDState1940. Note that this measure uses hourly earnings, and is different from the measure of Convergence developed in Appendix Table 1, which uses per capita income.

d. Rather than using observed state income in 1980, we predict state income using 1940 state income and the observed convergence rate of 65% to calculate Ystate1980hat=0.35*Ystate1940. We characterize the counterfactual distribution of earnings in the absence of state income convergence as Y + Ystate1940 - Ystate1980hat.

e. Method follows note (d), except that we calculate the counterfactual with convergence as Y - Ystate1980 + Ystate2010hat.

A fact sheet from THE PEW CHARITABLE TRUSTS | July 2016

State Strategies for Detecting Fiscal Distress in Local Governments

Study shows how states monitor the fiscal health of localities

As local governments across the country struggle to resolve budgetary challenges, some states are exploring ways to help their counties, cities, towns, and villages avoid defaulting on loans or filing for bankruptcy.

Local governments are grappling with growing liabilities, including pensions and other post-employment benefits,[1] as well as costly infrastructure needs[2] and reduced state and federal aid.[3] In many communities, revenue and spending have not returned to the levels seen just before the Great Recession began in 2007. In fact, as of 2015, only 7 percent of U.S. counties had recovered to pre-recession levels based on indicators analyzed by the National Association of Counties: jobs, unemployment rates, economic output, and median home prices.[4] Even as the recovery has proved sluggish and uneven, the reality of the next downturn is beginning to loom. Although economists are divided on when that may occur,[5] some local governments are beginning to plan for the next recession.

> Most states routinely collect documents such as audits, financial reports, and budgets from local governments, but only a few analyze this information to try to detect signs of fiscal distress or, more generally, take the fiscal pulse of localities.

State policymakers have a critical stake in ensuring the fiscal health of local governments so that they can maintain essential services to residents and protect the vitality of their economies, which generate revenue for governments at all levels. County and municipal governments are ultimately the responsibilities of states. James Spiotto, an expert on municipal distress who has testified before Congress on the topic, said that although states do not necessarily take on the financial liabilities of local governments, they are ultimately responsible for the disposition of failed municipalities. In other words, Spiotto said: "The state is always going to be responsible if the local government fails. They're the parent."[6]

Despite this responsibility, many states historically have done little to track the budgetary well-being of local governments. An upcoming report by The Pew Charitable Trusts looks at how states attempt to detect fiscal distress in local governments, or more generally assess the fiscal condition of localities. This fact sheet lays out the report's basic findings and highlights common challenges and potential solutions.

Most states routinely collect documents such as audits, financial reports, and budgets from local governments, but only a few analyze this information to try to detect signs of fiscal distress or, more generally, take the fiscal pulse of localities. The reasons for this vary: Some states view these tasks as beyond their responsibility, some say they lack the money and staff, and others say they don't have the legal authority to intervene even when distress is evident.

As many states have learned, however, taking a hands-off approach to local government fiscal health can lead to costly surprises. Several localities have gained nationwide attention after seeking bankruptcy protection in recent years, including Detroit; Jefferson County, Alabama; Stockton, California; and Central Falls, Rhode Island. In addition, the threat of default and possible bankruptcy is looming in Atlantic City, New Jersey. In the case of Detroit, the state of Michigan spent $195 million from its rainy day fund to help the city exit bankruptcy.

In general, however, insolvencies remain relatively rare: Over the past 60 years, only 64 counties, cities, towns, and villages have filed for bankruptcy, according to Spiotto.[7] That is in part by design: 21 states do not allow local governments to file for bankruptcy, while several others place conditions on these filings.[8]

Although local government bankruptcies are not a widespread problem, many localities struggle to meet the needs of their residents. There are myriad examples of municipalities and counties in serious enough fiscal distress to erode critical services and hamper the community's ability to thrive.

States can do more than just wait to react to the next fiscal emergency; they can work proactively to detect local distress. In 2013, Pew explored how and when states intervene in local governments in "The State Role in Local Government Financial Distress."[9] The report described the stages of municipal difficulty, from distress to crisis to bankruptcy; the reasons for state intervention; and various approaches states can take, including refusing to become involved even when local governments ask for help, intervening on a case-by-case basis, and repeatedly exercising their authority to make decisions for local governments. The report recommended that states monitor the fiscal conditions of local governments with an eye toward helping them avoid full-blown crises, if possible.

Pew has studied the range of policies and practices that states have in place to assess and track fiscal conditions at the local level, with a focus on whether and how states try to detect signs of local fiscal distress. A 50-state report will be released later this year. To operate a "fiscal monitoring system" for purposes of this research, a state must actively and regularly review the finances of its general purpose local governments to monitor fiscal conditions or detect problems.[10] Researchers interviewed officials in every state and analyzed relevant statutes. To learn about the issue from the perspective of local governments, researchers also talked with officials from municipal leagues across the country. These efforts add up to the most comprehensive study of fiscal monitoring across the country to date.

Pew's research found:

- Twenty-two states[11] make some effort to monitor the fiscal health of local governments, meaning that they actively and regularly review financial information from local governments with the aim of trying to detect fiscal distress or, more generally, assessing the fiscal condition.
- Of the 22, seven can be classified as "early warning" states, meaning that they have laws defining when local governments are in fiscal distress and systems to identify signs that a locality is declining toward such a condition.[12]
- State efforts to monitor local government fiscal health vary widely in terms of scope, frequency, responsibility for the work, and options available to deal with fiscal distress, among other factors.

Some state officials may feel that they have little reason to worry about the fiscal health of their local governments: A number of them said municipal distress is not an issue in their state, citing fiscally conservative cultures or mechanisms in place to ensure local fiscal health, such as limits on taxes, expenditures, and borrowing. The reality, however, is that a record of fiscally healthy local governments cannot guarantee what will happen in the future. One Rhode Island official said the Central Falls bankruptcy "was certainly a wake-up call, too, foreveryone. … Before, no one really envisioned a municipality going bankrupt."[13]

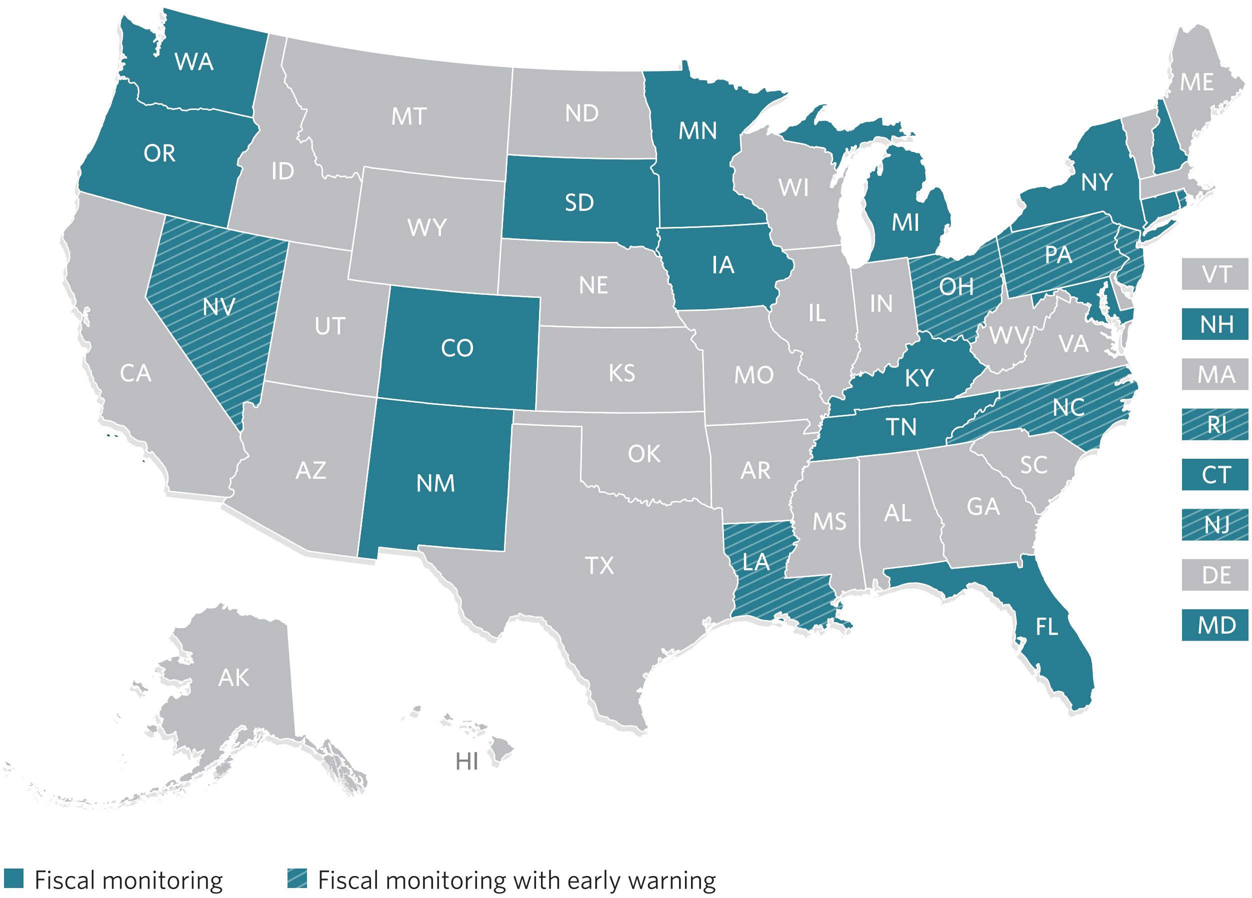
Just as governments at all levels learned from previous crises, states have an opportunity to re-examine their roles in helping local governments avoid or grapple with fiscal distress. That would follow the model set when the Great Depression prompted New Jersey and North Carolina to adopt rigorous local oversight systems in the 1930s, and the financial crises of the 1970s and 1980s in cities such as Cleveland, New York, and Philadelphia spurred initiatives in multiple states.

As many local governments struggle to adjust to the reality of decreased revenue and increased costs, several states—including New York, Rhode Island, and Tennessee—have either adopted fiscal monitoring systems or strengthened existing ones in recent years. Ohio and Colorado are considering strengthening their systems to detect and deal with fiscal distress. For states that want to figure out how local governments are faring and whether any may be headed for fiscal crisis, Pew's upcoming report will describe the fiscal monitoring landscape across the country.

Figure 1

Fiscal Monitoring in the United States

22 states have established programs, including seven with early warning systems



Sources: Pew analysis of state statutes and interviews with state officials

Challenges and solutions

The 22 states take various approaches to detect fiscal distress in local governments, depending on their contexts and needs. Pew identified promising responses to the challenges of local fiscal distress for states to consider when developing new fiscal monitoring systems or strengthening existing ones.

Challenge: Learning about fiscal distress too late.

States that try to detect fiscal distress by reviewing audits once a year will inevitably learn about problems after they have developed, rather than as they are emerging.

Solution: States check in with local governments on a frequent and regular basis to try to detect distress earlier. Reviewing budgets prospectively, along with recent financial statements, can help states stay ahead of the curve.

The earlier that states learn of fiscal distress, the sooner they can help—and the less they may need to become involved in the long run. Several states analyze local government budgets for signs of fiscal distress, giving them a sense of what may be ahead instead of what has already occurred. Detecting problems early also reduces the risk of a budget surprise when state officials determine that they must provide direct aid to a local government or ensure that a debt payment is made on time.

Challenge: Inconsistent monitoring when procedures are informal and not codified in statute.

In some states, fiscal monitoring occurs solely because of the initiative of individuals interested in staying ahead of the problems caused by local distress. Procedures for detecting such distress can rely heavily on the experience of those charged with examining the financial health of local governments.

Solution: Formalize monitoring policies and procedures to promote consistency, transparency, and predictability for local government officials and the public.

Codifying fiscal monitoring in statute can help ensure that a state remains committed to both detecting fiscal distress and helping local governments, regardless of administration changes or tight budgets. That said, monitoring systems should remain flexible to adapt to the changing needs of states and local governments. Establishing specific indicators for state review can help ensure that fiscal monitoring happens consistently year after year and across all municipalities.

Challenge: Tensions between state and local government officials.

State efforts to monitor local governments for fiscal distress can lead to tensions between state and local officials. In some instances, local governments may resist fiscal monitoring because they fear or do not want state oversight.

Solution: States can establish good working relationships with local governments.

Although state oversight can naturally lead to tensions, some states have succeeded in working with local governments cooperatively so that the jurisdictions view the state as a partner, not an enforcer. Among the effective strategies are:

- Hire personnel from local governments to staff state divisions dealing with counties and municipalities to help establish credibility for the state operation.
- Allow local governments a formal role in the monitoring process. In some states, municipal officials serve as members of commissions or boards that provide input to the state on monitoring processes or to other local governments in need of financial help.
- Emphasize training local government personnel to help prevent problems from occurring, instead of enforcement.
- Create frequent opportunities for state and local government officials to interact and have meaningful discussions about fiscal health to keep lines of communication open throughout the year, not just at audit time.

Challenge: Seeing intervention as the only response.

States that intervene in local fiscal crises but have few or no intermediate steps to help local governments may lack sufficient options.

Solution: Identify smaller steps to help local governments that stop short of intervention.

States can develop a range of options to help local governments at all levels of fiscal distress, from early warning signs to crisis. Providing technical assistance, working with local officials on their budgets, and training are common tools.

Conclusion

Pew's study shows that states take a broad variety of approaches to monitoring and intervening in the fiscal health of local governments. Some tend not to step in even when cities are struggling to survive, while others are intimately aware of the fiscal activities of local entities. Fiscal monitoring systems vary according to the goals and contexts of each state, but a number of promising approaches can be applied broadly.

Although some local fiscal crises are truly unpredictable, states can play a critical role in ensuring that local governments remain as fiscally healthy as possible and that states know early when signs of fiscal distress emerge. As state and local governments prepare for the inevitable next downturn, lawmakers may want to consider adopting monitoring systems or strengthening existing ones so that they are less likely to be unpleasantly surprised when a local government struggles to pay its bills.

Endnotes

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6 The Pew Charitable Trusts, interview with James Spiotto, Feb. 29, 2016.

7 James Spiotto, "Is Chapter 9 Bankruptcy the Ultimate Resolution for Financially Distressed Territories and Sovereigns Such as Puerto Rico: Are There Better Resolution Mechanisms?," statement to Senate Judiciary Committee, Dec. 1, 2015, http://www.chapmanstrategicadvisors.com/insights-publications-18.html.

8 The Pew Charitable Trusts, *The State Role in Local Government Financial Distress* (July 2013), http://www.pewtrusts.org/en/research-and-analysis/reports/2013/07/23/the-state-role-in-local-government-financial-distress.

9 Ibid.

10 For this study, we excluded special purpose districts such as fire districts, as well as school districts, to narrow the scope of the work.

11 The states are Colorado, Connecticut, Florida, Iowa, Kentucky, Louisiana, Maryland, Michigan, Minnesota, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oregon, Pennsylvania, Rhode Island, South Dakota, Tennessee, and Washington.

12 The states are Louisiana, Nevada, New Jersey, North Carolina, Ohio, Pennsylvania, and Rhode Island.

13 The Pew Charitable Trusts, interview with Susanne Greschner, chief of the Rhode Island Division of Municipal Finance, Sept. 17, 2015.

For further information, please visit:

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7/1/16

An Overview of the Pension/OPEB Landscape

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Prepared for

Conference on Municipal Finance
Brookings Institution
Hutchins Center on Fiscal & Monetary Policy
Washington, DC
July 1, 2016

Introduction

It is impossible to discuss municipal finance without considering the cost of pensions and other post-retirement employee benefits (OPEB), largest of which is retiree health insurance. These costs have received enormous press coverage, usually incorporating sweeping generalities about the burden of employee post-retirement benefits for the nation as a whole. Much is made of the bankruptcies in Vallejo, California (2008), Prichard, Alabama (2010), Central Falls, Rhode Island (2011), Stockton, California (2015), and Detroit, Michigan (2015). At the state level, the pension situation in Illinois, New Jersey, and Connecticut is often described as typical. No one mentions Delaware, Florida, Georgia, Tennessee, and North Carolina – states that have done a good job of providing reasonable benefits, paying their required contributions, and accumulating assets. The point is that the picture at the state and local level is extremely heterogeneous, so it is crucial to look at the numbers state by state and locality by locality.

This paper provides a comprehensive accounting of pension and OPEB liabilities for state and local governments and the fiscal burden that they pose. The analysis includes plans serving more than 800 entities: 50 states, 178 counties, 173 major cities, and 415 school districts related to the sample of cities and counties. The analysis apportions the liabilities of state-administered cost-sharing plans to participating local governments for a more accurate picture of which governmental entity is actually responsible for funding pension and OPEB liabilities. The cost analysis calculates, separately, pension and OPEB costs as a percentage of own-source revenue for states, cities, and counties. It then combines pension and OPEB costs to obtain the overall burden of these programs. Finally, it adds debt service costs to provide a comprehensive picture of government revenue commitments to long-term liabilities.

The discussion proceeds as follows. The first section establishes the framework for analysis, describing the role of new standards from the Government Accounting Standards Board (GASB 68) in allocating the liability in cost-sharing plans between states and localities. In order not to muddy the waters, wherever possible we have adopted assumptions similar to Michael Cembalest (2016) at JP Morgan. The second section presents 2014 pension data at the state and local level as a percentage of revenues. The third section shifts to OPEB costs and reports current and required payments for states, cities, and counties. The fourth section brings together pension and OPEB costs, and adds the cost of servicing debt for each level of government. The final section concludes that the situation varies enormously among states, cities, and counties. Some look very bad, while others are managing their affairs effectively.

Establishing the Framework

Calculating the burden of pensions and OPEBs on government revenues requires several steps. The first is to follow GASB 68 and to reallocate to cities and counties their share of state liabilities and assets. The second is to select a particular measure of required contributions and the appropriate interest rate to discount promised benefits. The third is to select the appropriate revenue base for calculating the burden. As with Cembalest (2016), for both pensions and OPEBs, actual contributions are collected directly from government Comprehensive Annual Financial Reports (CAFRs) and government revenue and interest expense on debt come directly from the Census of Governments.

Applying GASB 68

In an effort to increase the visibility of pension commitments, GASB Statement 68 moves pension funding information from the footnotes of financial statements to the balance sheets of employers. It also requires employers that participate in so-called “cost-sharing” plans to provide information regarding their share of the state pension on their books.

A “cost-sharing” plan is a type of multiple-employer plan; the other type is an agent plan. In agent plans, assets are pooled for investment purposes but the plan maintains separate accounts so that each employer’s share of the pooled assets is legally available to pay benefits for only its employees. In cost-sharing plans, the pension obligations, as well as the assets, are pooled, and the assets can be used to pay the benefits of any participating employer. For employers participating in agent plans, their share of the plan has always appeared in the notes of their financial statements, so the only change is moving that information into the balance sheet. In contrast, until 2015, employers participating in cost-sharing plans did not report their share, so including their share of state plan assets and liabilities on the balance sheets is a major change.

Figure 1 illustrates the flow of pension payments from city governments to various pension plans to which they contribute. The story would be similar for counties. For most city governments, pension payments include contributions to city-administered plans (often covering general employees and/or police and fire); contributions to non-teacher plans administered at the state level; and, very occasionally, contributions to state teacher plans. Generally, teacher plans receive their contributions from school districts, which raise their own revenue. An analysis of school district programs is presented in Appendix A because these programs do not fit easily into the fiscal format presented below.[1]

The government financial reports for 2015 include the share of pension liabilities for entities participating in cost-sharing plans. The exercise presented below, however, uses 2014 data because that is the latest year available for many cities and counties. As a result, we estimate the allocation based on a city's or county's Annual Required Contribution (ARC) for a given state plan as a percentage of the plan's total ARC. If ARC information is not available, the apportionment is based on the ratio of a city's actual contributions to the state plan's total actual contributions. More than half the cities (104 of the 173) and counties (97 of the 178) in our sample participate in cost-sharing state plans and are affected by GASB 68. Figure 2 shows the impact of the new GASB 68 reporting on the distribution of pension liabilities. Of course, when GASB 68 shifts the recognition of liabilities from the states to the cities and counties, it reduces the unfunded liability for the states by a corresponding amount. Both the pension and OPEB data presented below attribute the liabilities and the assets to the governmental entities ultimately responsible for payment.

Calculating the Expense of Pensions and OPEBs

Calculating the annual pension and OPEB burden requires three steps. The first is selecting an interest rate for discounting future benefit promises. The second is defining the contribution concept. The final step involves adjusting the reported data to align with the selected concepts.

Choosing a discount rate. In 2014, the nominal, long-term return assumption used by state and local pension plans averaged 7.6 percent, ranging from 6.25 percent to 8.50 percent. (The following discussion does not get into the debate by some financial economists that sponsors should use a riskless rate to discount promised benefits.) Figure 3 shows that during the 1955-2014 period, the average rolling 10- and 30-year nominal returns for a hypothetical portfolio (65 percent stocks/35 percent bonds) exceeded the long-term return assumption by at

[1] These types of direct contributions made by the city or school district to the pension plan are represented by the solid lines in the Figure. Occasionally, cities transfer funds to the school district, which is represented by the dotted line in the Figure.

least 100 basis points. Therefore, the average long-term nominal return assumption appears quite reasonable based on history, particularly over longer periods. But, many investment experts suggest that future equity returns could be considerably below historical averages (see Table 1), and returns on bonds are at historically low levels. To be conservative and consistent with the Cembalast (2016) analysis, we have adopted a nominal return of 6 percent.

Selecting the concept. For both pensions and OPEBs, the annual required payment consists of two components – one to cover costs of benefits accruing in the current year (the normal cost) and another to amortize the plan's unfunded actuarial liability. Two problems arise, however. First, many plans do not pay their required contribution, either as a policy choice or because their plan is subject to a statutory contribution rate that is less than the full required contribution. Second, in a number of cases the amortization payment is structured in such a way that the unfunded liability will never be paid off. Specifically, sponsors set the amortization payment as a fixed percentage of future payrolls – assumed to grow annually – and then reset the amortization payment each year as the 30-year amortization period rolls forward. Another alternative, followed by nearly half of the plans in our sample, is to use a closed 30-year amortization period but "start over" periodically by resetting the 30-year period midway through – just as the required payments begin to escalate substantially. While this approach produces better outcomes than relying on an open 30-year amortization period, it still does not produce full funding.

Thus, the pension expense can be measured in a number of ways: 1) how much plans actually contribute; 2) the plan's annual ARC; and 3) a required contribution that will actually pay off the unfunded liability. To be consistent with a recent analysis by Cembalest (2016), we have adopted options 1 and 3 – "actual" and "required," where required is defined as the normal cost plus a 30-year amortization of the unfunded liability in level dollar payments.

Adjusting the reported data. The goal is to recalculate the pension and OPEB ARCs to reflect a 30-year level-dollar amortization of the UAAL at a 6-percent discount rate. The first step is to separate the ARC into the normal cost and amortization payment components, because the adjustments affect each component differently. For many of the major plans, data on the two components are readily available through the Public Plans Database. In cases where the government is participating in a cost-sharing state pension plan for which data are available, the government's ARC is assumed to reflect the proportion of normal costs to amortization payment for the state plan as a whole. When plan data are not available, the funded ratio and interest rate are used to estimate the amortization payment, with the remaining amount being attributed to normal costs. The results of this approach show that the normal cost amounts to about a third of the pension ARC and about half of the OPEB ARC.

Once the ARCs have been separated into their normal-cost and amortization-payment components, each portion is adjusted separately. The normal cost is adjusted using an actuarial rule-of-thumb that assumes a 22-percent increase in the normal cost for each 1-percent change in the discount rate. The adjustment for the amortization payment involves three steps: 1) re-discounting the accrued liability using an actuarial rule-of-thumb that assumes a 12.5 percent change for each 1-percent change in the discount rate; 2) calculating a new UAAL using the actuarial assets and the re-discounted liability; and 3) calculating an amortization payment for the new UAAL assuming a 6-percent interest rate and 30-year amortization period. The adjusted normal cost and amortization payments are then re-combined to get a new required contribution – one that will actually pay off the unfunded liability.

Our results for *states* align closely with Cembalest (2016); Cembalest (2016) did not address cities or counties. A few discrepancies remain, however, due to the following four factors (listed in order of impact): 1) our method for parsing out the normal cost and amortization payment is based on actual plan data, while Cembalest (2016) backs out the results using a multi-step process; 2) we adopt a 6-percent discount rate for all pension plans, even those using a lower rate for reporting; 3) our adjustments to the normal cost and amortization are based on actuarial rules-of-thumb rather than the duration and yield curve; and 4) our pension and OPEB data are based on 2014 reported data, rather than 2015.

Selecting the Appropriate Revenue Base

The final step is to select the appropriate revenue base. The decision is more difficult than it first appears, because each level of government receives not only revenues it raises itself but also transfers from higher levels of government, and it pays money to lower levels. Thus, one could use either own-source revenues or net revenues (own-source plus net transfers). At the state level, the decision is relatively easy; the money the states receive from the federal government roughly equals the amount the states pay to counties, cities, and school districts. That is, own-source and net revenues are roughly the same (see Table 2). For consistency with

Cembalest (2016), we use own-source revenues at the state level. In addition to revenue from own-sources, this measure includes other general revenue, interest on the general fund, and liquor store profits.

Deciding on a revenue base for counties, cities, and school districts is more difficult, because these entities get, on average, 33 percent, 20 percent, and 55 percent of their revenues from other governments. For counties and school districts, most of the money comes from the state; for cities, a substantial share also comes from the federal government. Using own-source revenue as the denominator overstates the drain on the locality's total resources, but provides a sense of the tax increase required if pension or OPEB costs come in higher than expected. The following analysis reports costs as a percentage of own-source revenues in the text, but the results based on net revenues (own-source plus net transfers) are presented in Appendix B.

Pension Contributions as a Percentage of Own-Source Revenues

The data for this analysis include pension and OPEB liabilities from 50 states, 178 counties, 174 major cities, and 415 school districts related to the sample cities and counties. By payrolls, the sample accounts for 100 percent of states, 46 percent of counties, 43 percent of cities, and 26 percent of school districts (see Figure 4). Only about 40 percent of the pension liabilities in state-administered plans are the responsibility of state government; the other 60 percent are the responsibility of the local governments.

Figure 5 shows current and required (with a 6-percent discount rate and level-dollar amortization over 30 years) pension contributions as a percentage of own-source revenues by state. The states are ranked by their final standing once pension, OPEB, and interest cost have been combined, so they are not in perfect descending order. Nevertheless, the costs vary dramatically from a high of 29 percent of own-source revenues in Illinois to a low of 1 percent in Nebraska. Note, however, that the costs are below 10 percent of revenues in all but nine states and below 5 percent of revenues in 24 states.

Figure 6 presents current and required pension contributions for counties. As discussed above, these costs are a high percentage of own-source revenues in part because own-source revenues account for only two thirds of total county resources. However, even reducing these percentages by a third still leaves many California counties with substantial costs (see Appendix B, Figure 20). Given that the money to pay county pension costs must come from either the state or county own-source revenues, it is interesting to calculate combined pension costs for California, Maryland, and Virginia – three states where counties play a major role. That is, the numerator includes the current and required pension costs for the state and the counties in that state, and the denominator includes the state own-source revenues and the counties' own-source revenues. This constructed state/county pension cost burden is compared with the state pension cost alone (see Figure 7). The calculation highlights the importance of considering counties in those states where they play a significant role.

Figure 8 presents for cities the actual and required pension payment as a percentage of own-source revenues. Of the 50 largest cities, eleven – Chicago, San Jose, Miami, Houston, Baltimore, Portland, Omaha, Boston, Tucson, Phoenix, and Las Vegas – faced pension contributions in excess of 20 percent of own-source revenues. On the other hand, 18 of the 50 had required pension contributions of less than 10 percent.

The county and city calculations raise an issue that does not arise at the state level. The vast majority of cities and counties function independently from their associated school districts, with the school district maintaining separate administration and finances. However, 51 of the over 350 cities and counties in our sample do include a school district. For example, in Maryland and Tennessee, most of the county governments operate school systems. In New York City and Boston, the school districts are part of the city government. Given that school districts account for nearly half of local government finances, their inclusion in some local governments but not others will distort measures of costs across municipalities. Therefore, for local governments that include school districts, we separate school district costs and revenue from that of the local governments. While pension and OPEB costs for the school district and its parent government are reported separately in the parent-government's financial report, separate revenues must be estimated. Our decision is to allocate revenues based on payrolls. For example, in the 2014 Census, the City of Boston reports that just over 45 percent of its total payroll is for education professionals, so 45 percent of the city's finances are allocated to the school district, leaving 55 percent for the city itself. Pension and OPEB costs for the local government and school district are then reported relative to the newly apportioned finances. It is unclear the extent to which this ad hoc adjustment distorts the final results.

The overall picture emerging from the pension exercise is that required pension payments are an extraordinarily large percentage of own-source revenues for a small percentage of states, counties, and cities, but many governmental entities appear to have their pension costs under control. Pensions, however, are just one component of the required payments facing governments. In addition, most state and local governments provide other post-employment benefits (OPEBs), the largest of which is retiree health insurance. [2]

OPEB Contributions as a Percentage of Own-Source Revenues

Retiree health plans have received increased attention in recent years due to rapidly rising health costs and new reporting guidelines from the GASB. These GASB 45 guidelines, which were released in 2004 and became effective in 2007, require states and localities to change the way they account for the cost of retiree health plans from a cash to an accrual basis, essentially applying to OPEB plans the standards used for pensions. [3] Specifically, public sector employers must regularly report for their retiree health plans the actuarial accrued liability, the actuarial value of assets, the unfunded liability, the funded ratio, and the ARC payment. Soon, GASB 75 will supersede GASB 45, and narrow the allowable actuarial cost methods that can be used for reporting liabilities as well as require the liability of cost-sharing OPEB plans to be apportioned to participating employers.[4]

Although GASB 45 does not *require* sponsors to establish trust funds or move toward full funding, it provides an incentive to fund by allowing them to use a higher rate to discount future benefit promises once they set up a trust and commit to paying the ARC.[5] That is, with funding, the actuary can discount obligations by the expected long-term return on plan assets rather than the lower short-term rate used for plans without funding.

The data for the OPEB analysis span the same sample of over 800 government entities used in the pension analysis. The provision of OPEB benefits, however, is much less centralized than that of pensions. In the case of pensions, state-administered plans cover not only state employees, but also nearly all teachers and about 70 percent of local government employees

[2] OPEB costs also include dental, vision, life insurance, disability, and long-term care.
[3] Implementation of GASB 45 was phased in over a three-year period, with the largest governments – those with total annual revenues of $100 million or more – required to report their liabilities in their FY2008 financial statements; see U.S. Government Accountability Office (2009). Also relevant is GASB 43, *Financial Reporting for Postemployment Benefit Plans Other Than Pensions*, which was released shortly before GASB 45.
[4] Like GASB 67 and 68 have already done for pensions, GASB 74 and 75 will also introduce a blended discount rate and require unfunded liabilities to be reported on the plan sponsor's balance sheet for OPEBs.
[5] Technically, setting up a trust is sufficient for the use of a higher discount rate under GASB 45. However, the use of the more favorable rate only applies to the extent that accumulated resources are estimated to be sufficient to fund required payments.

(generally those in smaller cities and towns). The 30 percent of local employees who are not covered by state pension plans are covered primarily by large city or county plans. Thus, a sample that includes all state-administered plans and a reasonable number of major city and county plans will cover most state and local pension liabilities.

Such is not the case with retiree health care plans. State-administered OPEB plans are often limited to state employees, excluding both local government employees and teachers. Thus, it is important to explore the extent to which both large and small local governments and school districts provide their own retiree health insurance.[6] Large local governments and school districts are included in our sample; small ones are not. If one were attempting to account for total OPEB costs, it would be necessary to make estimates for these excluded entities.

A comprehensive estimate of OPEBs shows that two-thirds of the liabilities are at the local level, whereas for pensions two thirds are at the state level. Second, unfunded OPEB benefits amount to 28 percent of unfunded pension benefits – when pension benefits are calculated with an interest rate comparable to OPEBs. And, finally, while OPEB liabilities are large, several factors, such as greater flexibility in adjusting benefits and increasing retirement ages, limit their potential drain on state and local resources.[7]

For the current analysis, where the focus is states, large counties, and large cities, complete OPEB data are available. Figures 9-11 show – for states, counties, and large cities – current and required OPEB payments as a percentage of own-source revenues. States with large required pension payments also tend have large OPEB costs – the four costliest states in terms of OPEB also have pension costs that are over 10 percent of revenues. At the county and city level, the high costs are more evenly distributed among the entities shown. On balance, required OPEB costs equal about a third of required pension costs.

Pension, OPEB, and Interest Payments as a Percentage of Own-Source Revenues

The final section pulls together current and required payments for pensions and OPEBs, and adds interest payments. The interest expense comes directly from the Census of Governments. The only adjustment made is that, when school districts are combined with either cities or counties, interest expense is allocated based on education and non-education payrolls.

[6] Prior research explored retiree health for teachers at the state level only (Clark 2010).
[7] For further discussion, see Kearney et al. (2009) and Clark (2009).

Following Cembalest (2016), contributions at the 15-percent and 25-percent level are bold lines reflecting thresholds where concerns start to be raised and where the government's situation becomes untenable, respectively.

The results for states are shown in Figure 12. The good news is that 36 states have required payments below 15 percent of own-source revenues and 23 of those states face payments below 10 percent. The bad news is that five states – Illinois, Connecticut, and New Jersey, Hawaii, and Kentucky – face required payments in excess of 25 percent of revenues and Massachusetts, Rhode Island, and Delaware face payments in excess of 20 percent. Figure 13 breaks down the required payment into pensions, OPEB, and interest; pensions and OPEB swamp interest across the board. This pattern is not surprising given that U.S. states have about $500 billion of bonds supported by state tax collections and $0.5-$1.5 trillion of unfunded liability depending on the interest rate used to discount the benefits.

Figures 14 and 15 present the results for counties and cities, respectively. Even accounting for the fact that own-source revenues are only 67 percent of county and 80 percent of city net revenues, costs are extremely high. Six counties in California have costs in excess of 30 percent of own-source revenues. In terms of cities, Chicago, Detroit, San Jose, Miami City, Houston, Baltimore, Wichita, and Portland lead the list, all with costs in excess of 40 percent of revenues.

The question of course is what the worst-off states, counties, and municipalities can do to improve their situation. Four options exist. One is to pray for higher returns. Unfortunately returns would have to be consistently in the 10-15 percent range for the next 30 years to solve the problem – an unlikely outcome given today's financial markets. A second option is to raise taxes to meet the required commitments. Unfortunately, many of the states with the greatest burden already have relatively high taxes. A third option is to cut other spending by 10 to 20 percent. A final option is to raise employee contributions far beyond what they are already contributing to their plans. Clearly, those governments in the worst shape face an enormous challenge.

Conclusion

The cost of pensions and OPEBs has become a front-burner issue in any discussion of municipal finance. While news headlines emphasize cases of jurisdictions in extreme financial distress, the key takeaway from this paper is that the picture at the state and local level is extremely heterogeneous. Therefore, a full understanding of the issue requires looking at the numbers state by state and locality by locality. It is also important to capture localities comprehensively, including cities, counties, and school districts.

Based on a large sample of states and localities, the analysis finds that required pension payments are an extraordinarily high percentage of own-source revenues – more than 20 percent – for a handful of states, counties, and cities, but most jurisdictions have their costs under control. Adding in OPEB costs, of course, raises the total spending requirements but the overall story remains similar. For example, eight states face costs in excess of 20 percent of own-source revenues, but 23 states have costs below 10 percent. Cities, counties, and school districts also show considerable variation.

The small minority of jurisdictions facing dire circumstances have only unpalatable options: some combination of raising taxes, cutting spending, and/or hiking employee contributions. Unfortunately, these jurisdictions tend to have less flexibility in making major fiscal changes and raising employee contributions runs the risk of making it harder to recruit and retain top-notch workers. In short, these governments face an enormous challenge.

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Table 1. *Expected Nominal Returns for U.S. Equities from Selected Financial Firms, 2015-16*

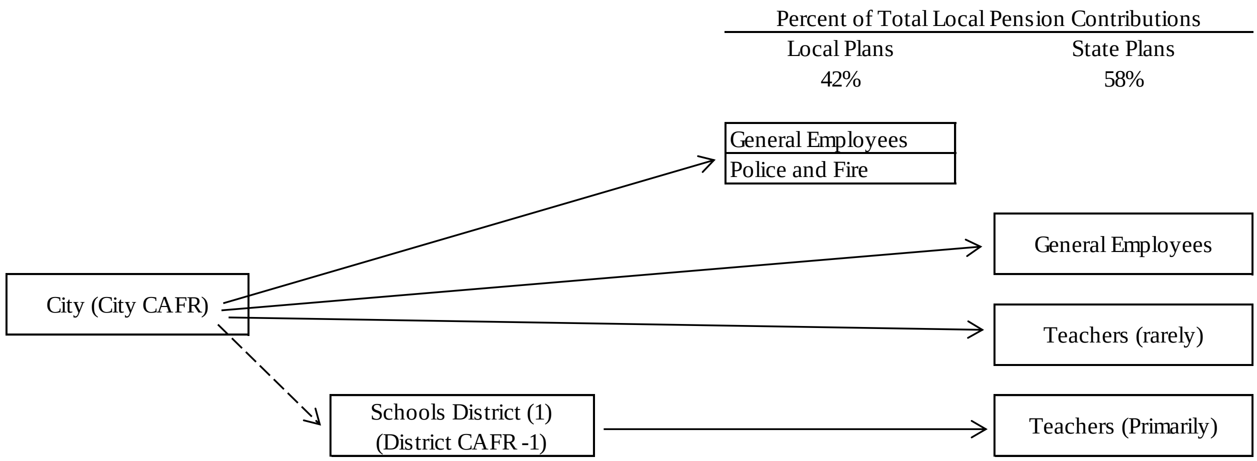
Firm	Average Annual Nominal Returns (%)	Horizon (years)
Bogle and Nolan[a]	7%	10
Charles Schwab	6.3%	10
Goldman Sachs	4.7-5.5%	5
GMO	-0.1%	7
McKinsey	Slow growth: 6.0 – 6.5 Growth recovery: 8.0 – 9.0	20
Morningstar[b]	6-7%	Next few decades
Research Affiliates[c]	3.2%	10

[a] The authors are both affiliated with Vanguard's Bogle Financial Markets Research Center.
[b] Josh Peters, Morningstar Director of Equity-Income Strategy.
[c] Research Affiliates projects a 1.2 percent real equity return; the projection is converted to a nominal value by adding 2 percent inflation.
Sources: Bogle and Nolan (2015); GMO (2016); Goldman Sachs (2016); McKinsey Global Institute (2016); Morningstar (2015a); Research Affiliates (2016)

Table 2. *Sources of Total Net Revenue, by Level of Government, 2014*

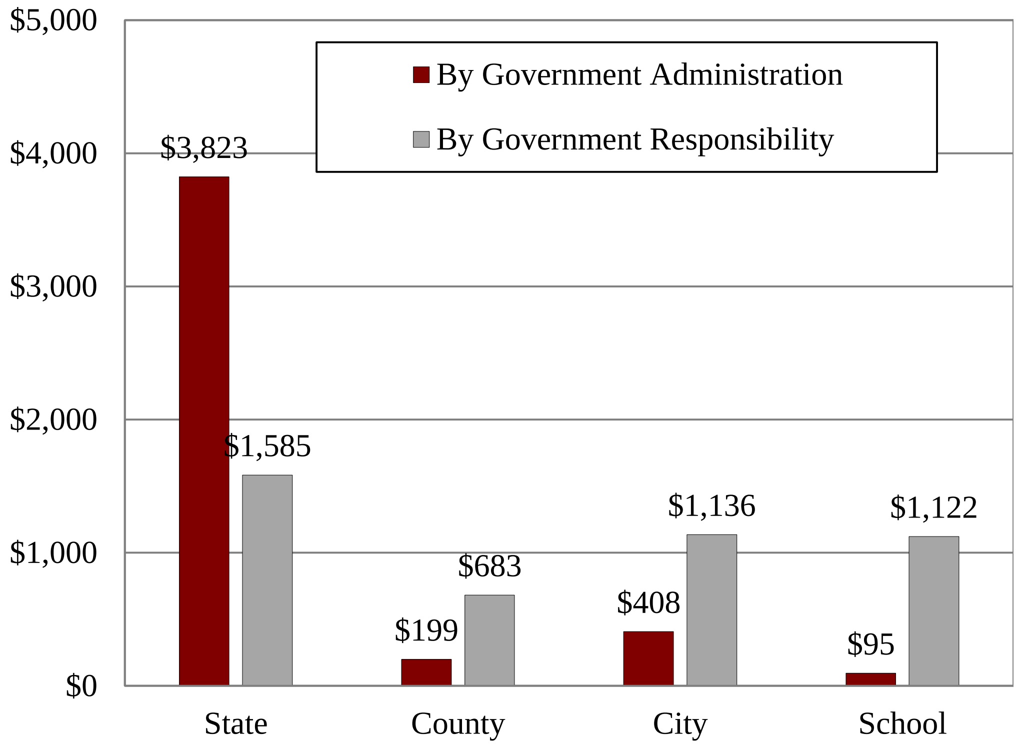
Level of Government	Intergovernmental Transfers					Own-source Revenue
	Inflows from:					
	Federal	State	Local	Outflows	Net Transfers	
State	42.2%	0.0%	1.1%	40.2%	3.1%	96.9%
County	3.8%	30.4%	2.5%	3.7%	32.9%	67.1%
City	6.8%	13.1%	3.1%	2.7%	20.3%	79.7%
School District	1.1%	51.8%	3.7%	1.6%	54.9%	45.1%
Total	20.5%	16.5%	2.3%	18.6%	20.6%	79.4%

Figure 1. *Contributions from Cities and Towns to Pension Plans*



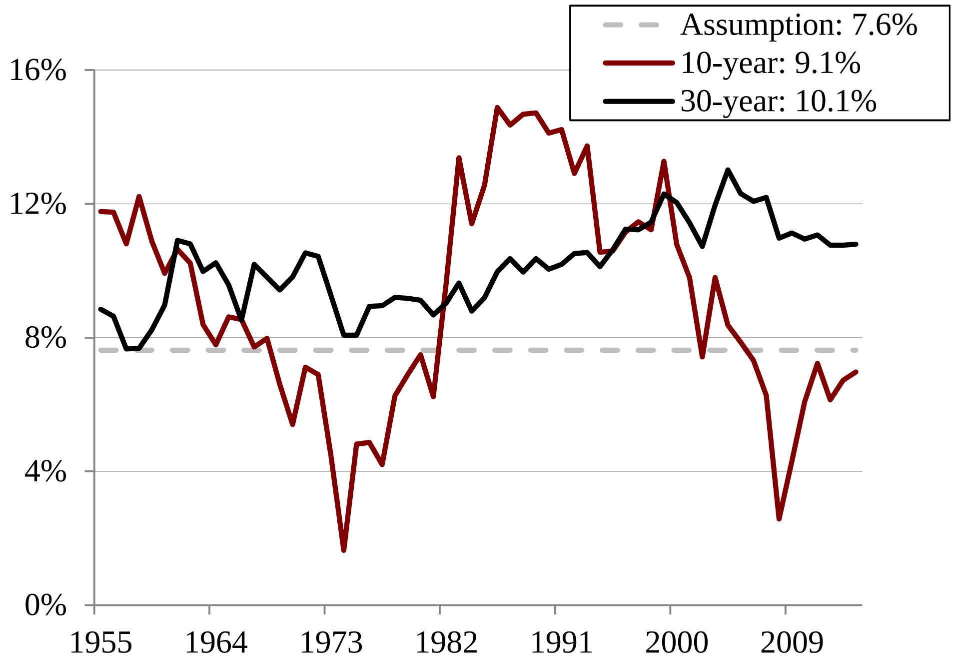
Source: Munnell and Aubry (2016).

Figure 2. *Distribution of Pension Liability Before and After GASB 68, in billions*



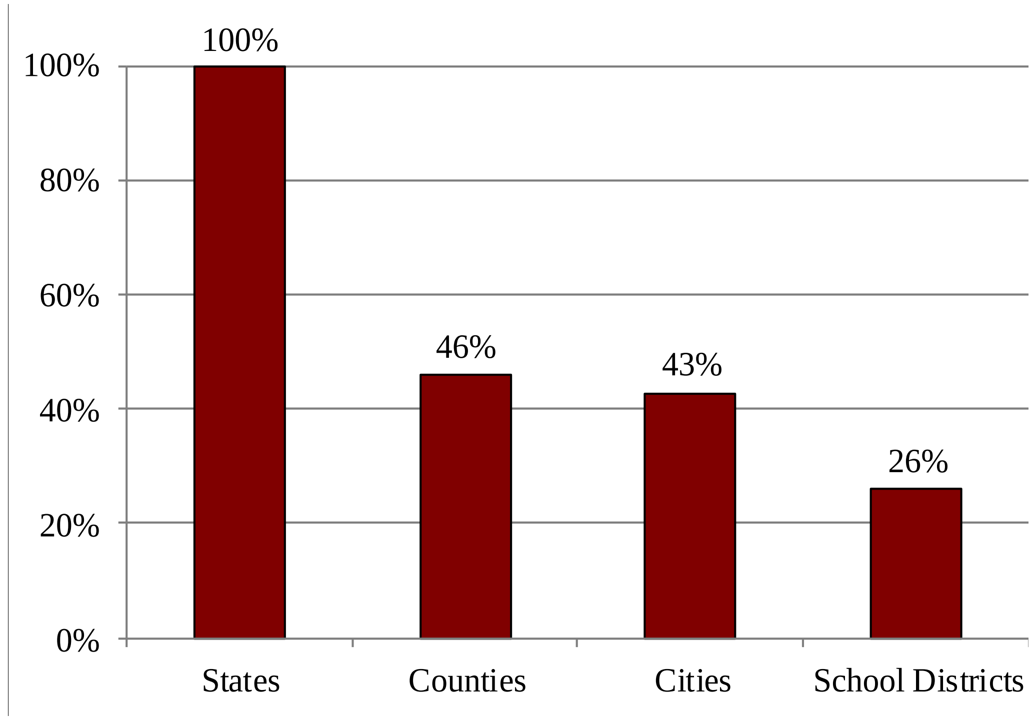
Source: Authors' calculations based on various FY 2014 plan and government financial reports and actuarial valuations; and U.S. Census Bureau (2014).

Figure 3. *10-Year and 30-Year Geometric Nominal Returns for Hypothetical Portfolios of 65 Percent Stocks and 35 Percent Bonds, 1955-2014*



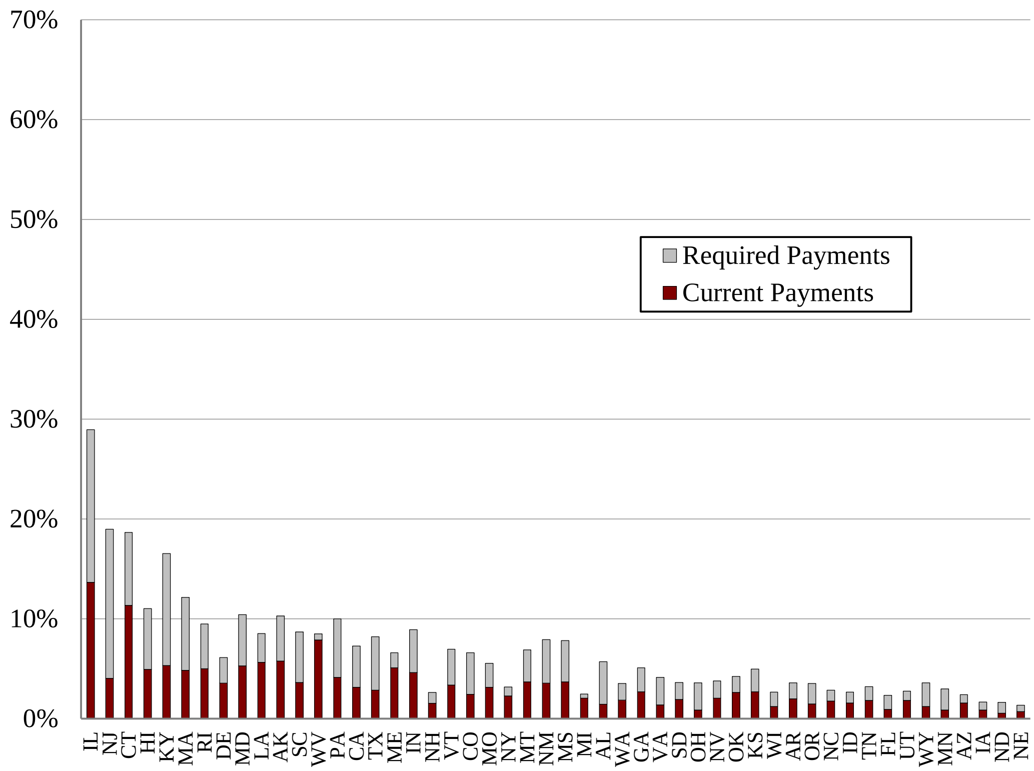
Source: Authors' calculations from Morningstar, Inc. (2015b); and French (2015).

Figure 4. *Percentage of State, County, Local, and School District Payrolls Covered by Sample, 2012*



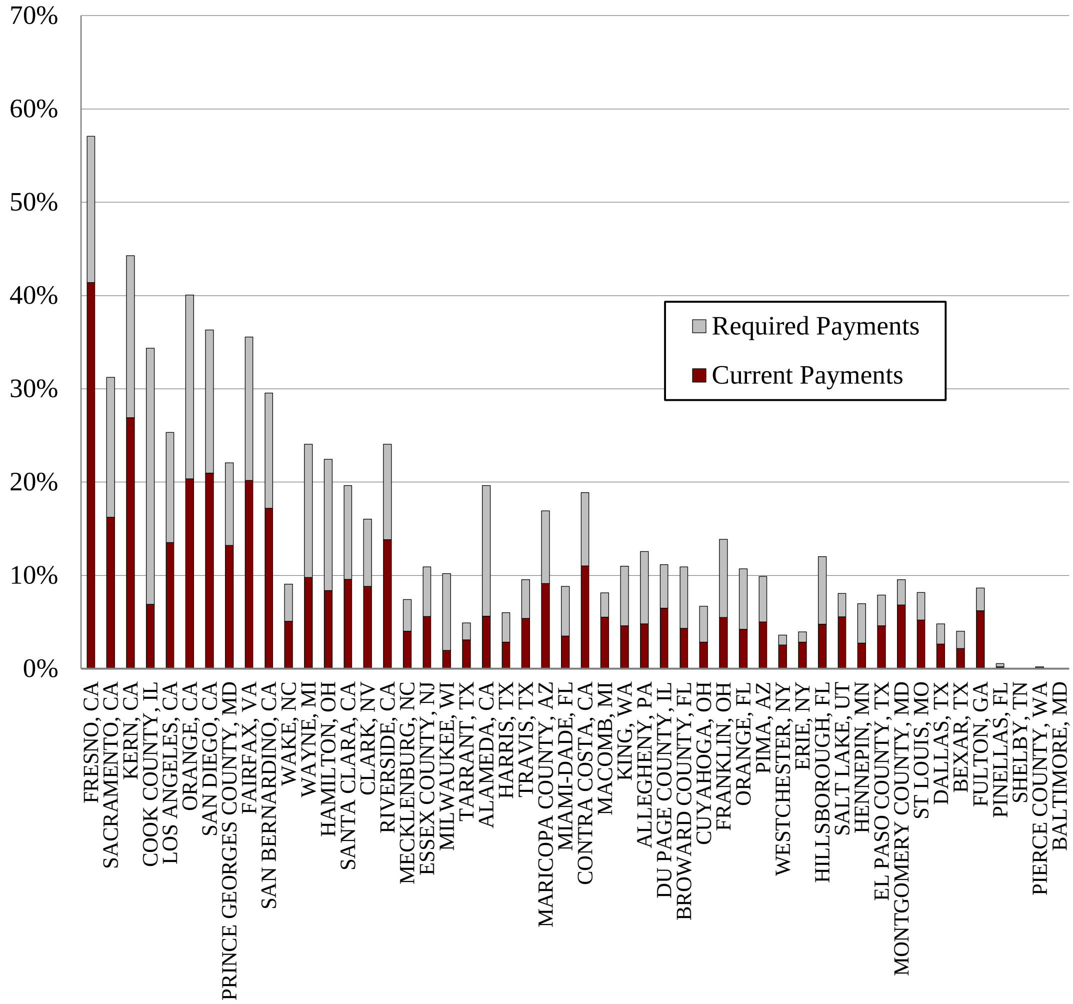
Source: Authors' calculations based on U.S. Census Bureau (2012).

Figure 5. *States: Current and Required Pension Payments as a Percentage of Own-Source Revenue, 2014*



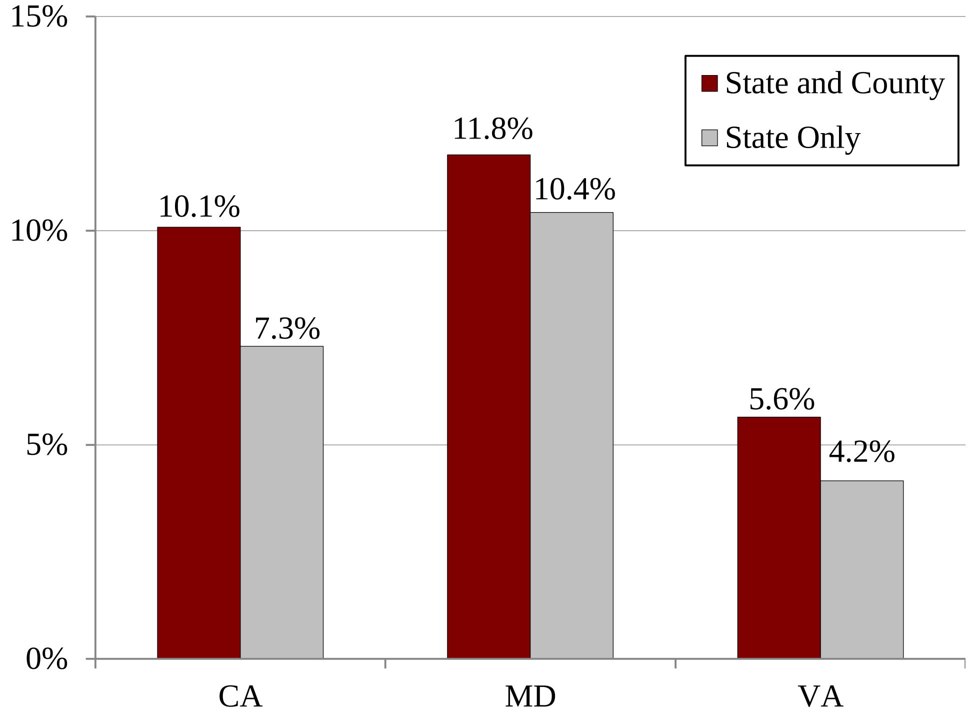
Source: Authors' calculations based on various FY 2014 plan and government financial reports and actuarial valuations; and U.S. Census Bureau (2014).

Figure 6. *Large Counties: Current and Required Pension Payments as a Percentage of Own-Source Revenue, 2014*



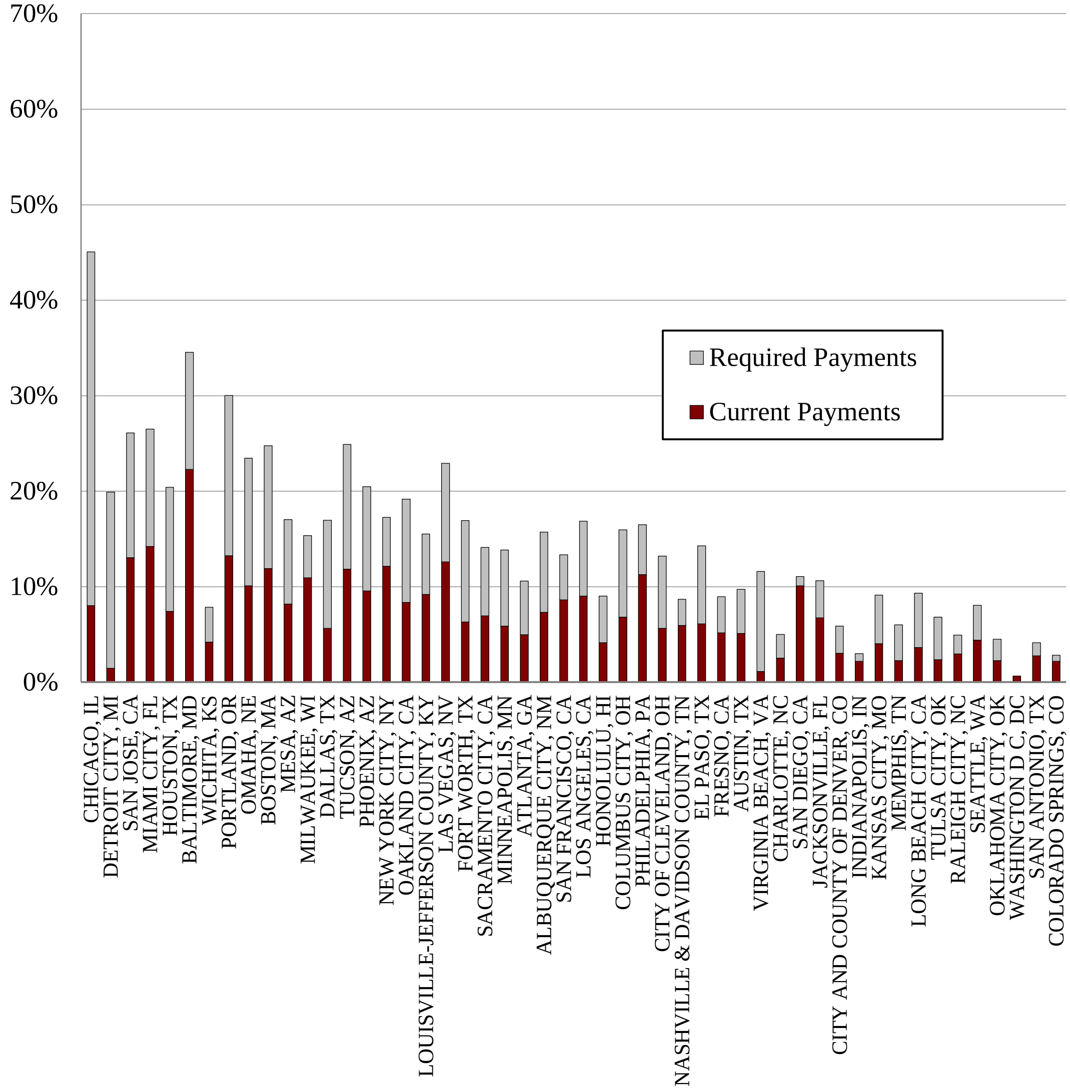
Source: Authors' calculations based on various FY 2014 plan and government financial reports and actuarial valuations; and U.S. Census Bureau (2014).

Figure 7. *States and Counties: Required Pension Payments as a Percentage of Revenue, Selected States 2014*



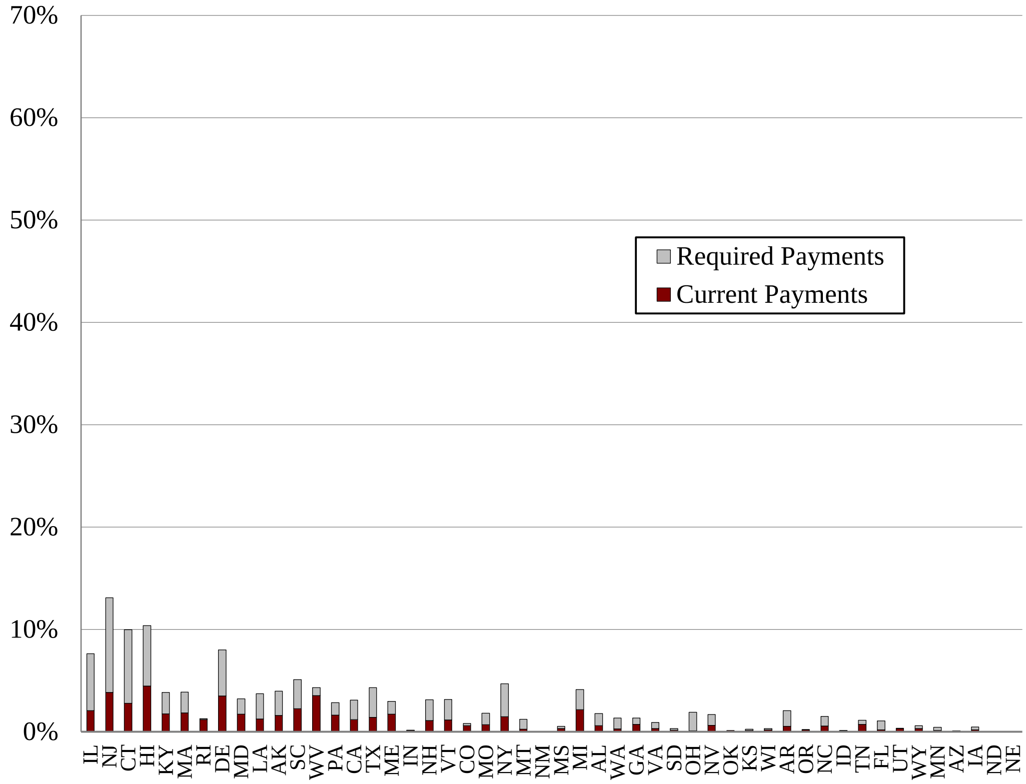
Source: Authors' calculations based on various FY 2014 plan and government financial reports and actuarial valuations; and U.S. Census Bureau (2014).

Figure 8. *Large Cities: Current and Required Pension Payments as a Percentage of Own-Source Revenue, 2014*



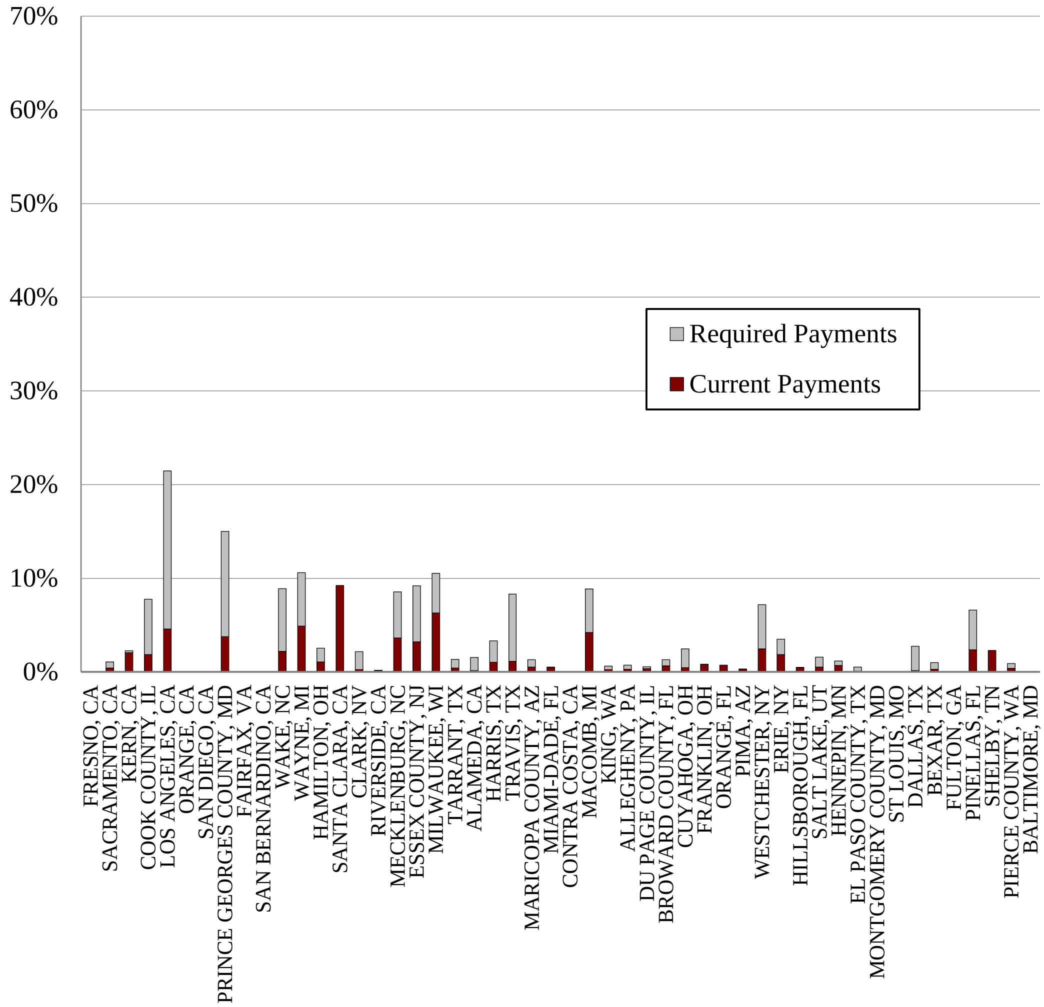
Source: Authors' calculations based on various FY 2014 plan and government financial reports and actuarial valuations; and U.S. Census Bureau (2014).

Figure 9. *States: Current and Required OPEB Payments as a Percentage of Own-Source Revenue, 2014*



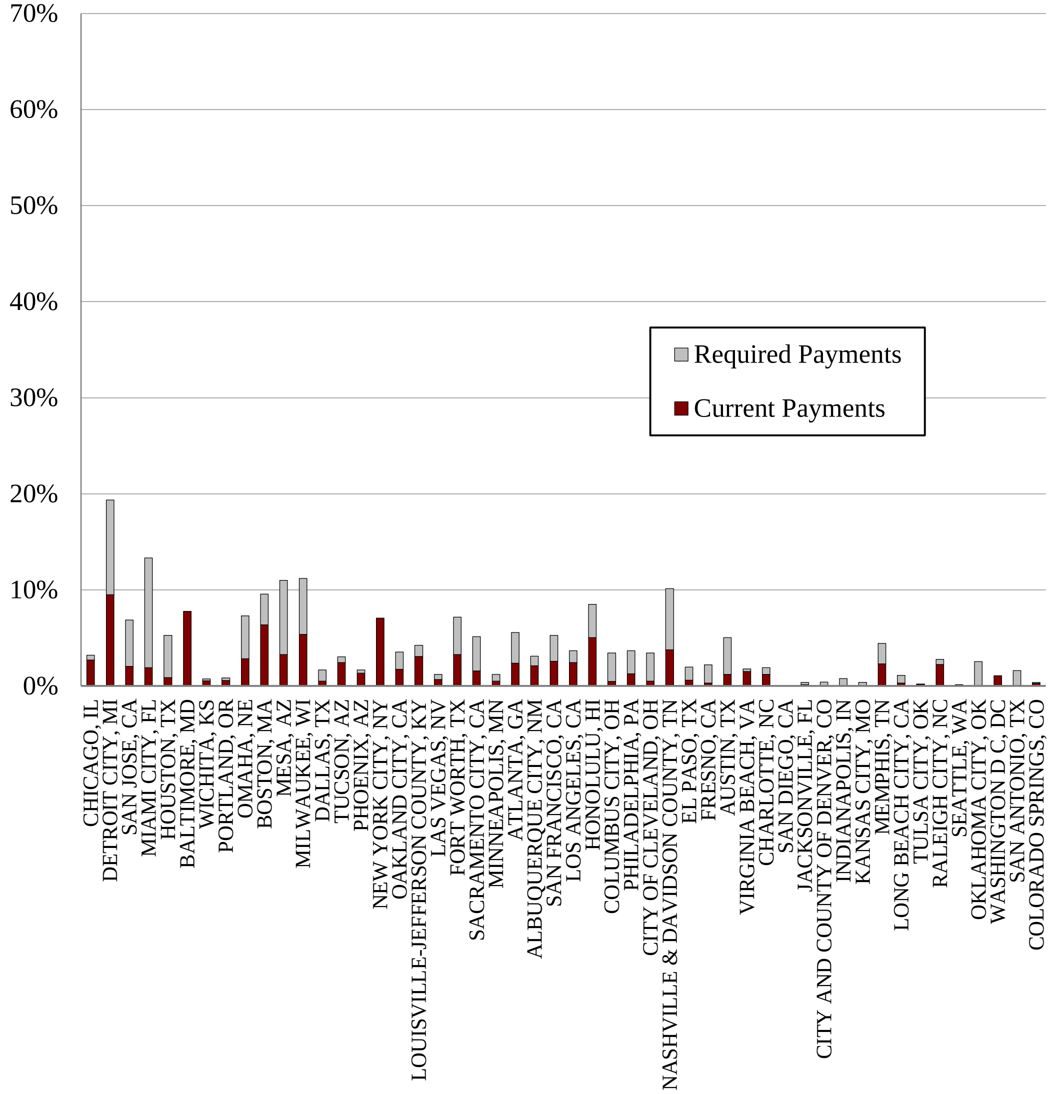
Source: Authors' calculations based on various FY 2014 plan and government financial reports and actuarial valuations; and U.S. Census Bureau (2014).

Figure 10. *Large Counties: Current and Required OPEB Payments as a Percentage of Own-Source Revenue, 2014*



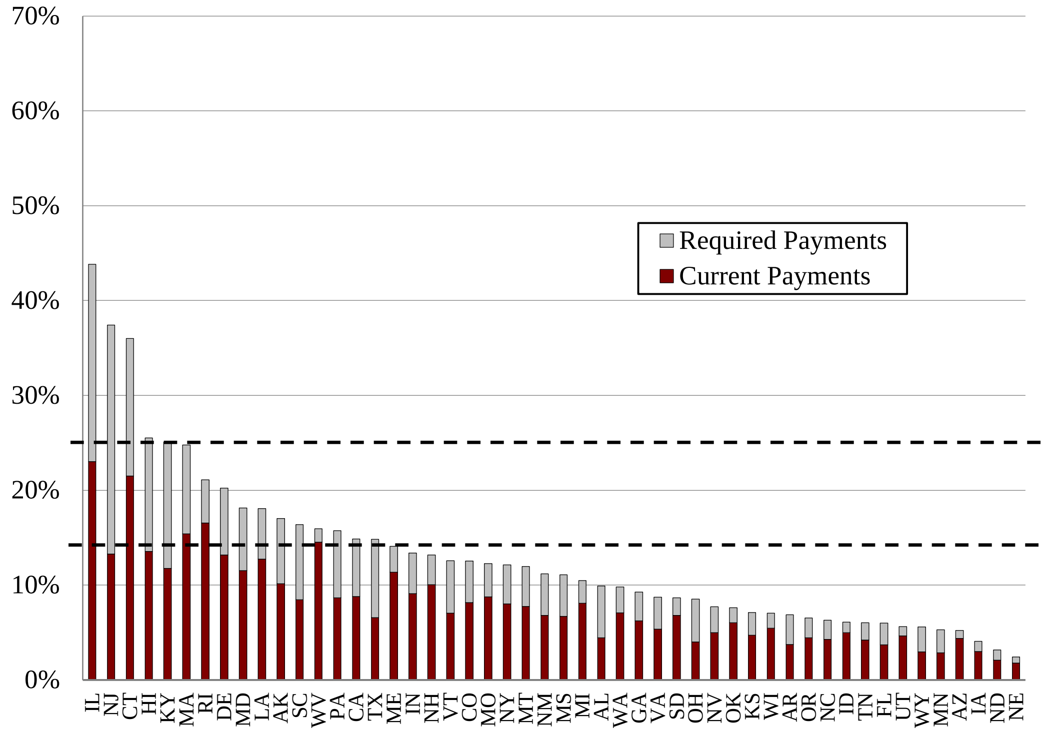
Source: Authors' calculations based on various FY 2014 plan and government financial reports and actuarial valuations; and U.S. Census Bureau (2014).

Figure 11. *Large Cities: Current and Required OPEB Payments as a Percentage of Own-Source Revenue, 2014*



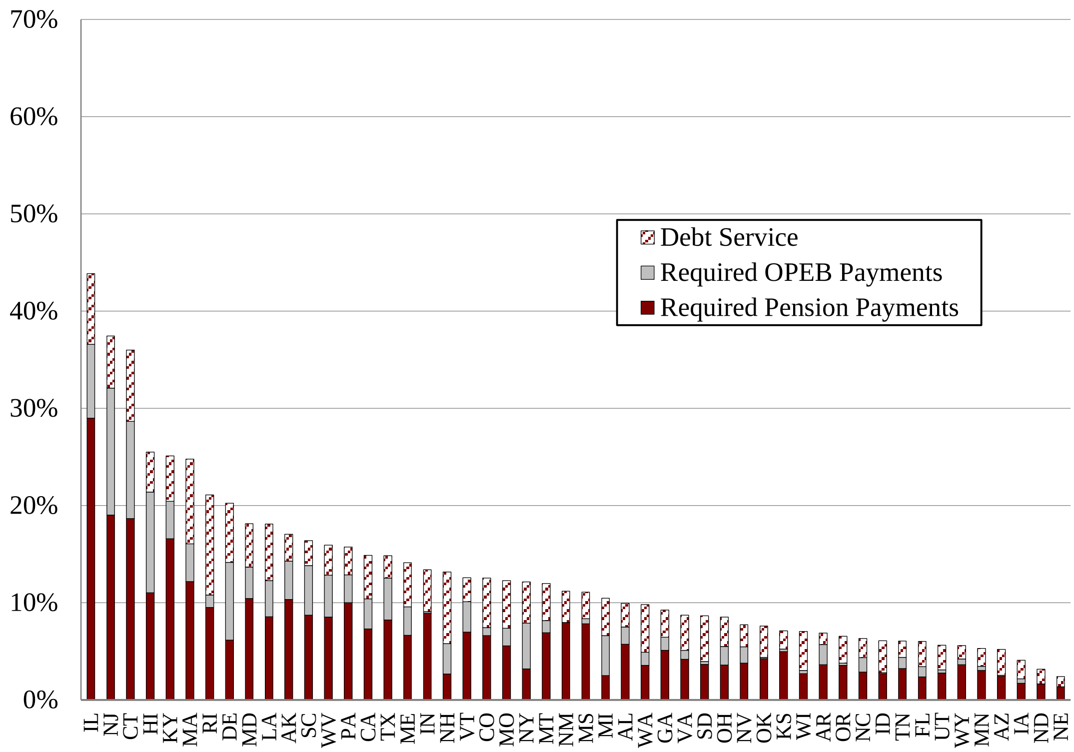
Source: Authors' calculations based on various FY 2014 plan and government financial reports and actuarial valuations; and U.S. Census Bureau (2014).

Figure 12. *States: Current and Required Pension, OPEB, and Interest Payments as a Percentage of Own-Source Revenue, 2014*



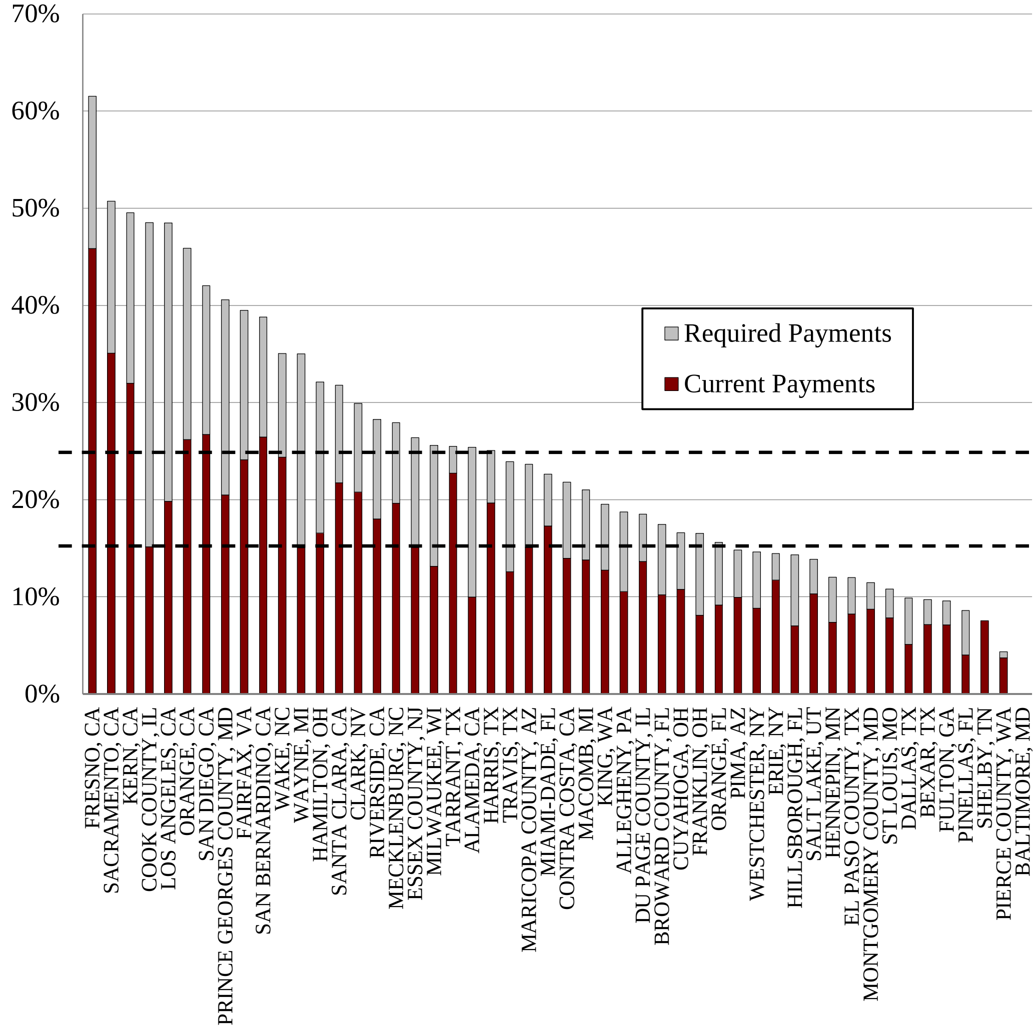
Source: Authors' calculations based on various FY 2014 plan and government financial reports and actuarial valuations; and U.S. Census Bureau (2014).

Figure 13. *States: Required Payments for Pensions, OPEB, and Interest Payments as a Percentage of Own-Source Revenue, 2014*



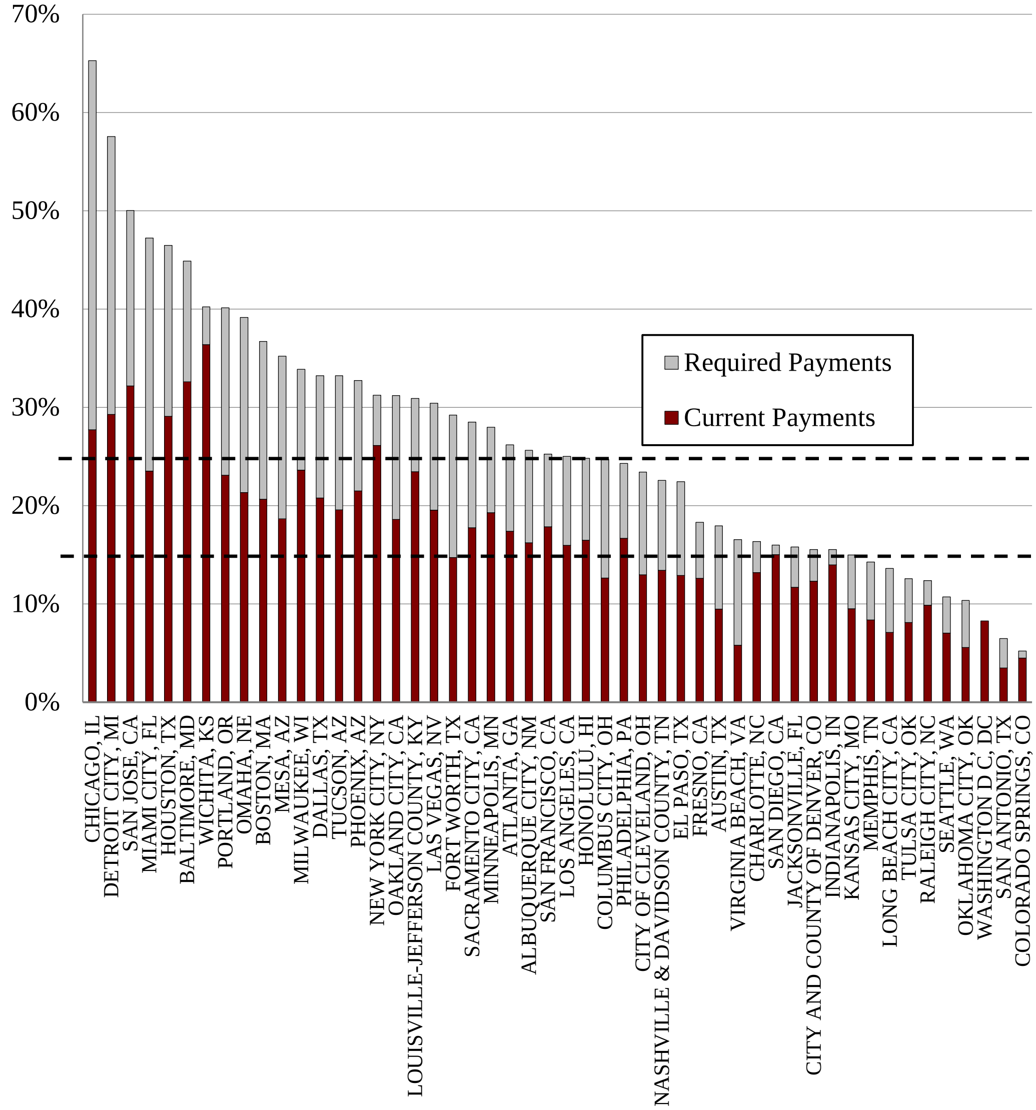
Source: Authors' calculations based on various FY 2014 plan and government financial reports and actuarial valuations; and U.S. Census Bureau (2014).

Figure 14. *Large Counties: Current and Required Pension, OPEB, and Interest Payments as a Percentage of Own-Source Revenue, 2014*



Source: Authors' calculations based on various FY 2014 plan and government financial reports and actuarial valuations; and U.S. Census Bureau (2014).

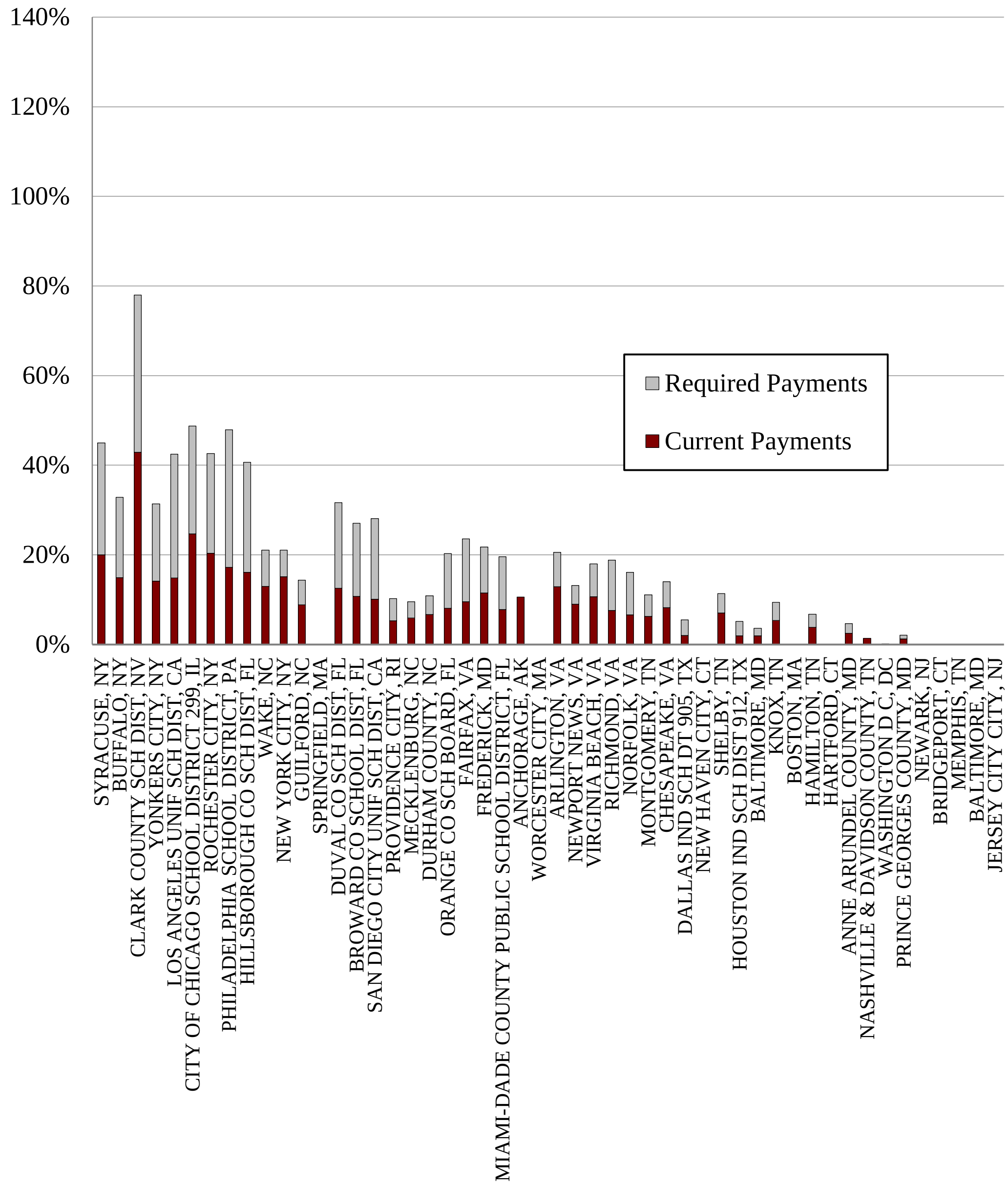
Figure 15. *Large Cities: Current and Required Pension, OPEB, and Interest Payments as a Percentage of Own-Source Revenue, 2014*



Source: Authors' calculations based on various FY 2014 plan and government financial reports and actuarial valuations; and U.S. Census Bureau (2014).

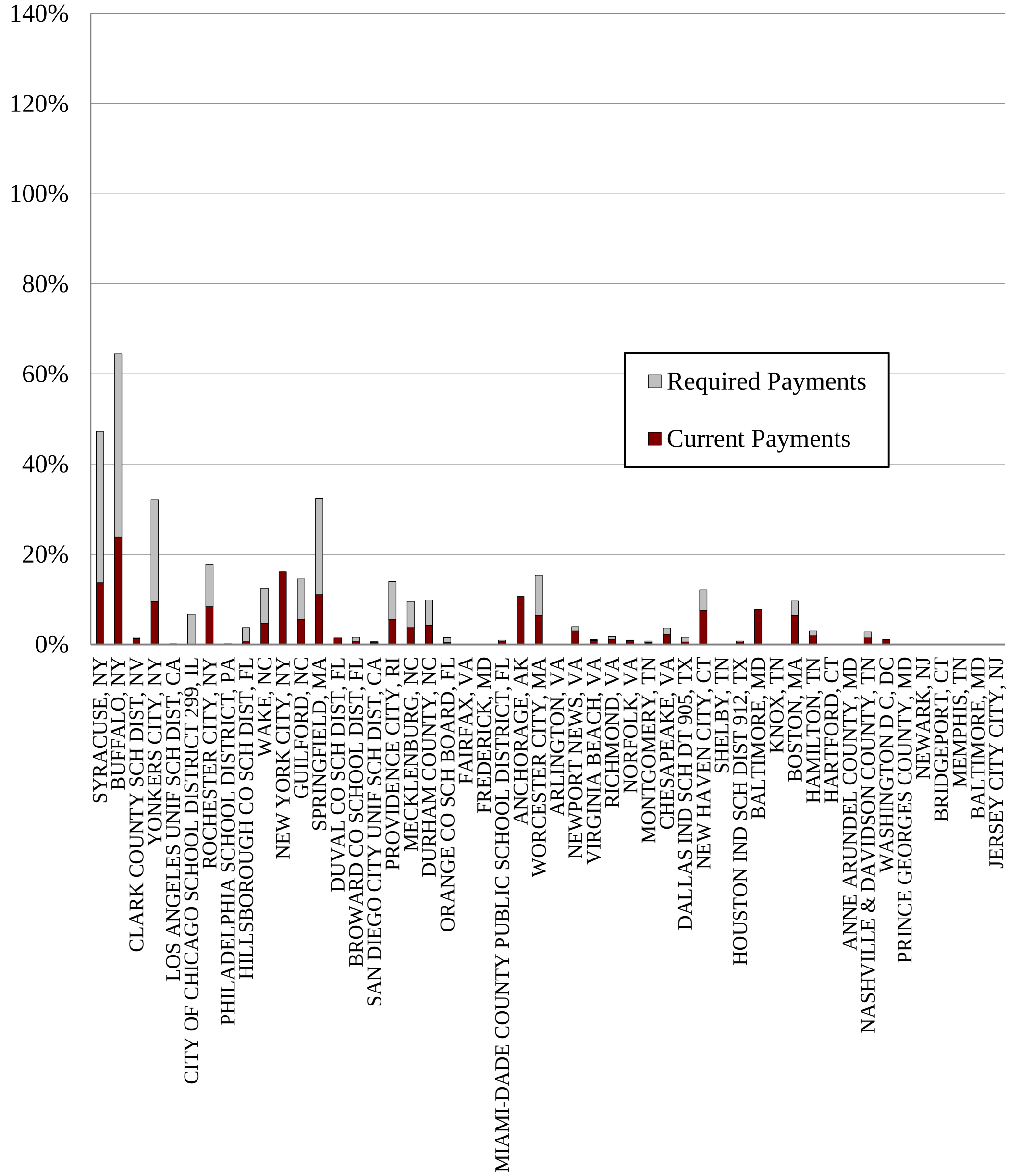
Appendix A

Figure 16. *Large School Districts: Current and Required Pension Payments as a Percentage of Own-Source Revenue, 2014*



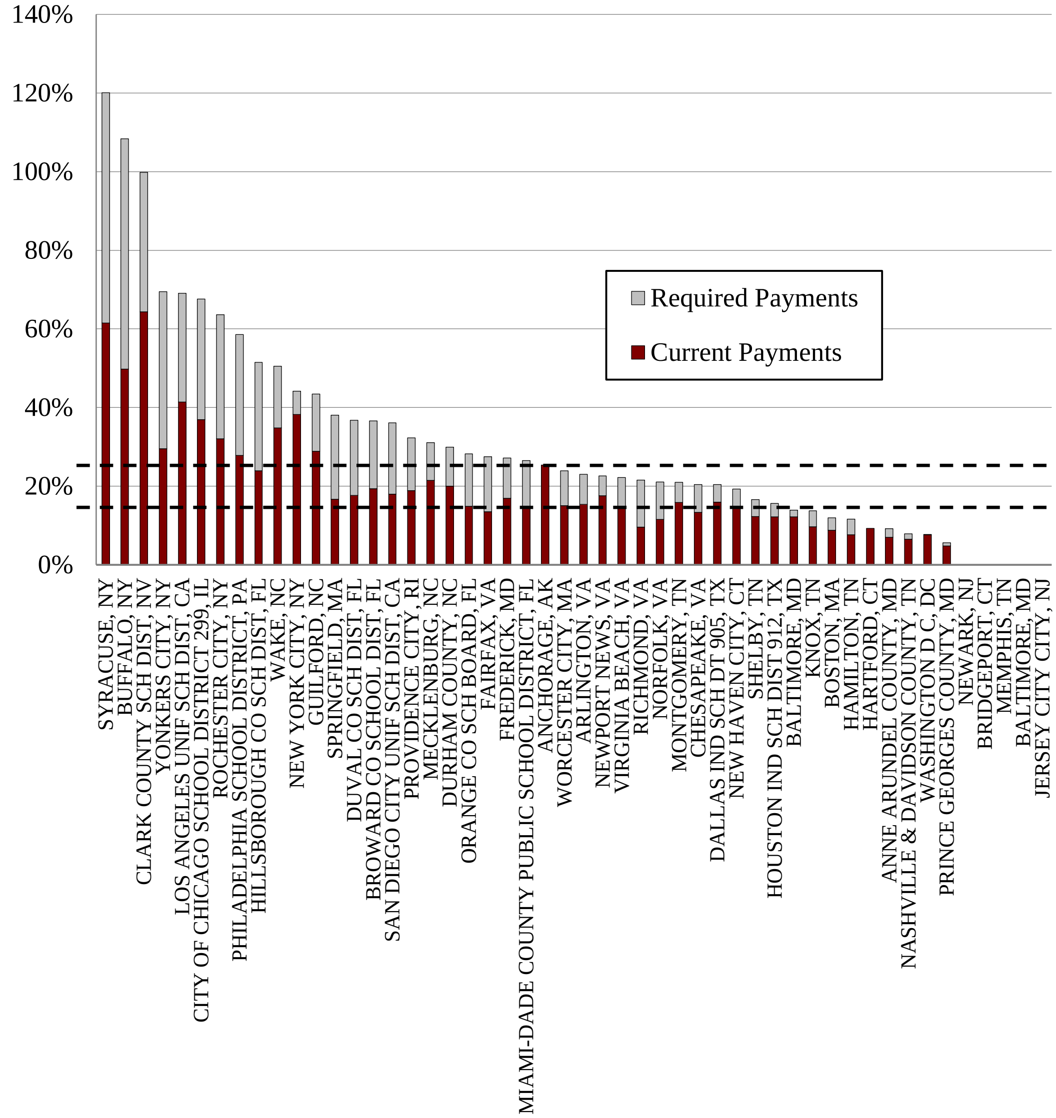
Source: Authors' calculations based on various FY 2014 plan and government financial reports and actuarial valuations; and U.S. Census Bureau (2014).

Figure 17. *Large School Districts: Current and Required OPEB Payments as a Percentage of Own-Source Revenue, 2014*



Source: Authors' calculations based on various FY 2014 plan and government financial reports and actuarial valuations; and U.S. Census Bureau (2014).

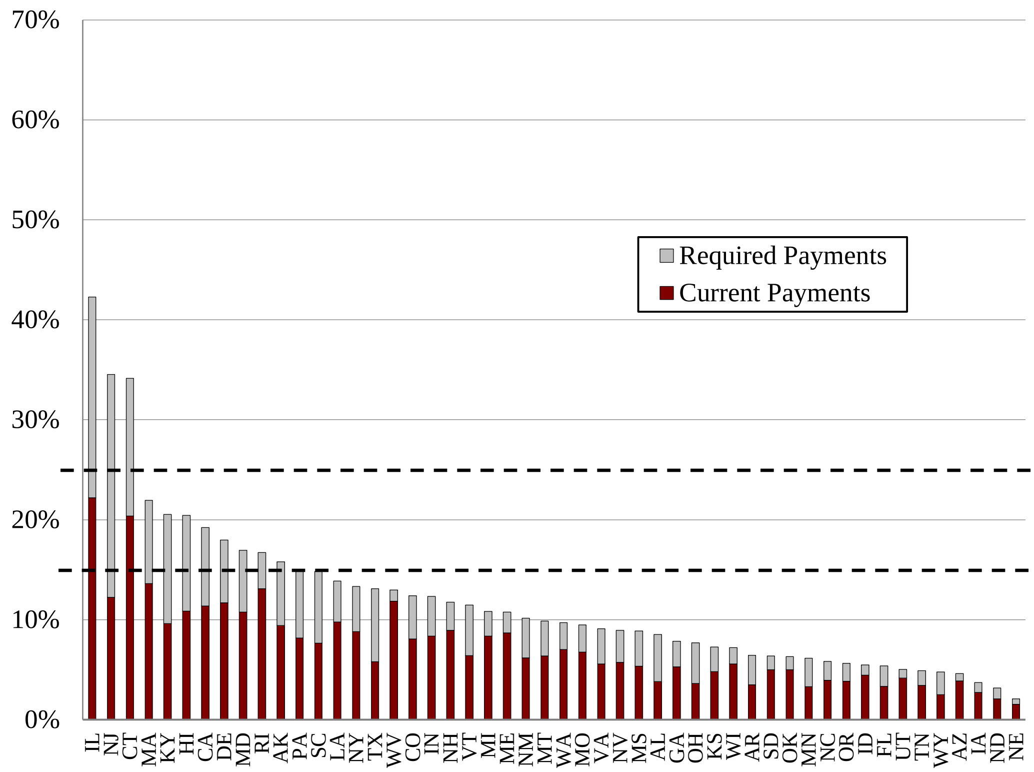
Figure 18. *Large School Districts: Current and Required Pension, OPEB, and Interest Payments as a Percentage of Own-Source Revenue, 2014*



Source: Authors' calculations based on various FY 2014 plan and government financial reports and actuarial valuations; and U.S. Census Bureau (2014).

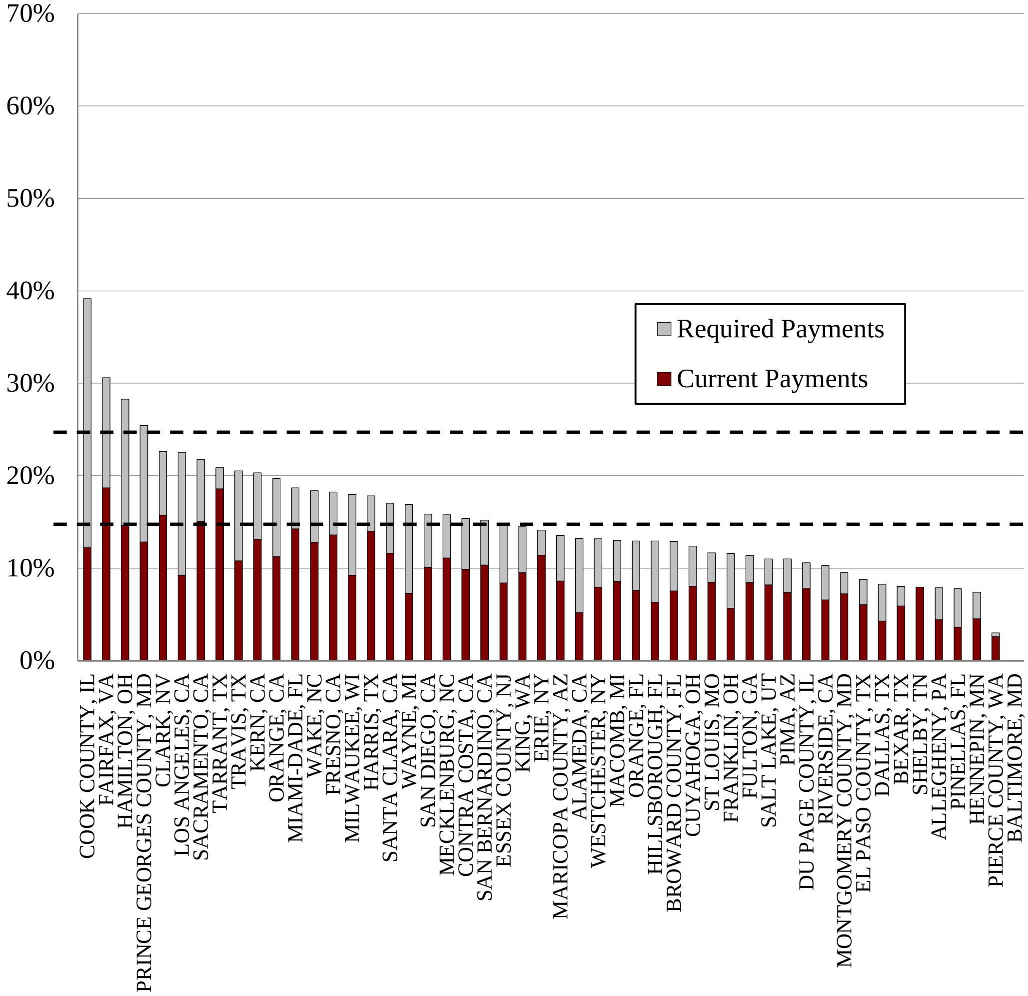
Appendix B

Figure 19. *States: Current and Required Pension, OPEB, and Interest Payments as a Percentage of Net Revenue, 2014*



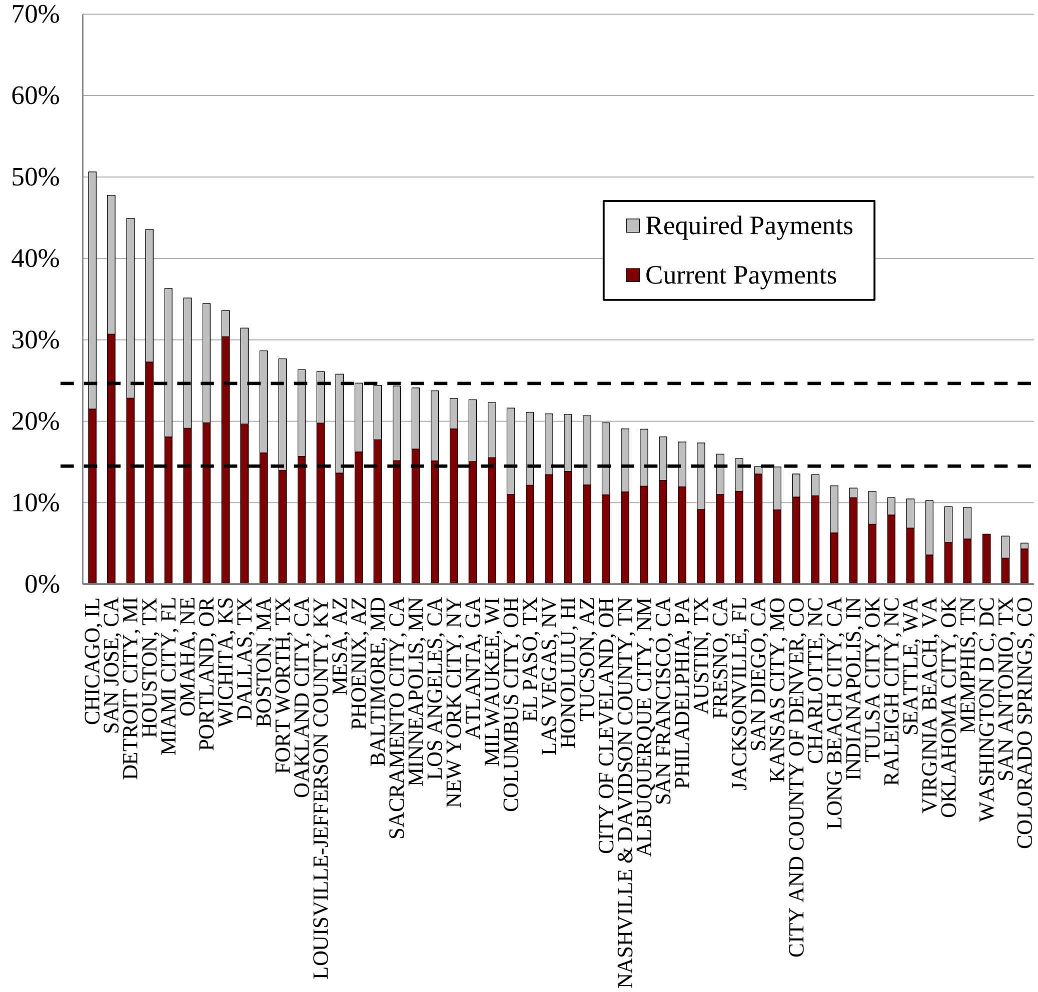
Source: Authors' calculations based on various FY 2014 plan and government financial reports and actuarial valuations; and U.S. Census Bureau (2014).

Figure 20. *Large Counties: Current and Required Pension, OPEB, and Interest Payments as a Percentage of Net Revenue, 2014*



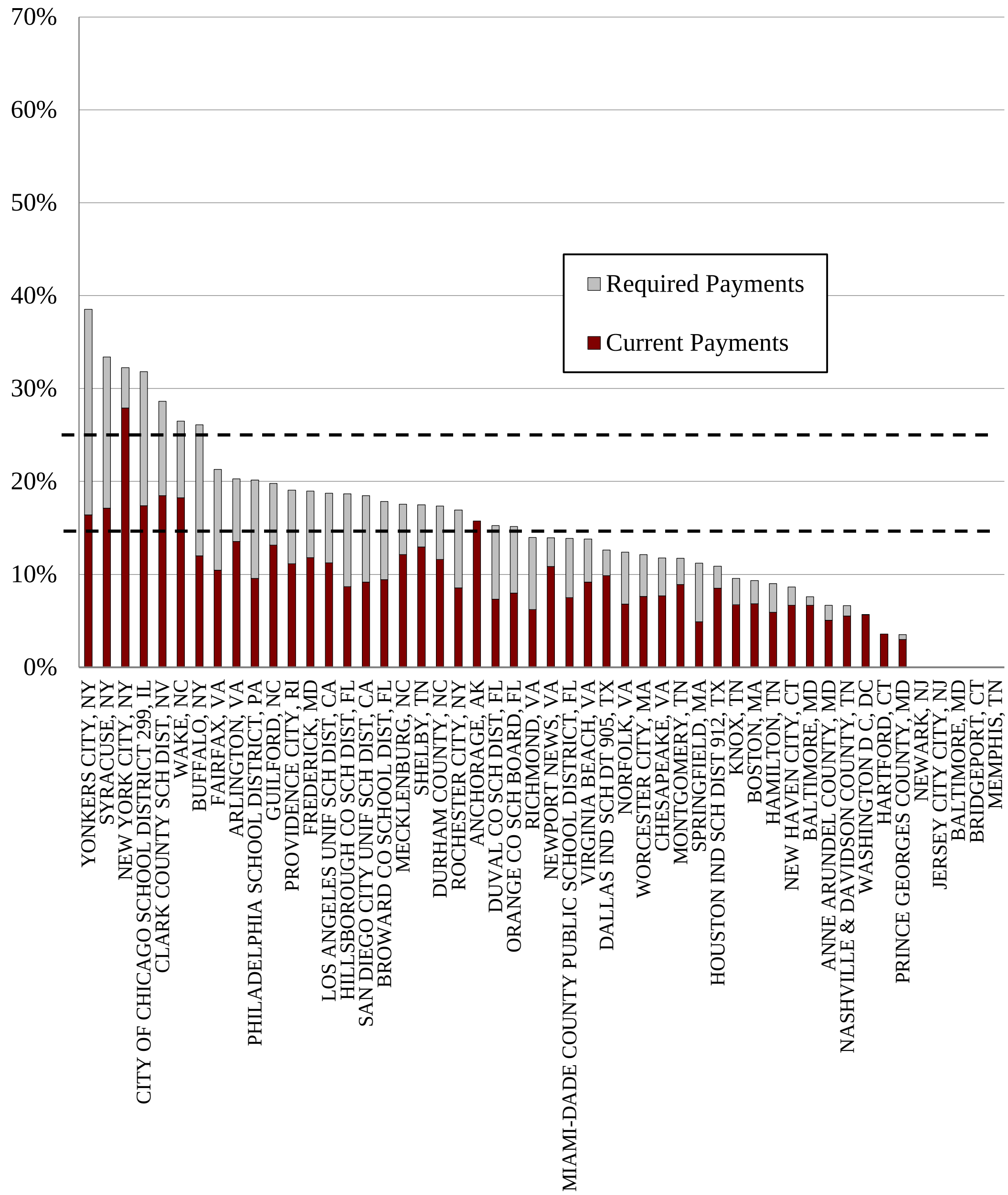
Source: Authors' calculations based on various FY 2014 plan and government financial reports and actuarial valuations; and U.S. Census Bureau (2014).

Figure 21. *Large Cities: Current and Required Pension, OPEB, and Interest Payments as a Percentage of Net Revenue, 2014*



Source: Authors' calculations based on various FY 2014 plan and government financial reports and actuarial valuations; and U.S. Census Bureau (2014).

Figure 22. *Large School Districts: Current and Required Pension, OPEB, and Interest Payments as a Percentage of Net Revenue, 2014*



Source: Authors' calculations based on various FY 2014 plan and government financial reports and actuarial valuations; and U.S. Census Bureau (2014).