Municipal Finance and Labor Mobility*

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Preliminary. Comments welcome.

Abstract

We examines how labor mobility influences municipal financing decisions, particularly the balance between debt and taxation. Using Annual Comprehensive Financial Reports from the 1,200 largest U.S. cities spanning 2008-2021, we find that net labor in-migration leads municipalities to increase tax rates while reducing debt reliance. We develop a theoretical model demonstrating that the tax elasticity of labor mobility critically determines financing choices. When mobility is highly tax-sensitive, municipalities favor debt financing to avoid tax-induced out-migration. When mobility is less elastic, municipalities can rely more on taxation. Two competing mechanisms emerge: labor influx increases service demand, raising fiscal pressures, while simultaneously expanding the tax base and enhancing revenue capacity. When tax elasticity is inelastic, the tax base expansion effect dominates, resulting in net debt reduction. These findings illuminate how municipalities strategically adapt their financing mix based on labor mobility patterns.

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"*This is a defining moment in American history. It's about the future of the middle class in this country.*"

Janesville: An American Story, Amy Goldstein (2017)

"*In the meantime, Janesville turns out once again to be a metaphor — this time for a moment when jobs have become plentiful. Yet the centrepiece of the town's industrial identity for nearly a century remains vacant and scarred.*"

Return to Janesville — life after manufacturing in America's heartland, Amy Goldstein (2024)

1 Introduction

Mobility—the ease with which residents can relocate—is a defining feature of municipal finance that sets it apart from national-level public finance (Glaeser, 2013). While much of the literature focuses on public debt policy frameworks at national and subnational levels, Barro (1979) underscores the importance of migration for local jurisdictions. As he notes, his model "neglects any effects of public debt policy on migration, which would be an important consideration for a local government" (p. 941).

Migration refers to the spatial reallocation of individuals driven by factors such as municipal services, social networks, amenities, and economic opportunities. Labor mobility, a subset of migration, focuses on the geographic movement of human capital in response to economic incentives. Our analysis centers on labor mobility to isolate the economic drivers of residential choices, particularly employment opportunities and municipal services, while abstracting from other migration factors. We examine how labor mobility shapes municipal financial decisions—the trade-off between debt and taxation—and how municipalities adjust these financing options while accounting for residents' potential responses to changing economic conditions.

To achieve our research objectives, we construct a dataset comprising annual financial data from the largest 1,200 U.S. cities, thereby ensuring a diverse and representative sample for our analysis. Utilizing comprehensive data from 2008 to 2021, we investigate how labor migration shapes municipal decisions between debt and taxation. Our analysis reveals a clear pattern: declines in local working-age population lead municipalities to lower tax rates and increase debt financing, while a working-age-population increase results in higher tax rates and reduced reliance on debt. Specifically, our estimates indicate that a 1% increase in municipal working-age population is associated with a 0.9% reduction in leverage and a 0.7% increase in property tax rates, with elasticities of -0.9 and 0.7, respectively. These results are further strengthened by using China's accession to the WTO as an exogenous shock to the local labor market, with the estimated elasticities inceasing to -4 and 1.9. Our study examines the long-term economic impact, providing robust evidence that labor mobility significantly influence municipal financing decisions. This relationship is particularly salient in light of Autor et al. (2021)'s findings that increased Chinese import competition led to persistent negative impacts on manufacturing employment.

To understand how municipalities respond to labor mobility and derive policy implications, we develop a tractable model of municipal decision-making. The model features a municipality that provides public services and transfer payments to its residents. Residents make migration decisions based on a bundle of local amenities, including public service, tax rates, and local economic conditions. Each period, after observing economic shocks, the municipality faces a budget constraint that covers debt service, operating expenses, and infrastructure investment.

The municipality finances these expenditures through a combination of tax revenue, service fees, and debt issuance, with fiscal emergency declaration serving as a costly last resort. The financing decision faces two key frictions: while municipal debt is risk-free, the municipality faces borrowing constraints; additionally, tax policy adjustments incur implementation costs, discouraging frequent and aggressive changes to local tax rates. This framework captures the fundamental trade-offs in municipal financial management: balancing budget requirements against labor mobility while managing financing frictions.[1]

Our model highlights the crucial role of labor mobility in shaping municipalities' optimal financing decisions. In particular, the choice between debt and taxes depends significantly on the tax elasticity of labor mobility. When this elasticity is high (elastic) or equal to one (unit elastic), it is more effective to issue debt, within permissible limits, rather than to raise tax rates to cover expenditures. This strategy allows municipalities to improve the availability of public services without placing a heavy tax burden on residents or risking out-migration. On the other hand, when the tax elasticity of labor mobility is low (inelastic), raising tax rates becomes a feasible way to meet funding needs, allowing the municipality to increase overall tax revenue and maintain essential services without placing excessive reliance on debt.

To validate our model, we estimate its parameters by aligning them with key characteristics of municipal-level data from 2008 to 2021. Contrary to the conventional view that labor mobility is highly sensitive to tax changes, our findings reveal an inelastic tax elasticity of labor mobility, which fundamentally shifts the financing strategies municipalities should consider. Unlike previous studies (e.g., Carlson et al., 2024), our results suggest that this low tax elasticity makes raising tax rates an effective strategy for funding municipal expenditures without prompting significant outmigration and loss of labor force.

We use our estimated model to explore how municipalities adjust their financing strategies in response to a persistent positive economic shock. This shock boosts labor demand and attracts labor in-migration. The effect of labor in-migration on municipal leverage operates through several

[1]As a robustness check, we modify our model by replacing the bond borrowing collateral constraint with a defaultable bond. This modification leaves the main results of the model intact.

interconnected channels. First, as in-migration rises, the tax base expands, leading to higher tax revenues and lower reliance on debt financing. This revenue channel implies a negative relationship between labor in-migration and municipal leverage.

However, labor in-migration simultaneously increases demand for infrastructure and public services. Meeting these expenditure needs requires substantial municipal capital investment and recurring maintenance expenditures for transportation networks, utilities, and public amenities. This expenditure channel creates upward pressure on both leverage and tax rates. Moreover, the expanded infrastructure stock relaxes borrowing constraints. This credit channel lead to greater debt capacity.

The net effect of labor in-migration on municipal leverage thus hinges on the relative strength of these channels. Our quantitative analysis reveals that when the tax-elasticity of mobility is low, tax base expansion outpaces debt demand growth, indicating that the revenue channel dominates the expenditure and credit channels. As a result, leverage declines. These findings align with our empirical results, offering further validation for the model.

Next, we investigate the quantitative role of labor mobility in shaping municipal financing decisions and fiscal health. To this end, we compare our benchmark model to an alternative version where labor mobility is completely restricted, with the population elasticity with respect to economic conditions, infrastructure services, and taxes is set to zero, eliminating any incentive for labor to relocate. We then "turn on" each elasticity one at a time to assess its individual impact. This stepwise approach allows us to isolate the influence of each factor on labor mobility and municipal decision-making. Our findings reveal that labor mobility is a key determinant of municipal financial strategies and its financial stability.

Specifically, positive infrastructure elasticity encourages investment by increasing the returns to public capital, while negative tax elasticity raises the cost of taxation, deterring reliance on tax hikes especially during downturns. Economic-condition elasticity amplifies these effects by making migration more sensitive to local economic fluctuations. In the case of perfect immobility, municipalities can raise taxes without triggering out-migration or shrinking their tax base. At the same time, with infrastructure investment no longer able to attract new residents, public investment declines, operating costs fall, and debt capacity contracts. As a result, municipalities run smaller fiscal deficits and rely more on taxation than borrowing. Among these factors, tax elasticity has the greatest influence, as the tax-elasticity-only model most closely replicates the fiscal dynamics of the full baseline scenario.

We then use the validated model to explore policy implications through a series of counterfactual experiments, assessing whether cities like Detroit and Janesville could have achieved better fiscal outcomes by following the model's recommended strategies. For Detroit, the model indicates that an early fiscal emergency declaration, paired with essential infrastructure investment to retain residents, have substantially reduced debt accumulation and potentially averted bankruptcy. In

Janesville's case, the model implication closely resembles the city's actual fiscal management. The 2011 property revaluation, which lowered tax rates without reducing revenue, reflects the model's emphasis on early proactive adjustments to stabilize finances. Together, these cases demonstrate the critical role of timely fiscal interventions, strategic capital investments, and balanced debt and tax financing in strengthening municipal fiscal resilience.

Finally, we test the model's mechanism by examining how the relationship between labor migration, tax policy, and debt reliance varies with workforce mobility. Grouping cities by their degree of labor mobility, we find that the documented relationship is stronger in cities with low mobility and weaker where workers are more mobile. This pattern provides suggestive evidence that labor mobility is a key channel influencing municipal financing decisions, as predicted by the model.

Our paper makes contributions to several strands of the literature, the first of which is public finance regarding debt and taxation in funding expenditures. At the federal level, Barro (1974) establishes the Ricardian equivalence proposition, which argues that agents' consumption decisions remain unchanged regardless of whether the government finances its spending through debt or taxes, effectively rendering the two instruments equivalent. Barro (1979) introduces tax-smoothing theory, which suggests that deficits are managed to stabilize tax rates over time, leading to increased debt issuance during temporary spikes in government spending. More recently, Jiang et al. (2022) extends this by incorporating default options, examining an optimal blend of tax and borrowing policies influenced by primary deficits, interest payments, GDP growth, and hedging costs.

At the municipal level, labor migration responses are crucial in shaping choices between debt and taxation. Carlson et al. (2024) focus on municipalities' capital structure, specifically the debt-to-investment ratio, under the assumption that population is highly tax elastic. Their framework views taxes as a burden and suggests that debt serves as a mechanism to smooth this burden across time and states of the economy. While our model shares Carlson et al. (2024)'s insight about incorporating migration responses to municipal tax policies, we extend their theoretical framework along three dimensions. First, we remove the disutility of taxation from the municipality's objective function and instead introduce bidirectional transfers: emergency transfers from residents to municipalities and positive transfers in the reverse direction. This reframes the benefit of debt from tax smoothing to managing costly emergency transfers or enabling welfare-enhancing payments to residents. Second, we replace the disutility of taxation with explicit tax adjustment costs in the model, capturing the frictions associated with tax changes. As a result, the optimal tax policy balances the fiscal benefits of higher revenue against both the utility losses from out-migration and the costs of adjusting tax rates. Third, whereas Carlson et al. (2024) emphasize the static tradeoff between debt and taxes, our model sheds light on the dynamic tradeoff and adjustments between debt and tax in public financing decisions.

Our paper also adds to the growing literature on municipal finance. Theoretically, Myers (2022) models how municipalities manage spending, borrowing, and pensions, showing that some California cities took on greater financial risks after the financial crisis to cover pension shortfalls. Unlike his framework, which assumes governments prioritize service provision and accept household transfers without considering the households' loss of consumption, our model incorporates significant costs associated with declaring fiscal emergencies, promoting more cautious financial decision-making. Gordon and Guerron-Quintana (2021) argue that in-migration leads to excessive debt accumulation, based on the assumption that planners value only current residents. Our model relaxes this assumption by accounting for more rapid labor migration, where both current and incoming residents benefit from public infrastructure in the current period.

Empirically, the recent research literature has shifted its focus towards local municipalities, such as cities and large city-equivalent entities like towns, villages, and boroughs. This is motivated by the relative ease of understanding municipal financial decision-making process, as compared to state or county governments, which often have more complex revenue and expenditure structures.[2] Ahern (2021) examines 39 large cities from 2003 to 2018 and finds that city expenditures grow rapidly with population, while revenue is more income-dependent, creating potential financial strain for smaller, lower-income cities. Giesecke et al. (2024), using a sample of 622 local governments, report that over 60% of U.S. municipalities hold negative net positions, primarily driven by the accumulation of unfunded pension and other post-employment benefit (OPEB) liabilities. These legacy obligations have contributed to wider credit spreads in the municipal bond market. Janas (2024), analyzing data from the 1920s and 1930s, finds that high-debt cities cut public services and lost skilled workers during the Great Depression as they reallocated budgets toward debt repayment, spurring household out-migration. Our study leverages a comprehensive dataset of the 1,200 largest U.S. municipalities from 2008 to 2021. This rich dataset enables us to document both financial and real behaviors of local governments. We embed these empirical patterns in a theoretical framework to understand how municipalities optimize their debt and tax policies in response to economic shocks.

Finally, we contribute to the expanding literature on the impact of trade shocks on financial outcomes. Prior research shows that increased import competition affects various aspects of firm behavior and financial performance: firms face higher borrowing costs (Valta, 2012), adjust their leverage (Xu, 2012), reduce capital expenditures (Frésard and Valta, 2016), cut domestic employment while increasing outsourcing (Pierce and Schott, 2016), and alter their innovation strategies (Hombert

[2]Municipalities, such as cities, rely on a diversified set of revenue sources, including property taxes, sales taxes, user fees, and other local revenues. Property taxes tend to be a significant component, but are supplemented by revenue from various economic activities. In contrast, counties have a more limited set of revenue options, often heavily dependent on property taxes, especially in rural areas with constrained economic activity and sales tax potential. Municipal governments primarily focus on providing essential local services, including public safety, utilities infrastructure, and community amenities. In contrast, county governments typically administer broader regional services, including public health programs, social welfare systems, and judicial operations.

and Matray, 2018). Beyond firms, trade shocks also influence household financial decisions, as seen in shifts in household debt (Barrot et al., 2022). Despite this extensive body of work, little attention has been paid to the effects of international trade shocks on municipal finance either theoretically or empirically. Feler and Senses (2017) highlight how trade shocks disrupt local economies by altering public goods provision. We complement their work and exploit trade-induced labor demand shocks to examine how municipalities adjust their financing strategies, specifically the balance between debt issuance and tax policy.

2 Data

We aggregate and combine datasets to construct compendious municipal information covering detailed city-level financials, characteristics, yields, ratings, and locations for municipal bond offerings and city-level (or county-wide, if city-level unavailable) economic and socioeconomic data across measures such as finance, demography, housing, tax rates, and other information.

2.1 City-level Financials

The primary data source for this study is the *Annual Comprehensive Financial Report (ACFR)*, previously known as the *Comprehensive Annual Financial Report (CAFR)*. ACFRs are mandatory annual reports prepared by state and local governments in the United States, serving as the equivalent of audited financial statements for businesses. These reports are typically compiled by the government's finance department and reviewed by independent auditors. Like an annual report published by publicly traded companies, the ACFR provides a detailed overview of the government's financial statements and performance for the fiscal year. Its purpose is to present the overall financial health and position of the governmental entity and to provide transparency to taxpayers and potential investors by disclosing all relevant financial activities and metrics.

The ACFR's financial section contains audited basic financial statements, including the statement of activities, statement of revenues, expenditures, and changes in fund balance, statement of cash flows, and statement of changes in fiduciary net position. These components collectively offer a comprehensive view of the government's financial status and operations.[3,4]

[3]The Appendix Section A.1 feature excerpts from key sections of the City of Auburn, Alabama's 2021 ACFR for the fiscal year ended September 30, 2021, to illustrate the type of information contained in a sample government ACFR. To facilitate understanding of governmental accounting, particularly for readers unfamiliar with municipal financial statements, we provide an illustrative example of hypothetical city financial statements with detailed explanatory notes using Claude: https://claude.ai/share/bb0ad1d8-50cf-49c0-847e-2a23af2ee8c1.

[4]We chose not to use the *Annual Survey of State and Local Government Finances (ASSLGF)* for several reasons. First, as documented by Ahern (2021) and confirmed by our analysis, there are numerous discrepancies between figures reported in ACFRs and ASSLGF for unexplained reasons. Second, ASSLGF lacks critical financial details for local

While Annual Comprehensive Financial Reports (ACFRs) are technically public documents, extracting usable data from their PDF format can be time-consuming and challenging. Our study uses data from *MuniCREDIT Financials* by DPC DATA, which compiles ACFR files for local governments subject to Municipal Securities Rulemaking Board (MSRB) regulations. Rating agencies such as *Moody's*, *Standard & Poor's (S&P)*, and *Bloomberg* also curate similar ACFR data.

DPC DATA enhances this information with municipality *Continuing Disclosure Agreement (CDA)* data. CDA requires municipal securities issuers to regularly provide updates to the MSRB about their securities. Although MuniCREDIT Financials offers extensive ACFR coverage, their data is limited to post-2018. To overcome this shortcoming, we commissioned DPC DATA to expand the dataset back to 2008. However, extending historical data can be resource-intensive. Therefore, we focused on the 1,200 most populous municipalities identified by the 2000 U.S. Census population survey. Obtaining ACFRs before 2008 typically requires manual efforts due to their limited availability through MRBS or other readily accessible sources (for example, the city's finance departments, the city's auditor office, or the local libraries). In addition, we supplement the DPC data by manually collecting information on capital expenditure and depreciation. Capital expenditure is identified from the "Capital Outlay" item listed under expenditures in the *Statement of Revenues, Expenditures, and Changes in Fund Balances of Governmental Funds*. We manually obtain depreciation data from the Reconciliation section of the *Statement of Revenues, Expenditures, and Changes in Fund Balances of Governmental Funds to the Statement of Activities*, whenever this information is available.

Of the 1,200 municipalities in our sample, we are not able to obtain GAAP financial statements, with this issue primarily concentrated in cities from New Jersey, Arkansas, Indiana, Iowa, and Nebraska because they use alternative accounting standards, typically cash-based rather than accrual-based. Our final sample comprises 1,056 municipalities distributed across the continental United States.

[Figure 1 about here.]

As depicted in Figure 1, our sample covers major cities such as New York (NY), Los Angeles (CA), Chicago (IL), Houston (TX), Philadelphia (PA), Phoenix (AZ), and San Diego (CA). It also includes medium-sized cities like Niagara Falls (NY), Johnson (TN), Logan (UT), Flagstaff (AZ), and Cupertino (CA), as well as smaller cities such as New Milford town (CT), Highland Park (IL), Lexington town (MA), Menlo Park (CA), and Inkster (MI). This diverse representation indicates the relatively comprehensive coverage of our sample, spanning various sizes and geographies across the United States.

governments, including revenue streams, debt obligations, and asset holdings. Key liquidity metrics (e.g., cash flow, working capital), solvency indicators, and capital asset management information (e.g., fixed assets, depreciation, capital plans) are absent. In addition, long-term liabilities such as pensions and OPEB are excluded, and specific tax millage rate data is unavailable.

We provide more detailed information in Table 1, including the number of cities covered from each state, along with the population sizes of both the smallest and largest cities within each state. This table demonstrates the representativeness of our coverage across different states, highlighting the diversity and distribution of municipalities included in our analysis.

[Table 1 about here.]

2.2 Auxiliary Data

We supplement our primary dataset with additional sources: (1) the US Census American Community Survey (ACS) for annual city-level working-age population trends, (2) the US Census Decennial Census for population growth and sample selection from 2008 to 2021, (3) Zillow's county-level single-family housing index, used as a control variable in our analysis due to its broader coverage compared to city-level data, and (4) the LSEG/Refinitiv database and Electronic Municipal Market Access (EMMA) database for information on city municipal bonds.

3 Empirical Facts

3.1 Overview of Municipalities

The section provides valuable insights into various critical aspects of local governments, including their fiscal health, revenue composition, capital investment, and debt financing behaviors. Results are reported in Table 2.

[Table 2 about here.]

Our analysis begins with an examination of local municipalities' operating surplus (or deficit) ratio, a key indicator of fiscal health that assesses whether a municipality's revenues sufficiently cover its operational expenses. This ratio is calculated by expressing the difference between total revenues and total expenditures as a proportion of total revenue. Our findings reveal an average operating surplus ratio of 0.04, indicating that, on average, municipalities maintain a modest operating surplus. However, the prevalence of fiscal deficits among local governments is noteworthy. The deficit indicator variable, with a mean value of 0.33, suggests that approximately one-third of the local governmental entities in our sample operate under deficit conditions during the analysis period.

Our analysis reveals a mean capital-to-total assets ratio of 67%, where capital stock is defined as total capital assets from government activities, net of accumulated depreciation. This figure suggests a significant allocation of resources—approximately two-thirds—towards capital formation, primarily manifesting in local infrastructure development. Furthermore, the average cash and short-term financial investment ratio of 20% highlights the prudent liquidity management practiced by municipalities to mitigate potential financial strains. On the liability side, gross direct debt, including municipal bonds, loans, leases, notes, or other forms of long-term borrowing, accounts for 30% of total assets, while total liability constitutes 54% of total assets on average. However, total liabilities may have been understated in earlier years, especially before 2015, due to incomplete reporting of pension and other post-employment benefits (OPEB). The pension and OPEB constitute a significant share of the city's liabilities. Specifically, the ratio of (assets minus liabilities excluding pension and OPEB) to assets has a median of 72% and a mean of 67%. When pension and OPEB liabilities are included, the median drops to 58% and the mean to 46%. Following 2015, both the pension-to-assets and OPEB-to-assets ratios surged to 27% and 21%, respectively, and have remained relatively stable since then.

On the revenue front, taxes are the primary source for municipalities, accounting for an average of 67% of total revenue. In addition to taxes, municipalities also generate income through service fees, evidenced by an average service charge-to-total revenue ratio of 23%. This indicates that municipalities are successfully leveraging their capital assets to create additional revenue streams. Property tax plays a critical role in municipal finance, with an average millage rate of 1.67%. Municipalities adjust their property tax rates frequently, with an average adjustment frequency of 55% within municipalities over the sample period. Furthermore, there is a strong commitment to capital investment, with an average capital investment rate of 7% and a relatively low within-municipality standard deviation of 0.03. The average capital depreciation rate is 5%, which is significantly lower than the typical rates observed in the corporate sector. For U.S. non-financial public firms, the average capital depreciation rate between 2008 and 2021 was 17.8%.

Lastly, we turn to debt issuance information, revealing a significant lumpiness in debt issuance, with a median issuance amount of zero. However, when debt is issued, it tends to be substantial, with the largest issuance amounting to 4.49 times the tax revenue or 2.3 times the total revenue.

Compared to U.S. nonfinancial and nonutility public firms, municipalities exhibit both differences and similarities. The distinct objectives and nature of local governments versus the corporate sector lead to varying behaviors. Local governments prioritize balanced budgets, contrasting with corporations' pursuit of profits. As such, local governments tend to have lower surplus-to-total revenue ratios and are more prone to running deficits.

Another distinction arises from the absence of different investment categories, such as intangible assets and M&A, in local government operations. This leads to a heavier reliance on physical capital, resulting in higher capital-to-assets ratios compared to corporate entities. Moreover, while local governments collect taxes, corporations pay taxes. This divergence contributes to local governments' lower capital depreciation rates and their reliance on tax income as the primary revenue source.

In terms of debt issuance, municipalities display distinct characteristics, including lower frequency, higher lumpiness, and greater volatility compared to the corporate sector. One possible explanation is that municipalities are subject to different regulatory frameworks and constraints compared to corporations.

On the other hand, both local governments and public firms are concerned about adverse economic situations. As a result, they both opt to accumulate cash reserves, leading to similar cash-to-assets ratios. This shared concern for economic uncertainty suggests the importance of liquidity management for both types of entities.

Building on the cross-sectional distribution of municipal financials, we examine how these key indicators evolve over time. We focus on critical variables previously outlined in Table 2: the government operating surplus ratio, capital-to-assets ratio, cash-to-assets ratio, debt-to-assets ratio, tax revenue as a share of total revenue, investment rate, depreciation rate, and working-age population growth. Figure 2 presents the temporal trends in these variables, offering a clearer view of how municipal fiscal conditions have shifted over the years.

[Figure 2 about here.]

The government operating surplus ratio, a measure of short-term financial strength, demonstrated overall improvement throughout the sample period. In particular, the lower quartile (25^{th} percentile) of this ratio turned positive by the end of the observation period, suggesting that even fiscally weaker municipalities experienced gains in their short-term financial position.

Capital stock's proportion of total assets rises at first, then declines. Cash and short-term investments do the opposite—decreasing initially before recovering. Debt shows a continuous downward trend. Tax income's share of total revenue grows steadily, suggesting increased dependence on tax-based funding. The capital investment rate dips and then climbs, forming a U-shape, while the depreciation rate stays mostly constant. These changes generally happen slowly, without abrupt shifts, pointing to a gradual evolution in municipal financial practices.

Similarly, the growth rate of the working-age population steadily declined over time, with an increasing number of municipalities experiencing negative growth.[5] This subdued trend persisted through 2019, signaling a prolonged period of labor force stagnation across municipalities during much of the post-recession recovery. In 2021, the distribution of growth rates widened, with both the median and upper tail rising. This pattern suggests that while many municipalities continued to face sluggish demographic trends, a subset experienced accelerated growth, potentially driven by pandemic-era migration shifts.

3.2 Labor Migration and Municipal Finance

Once a bustling hub of automotive manufacturing, Janesville faced significant employment challenges when General Motors closed its plant in 2008. This closure led to substantial job losses, shrinking

[5]Note that working-age population data from the US Census American Community Survey (ACS) begins in 2010, so growth rates are calculated from that year onward.

the tax base and intensifying pressure on municipal revenues. In response, Janesville explored various financing strategies, ultimately managing to stabilize its budget and invest in initiatives aimed at economic revitalization.[6]

With this context in mind, we now turn our attention to how municipalities adapt to local labor migration. Specifically, we will investigate how changes in working-age population influence municipalities' choices between debt financing and taxation. Understanding these responses provides valuable insights into the strategies municipalities employ as they manage changing economic conditions, revealing the interplay between local labor migration and fiscal decision-making.

3.2.1 Baseline Estimation

To explore this, we analyze the impact of changes in local working-age population on leverage adjustments over the past decade, from 2011 to 2020. We adopt a first-difference specification, where the constant term and any time-invariant traits at the municipal or county level that could influence the leverage ratio are differenced out. The regression specification we consider is as follows:

$$\Delta \text{leverage ratio}_{i,t} = \beta_1 \Delta \ln \text{working-age population}_{i,t-1} + \beta_2' \Delta X_{i,t-1} + \Delta \epsilon_{i,t}, \tag{1}$$

where Δleverage ratio$_{i,t}$ represents the change in municipality i's leverage ratio between years t (year 2020) and $t-9$ (year 2011). This leverage ratio is calculated as the municipality's debt balance divided by its total personal income. The numerator, or debt balance, represents the gross direct debt, which includes the total amount incurred by the municipality through direct borrowing. The denominator, total personal income, is estimated by multiplying the city-level population by the average income per capita. Due to the unavailability of city-specific income data, we use county-level income per capita as a proxy for the city-level figure.

Unlike traditional metrics such as debt per capita or the debt-to-revenue ratio commonly used in the literature (Gordon and Guerron-Quintana, 2021; Myers, 2022), our leverage ratio—similar to the debt-to-GDP ratio in national analyses—provides a more panoramic view of a municipality's fiscal health. Debt sustainability hinges on the local government's capacity to repay, which is closely tied to its economic conditions. Higher household income signifies a larger tax base and greater economic activity, enabling the municipality to generate the revenue necessary for debt servicing.

[6] The composition and scale of the municipal tax base have evolved significantly. In 2008, the top taxpayers, with a combined assessed value of $135.9 billion, included major industrial firms such as North American Truck Group (a Division of General Motors Corp.), Seneca Foods Corporation, and Lab Safety Supply (a Division of W.W. Grainger), alongside retail entities like Janesville Mall and Blain Supply (Farm & Fleet). By 2021, the tax base had shifted considerably, reaching $185.7 billion in total assessed value, with healthcare providers (Mercy Health System Corp., Dean/St Mary's/Riverview), retail operations (Dollar General distribution center, Blain Supply Inc.), and real estate developers (Oak Park Properties of Janesville LLC) emerging as the leading taxpayers.

Thus, the debt-to-personal income ratio serves as a valuable indicator of whether a municipality's debt level is manageable relative to its economic size.

The key independent variable, $\Delta \ln \text{working-age population}_{i,t-1}$, represents the change in municipal log working-age population between year $t-1$ (year 2019) and year $t-10$ (year 2010). In addition, we control for other changes in municipal characteristics, denoted as $\Delta X_{i,t-1}$, that may influence leverage as well. Drawing from the corporate finance literature, we incorporate several factors, including financial health (measured by operating surplus or deficit as a share of total revenue), asset tangibility (measured as the proportion of physical assets to total assets), liquidity (proxied by the cash-to-total assets ratio), municipal size (measured by the assessed value of all taxable property within the municipality), and growth opportunities (proxied by total factor productivity, or TFP).[7]

We also account for the potential impact of the 2008 Great Recession on changes in municipal finance during the 2010s. Xu et al. (2023) noted that the results presented in Autor et al. (2013) could be biased due to the omission of controls for contemporaneous changes in housing prices. To address this concern, we incorporate the lagged ten-year change in county-level median property prices as a control variable into our model. We source this data from Zillow, using it as a proxy for the recession's effects. To ensure comparability across time periods, all nominal variables are adjusted using the GDP deflator from the Federal Reserve Bank of St. Louis.

Tables 3 summarizes key variables used in our regressions. In the years following the financial crisis until the early 2020s, municipalities underwent significant financial and economic shifts. On average, leverage ratios, capital-to-assets ratios, and tariffs on Chinese imports declined, while working-age population, fiscal health, liquidity, and the scale of municipal operations improved. The housing market also showed strong recovery. Following tariff reductions on Chinese imports, the volume of imports from China increased. Municipalities saw a modest increase in millage rates and a slight decline in borrowing costs.[8]. This pattern suggests evolving municipal finances, marked by reduced leverage, enhanced fiscal health, and economic recovery through a growing working-age population and a stronger housing market.

[Table 3 about here.]

Our sample also reveals significant cross-sectional variation, as demonstrated by the standard deviations, and the range between the minimum and maximum values for each variable. These

[7]Due to the lack of city-level data required for TFP estimation, we use county-level TFP instead. Detailed information on the estimation process is provided in the model calibration section 5.1.

[8]City borrowing costs are estimated by regressing bond offering yields minus corresponding maturity-matched Treasury yields on comprehensive bond characteristics: callable, pre-refunded, bank-qualified, general obligation, insured bond, negotiated offering, rated bond, and investment-grade indicators; bond size; numeric credit rating; time to maturity; plus state, county, and year-month fixed effects. The regression residual provides our characteristics-adjusted borrowing cost measure for both general obligation and revenue bonds. Given infrequent municipal debt issuance and sparse yield data, missing values are imputed using each municipality's most recent bond yield.

variations highlight the disparate financial situations municipalities faced during this decade, emphasizing the importance of our controls in capturing the nuanced responses of different local governments. Overall, the summary statistics suggest that while general trends are evident, the specific experiences of municipalities varied considerably, providing a rich dataset to explore the drivers of leverage adjustments.

Table 4 report our regression estimates. In column (1), we regress ten-year changes in the leverage ratio solely on the lagged ten-year changes in working-age population. In column (2), we include additional determinants. Our analysis relies on cross-sectional variations in working-age population growth across municipalities. The estimates in column (2) reveal a statistically significant relationship between labor migration and leverage, with a reduction in working-age population leading to an increase in the leverage ratio. Specifically, a 1% decrease in working-age population is associated with a 0.020 percentage point rise in the leverage ratio, representing 0.9% of the sample's average leverage ratio. This corresponds to an elasticity of -0.9, highlighting the economic significance of the effect.

[Table 4 about here.]

Municipalities' borrowing decisions are also shaped by their borrowing costs. To account for this, we include a characteristics-adjusted bond yield, as detailed in the footnote above, to proxy for borrowing costs. The updated estimation results, now controlling for borrowing costs, are reported in column (3) of Table 4. Due to infrequent new debt issuance, the sample decreases from 827 to 696 cities even after imputing missing values with municipalities' most recent observed yields. Municipal bond issuance is non-random, requiring empirical research to address selection issues in bond issuance decisions. A useful starting point involves comparing extensive margin (whether to issue) versus intensive margin (how much to issue) effects. Despite this sample reduction, the estimated elasticity of labor migration with respect to leverage remains highly consistent with the column (2) findings.

To address the potential influence of mega municipalities on our results, we employ weighted least squares (WLS) using the inverse of log population size as the weight. The estimation results are shown in columns (4) to (6) of Table 4. The findings are quantitatively similar to the baseline estimates, suggesting that our results are robust and not driven by the largest municipalities.

3.2.2 Robustness

3.2.2.1 Alternative Numerator for Leverage Ratio

Multiple governmental entities, such as cities, counties, and special districts, often share boundaries and responsibilities for public projects funded by municipal bonds. Consequently, a municipality's gross direct debt does not fully represent its financial obligations. The concept of "*net applicable* *overlapping debt*" addresses this issue by accounting for the portion of debt a municipality shares with overlapping jurisdictions. To provide a more comprehensive view of municipal financial obligations, we incorporate net applicable overlapping debt into our baseline leverage measure. Table 5 presents the updated estimation results reflecting this adjustment.

[Table 5 about here.]

As shown in Panel A of Table 5, the sample size decreases by 140 municipalities because net applicable overlapping debt data are not consistently available for all municipalities. Despite this reduction in coverage, the estimated elasticity of municipal leverage with respect to labor migration increases substantially, approximately doubling in magnitude relative to our benchmark estimate, while remaining statistically significant. This suggests that the relationship between labor migration and municipal leverage is robust to alternative definitions of debt balance, and appears even stronger when overlapping debt obligations borne by local governments are taken into account.

3.2.2.2 Alternative Denominator for Leverage Ratio

In addition, we test the robustness of our results to an alternative scale measure used in the calculation of the municipal leverage ratio. In our benchmark specification, leverage is defined as total debt divided by total personal income, which serves as a proxy for the municipality's economic base. Here, following Myers (2022), we adopt a more conventional measure in the public finance literature by redefining the denominator as total government revenue, and accordingly calculate leverage as gross direct debt divided by total revenue.

We then re-estimate our baseline specification using this alternative leverage measure as the dependent variable. The results, reported in Panel B of Table 5, remain qualitatively consistent with those from our benchmark analysis. In particular, as shown in column (2), a 1% increase in labor migration leads to a 1.012 percentage point reduction in the debt-to-revenue ratio. This confirms that the observed negative relationship between labor migration and municipal leverage is not driven by the choice of scaling factor, and continues to hold when using a revenue-based measure of fiscal capacity, which directly reflects the government's ability to service debt.

Taken together, the estimation results from these robustness checks reaffirm the reliability of our main findings. Regardless of whether we adjust the numerator to include overlapping debt obligations or modify the denominator to reflect total revenue, the evidence consistently points to a significant negative effect of labor migration on municipal leverage.

3.2.3 IV Estimation

The validity of our estimates may be compromised by several potential sources of endogeneity, which could introduce bias into our results. A primary concern is the possibility of reverse causality:

residents might anticipate increased tax burdens in response to rising municipal leverage, potentially prompting outmigration and consequently affecting working-age population. Moreover, our model may suffer from omitted variable bias, wherein unobserved factors could simultaneously influence both local labor migration and municipal debt levels. While the incorporation of lagged working-age population changes as an explanatory variable offers some mitigation of these issues, it may not fully address the underlying endogeneity concerns.

To address these methodological challenges and establish causal relationships between labor migration and our outcomes of interest, we employ an instrumental variable (IV) approach. Prior studies (Autor et al., 2013; Pierce and Schott, 2016; Greenland et al., 2019) have documented that China's accession to the WTO in 2001 significantly increased U.S. exposure to Chinese imports. Areas and industries more exposed to these imports experienced larger and more sustained declines in employment, making these trade shocks suitable instruments for examining the impact of labor migration on municipal debt.

Specifically, we use trade liberalization as an exogenous shock and exploit the variation in exposure to Chinese imports across municipalities in the early 2000s. This allows us to identify the effects of labor migration on municipal leverage in the following decade. To be precise, we employ three trade-related variables as instruments for working-age population changes. First, we use the county-level Normal Trade Relations (NTR) gap in 1999 (IV_1), before China was granted permanent normal trade relations (PNTR) in 2000 (Pierce and Schott, 2016). The NTR gap represents the change in U.S. tariffs on Chinese imports that would have occurred if China's NTR status had not been renewed in 1999. The county-level NTR gap is calculated by weighting the industry-level tariff gap with 1990 industry employment shares in each county. A larger NTR gap indicates a greater negative shock, suggesting that counties exposed to a higher NTR gap would experience a more significant decline in local job opportunities. Second, we consider the county-level average changes in Chinese import tariffs between 1996 and 2005, also weighted by 1990 industry employment shares (IV_2). A decrease in a county's average tariff rates during this period indicates a more substantial import shock, leading to a reduction in local labor demand. Finally, we use the change in the value of Chinese goods imported by non-U.S. high-income countries in each industry during the 2010s, weighted by 2000 industry employment for each U.S. commuting zone (IV_3). This instrument, based on Autor et al. (2013), captures the community-zone level trade shock by exploiting cross-market variation in import exposure due to initial differences in industry specialization. By instrumenting for U.S. imports using changes in Chinese imports by other high-income countries, we can infer that a larger increase in Chinese imports per worker signals a more significant negative shock, which in turn reduces local job opportunities.

[Table 6 about here.]

Table 6 presents both the first-stage and second-stage results, highlighting the causal effects of labor migration on municipal leverage using the instrumental variables (IV) approach. The estimated effects are consistent across specifications, showing that a decline in working-age population leads to an increase in municipal leverage. The IV estimates are approximately four times as large as the OLS estimates, which is reasonable and aligns with expectations given the nature of the instruments. Furthermore, the impact of all three instruments on working-age population is in line with our hypotheses. The F-statistics from the first stage in all specifications confirm the strong relevance of our identification strategy. In addition, the signs of the coefficients on the instruments are consistent with expectations, and all coefficient estimates are statistically significant.

3.2.4 Labor Migration and Taxation

To illustrate municipalities' debt-tax choices in response to labor migration, we next examine the tax responses. Specifically, we replace the dependent variable in regression model (1) with the millage rate, defined as the amount assessed per $1,000 of property value, which allows us to analyze how fluctuations in working-age population influence tax rates directly. The results of this analysis are presented in Table 7.

[Table 7 about here.]

Our estimation results indicate that municipalities tend to raise (cut) property tax rates when experiencing a rise (decline) in working-age population driven by positive (negative) economic shocks. In particular, a 1% increase in working-age population induces a property tax rate increase of 0.12‰ based on the column (2) of OLS estimate and 0.31‰ according to the first IV estimate. Given the average tax rate of 16.5‰ in our sample, these changes correspond to elasticities of 0.7 and 1.9, respectively. This finding, along with our earlier results on leverage, provides a thorough overview of municipal financing patterns in response to local labor migration: As local working-age population rises, municipalities respond by increasing tax rates and reducing debt borrowing. Moreover, the coefficient on housing prices is consistent with the findings of Brosy and Ferrero (2021), who examined the Great Recession and found significant increases in property tax rates in areas facing negative shocks to their housing market. This consistent result strengthens our confidence in our empirical findings.

3.2.5 Discussion

Our results indicate a fall in municipal leverage alongside a rise in tax rates following net labor in-migration. This finding contradicts conventional wisdom and recent studies in the field.

The Ricardian equivalence theorem, or Ricardo-de Viti-Barro equivalence, posits that rational and forward-looking consumers will make identical spending decisions regardless of whether government spending is financed through debt or taxation, anticipating future tax increases to repay debt (Barro, 1974). This suggests that consumers view debt and taxes as perfect substitutes, rendering the government's financing choice irrelevant.

Barro (1979) proposes tax-smoothing hypothesis, suggesting that governments should strive to keep tax rates stable over time, rather than frequently adjusting them in response to temporary fluctuations in government spending or economic conditions. The rationale behind the theory is to minimize the economic distortions caused by taxation, which tend to increase when tax rates fluctuate significantly.

In the context of perfectly mobile labor, as discussed by Rosen (1979) and Roback (1982), government policies become indeterminate; any choice regarding debt, services, or taxes yields the same utility across regions. Gordon and Guerron-Quintana (2021) introduce the idea of imperfect labor mobility, arguing that cities may over-borrow in response to in-migration. In this scenario, current borrowing finances existing residents' consumption, with future tax revenues from incoming migrants used to repay the debt.

Carlson et al. (2024) analyze municipalities' choices between taxes and debt for funding expenditures, suggesting that municipalities often favor debt to smooth tax burdens over time and across different states. While higher debt may carry the risk of bankruptcy, high taxes would deter residents and reduce the tax base, thereby using debt allowing municipalities to maintain stability.

Contrary to these perspectives, our empirical findings reveal that municipalities prefer taxation over debt in response to labor in-migration. This unexpected outcome calls for a new explanation, which we will explore in the following sections.

4 The Model

In this section, we develop a dynamic stochastic partial equilibrium model of a municipality to replicate and explain the financing patterns observed in Section 3. We treat the municipality as a sovereign entity that invests in public infrastructure and provides essential services to its residents. These investments are primarily funded through a mix of tax revenue, program revenues, and, where necessary, debt issuance. The municipality's overarching goal is to maximize the welfare of local residents. Residents benefit not only from the public services and infrastructure provided but also from transfer payments distributed by the municipality.

Our framework draws inspiration from dynamic corporate finance models (Hennessy and Whited, 2005; Riddick and Whited, 2009), leveraging parallels and distinctions between corporations and municipalities. While these entities operate within different institutional frameworks, both are fundamentally vehicles for creating and distributing value. Corporations focus on maximizing shareholder value, by pursuing profitable investment opportunities in line with Friedman's doctrine. Municipalities, on the other hand, seek to maximize social welfare through the provision of public goods and services, following the Tiebout-Tullock paradigm—which combines Tiebout (1956) model of citizen sorting based on public service preferences with Tullock (1971) analysis of governmental incentives. This fundamental distinction is reflected in the differing objectives and investment opportunities faced by each entity.

Corporations raise capital by issuing equity, which is freely traded, and shareholders primarily benefit through dividend payments. The value of a corporation's equity is determined by the present value of expected future dividends. Municipalities, on the other hand, "raise capital" through taxes paid by residents. These taxes grant access to non-excludable public services, transfer payments, and community amenities in future periods.[9] This distinction shapes the respective optimization problems faced by corporations and municipalities, with parallel utility functions that capture the benefits received by corporate shareholders and municipal residents.

For both corporations and municipalities, capital structure refers to the mix of funding sources used to finance operations and investment. Corporations balance debt and equity, while municipalities rely on a combination of debt financing and taxation. This comparison highlights the contrasting components of corporate and municipal capital structures.

Table 8 illustrates the key distinctions and similarities between corporations and municipalities. With these foundations in place, we now present our model.

[Table 8 about here.]

4.1 Residents

4.1.1 Benefits and utility

The municipality is composed of infinitely-lived local residents. Similar to shareholders who receive dividends from corporations, municipal residents receive benefits in the form of services and transfer payments from the local government. The periodic utility function representing the welfare of the entire community is given by:

$$u(q, e) = Nq^{\psi} + e - \Phi(e)\,\mathbb{1}_{e<0}. \tag{2}$$

We define the level of public infrastructure as q, where each resident derives utility from the services provided, with utility increasing at a diminishing rate, governed by the curvature parameter $\psi \in (0, 1)$. The concavity of this function ensures that the level of public infrastructure remains finite. The total population size is denoted by N, and the aggregate utility that residents derive from public infrastructure is given by Nq^{ψ}.

[9] In this regard, municipalities share similarities with benefit corporations (e.g., Warby Parker and Open AI) and social enterprises (e.g., Ben & Jerry's), which balance revenue generation with societal objectives. Both prioritize stakeholder welfare alongside profitability, embedding social responsibility into their core missions.

Let $e \geq 0$ represent the total transfer payments made by the municipal government to residents, while $e < 0$ represents payments made by residents to the government. Positive transfer payments include welfare and social assistance, public health support, educational and child care subsidies, and other similar forms of aid. In contrast, the scenario where $e < 0$ reflects fiscal emergencies, in which residents vote to temporarily increase taxes to assist the municipality in recovering from financial distress (Myers, 2022). These "reverse" payments are uncommon and incur associated costs, represented by $\Phi(e)$, which we will elaborate on when discussing the municipality's financing options. The indicator function $\mathbb{1}_s$ is used to indicate whether event s occurs, taking the value 1 if it does, and 0 otherwise.

4.1.2 Migration

Each period, local residents decide whether to stay in or relocate from the municipality. This migration choice hinges on factors such as the local public infrastructure level (q), the local municipality tax rate (τ), and the local economic conditions, which are represented by productivity (z), which we will elaborate on in subsection 4.1.3.[10] To capture this decision, we use a reduced-form function that allows us to estimate the impact of each factor directly from the data. As a result, the municipal population N is determined by these three factors, as captured by the following function:

$$\log N(z, q, \tau) = \kappa \log z + \alpha \log q + \theta \log \tau. \tag{3}$$

Here, the parameter $\kappa \in (0, +\infty)$ represents the elasticity of migration with respect to productivity z, while $\alpha \in (0, +\infty)$ and $\theta \in (-\infty, 0)$ capture the elasticity of migration with respect to q and τ, respectively. They reflect how population responds to changes in local economic conditions, infrastructure, and taxation.

In our model, we abstract from retirement and treat population and working-age population as interchangeable. We assume that residents face a labor demand function determined by the wage rate w, firms' capital stock k and capital-income share η:

$$N^D = [\frac{w}{zk^\eta(1-\eta)}]^{\frac{-1}{\eta}}. \tag{4}$$

The labor demand function is derived from firms' profit-maximization problem.[11] For simplicity,

[10]We use z (local productivity) instead of the local wage rate to capture migration driven by the changes in job opportunities. A lower local wage rate alone does not necessarily lead to a smaller population size, as demonstrated by the case of Janesville, which experienced a population increase despite a lower wage rate following the relocation of GE after the Great Recession. This example shows that migration can be influenced by factors other than wage levels, such as economic conditions and recovery efforts.

[11]We assume that a representative firm operates with a constant returns-to-scale Cobb-Douglas production function, given by:

$$y = zk^\eta n^{1-\eta},$$

where y is the firm's output, k represents the capital input, and n represents the labor input. The parameter $\eta \in (0, 1)$

we normalize the firm's capital stock to one. By equating labor demand with the labor supplied by residents, we can determine the market wage rate $w = z(1-\eta)[N(z,q,\tau)]^{-\eta}$.

4.1.3 Aggregate shock

We assume that the unmodelled representative firm within the municipality is subject to aggregate productivity shocks, impacting its outputs and, consequently, labor demand and the income of local residents. The evolution of aggregate productivity follows a Markov chain. Specifically, the aggregate productivity, denoted as z and belonging to the set $\mathbf{Z} = \{z_1, ..., z_n\}$, transitions between states with probabilities $\Pr(z' = z_m | z = z_l) = \pi^z_{lm} \geq 0$, adhering to the condition $\sum_{m=1}^{n} \pi^z_{lm} = 1$ for $l = 1, ..., n$. Here, the prime symbolizes a variable in the subsequent period.

The shock process is captured by the following AR(1) process in logarithmic terms:

$$\ln z' = \rho \ln z + \varepsilon'_z, \varepsilon'_z \sim N(0, \sigma_z^2). \tag{5}$$

The parameter ρ governs the persistence of z, and the innovation to z, denoted as ε'_z, follows a normal distribution with a mean of 0 and variance σ_z^2.

4.2 Municipality

At the beginning of each period, the municipality is defined by four key state variables: public infrastructure ($q \in \mathbf{Q} \subset \mathbb{R}+$), tax rate ($\tau \in \mathcal{T} \subset \mathbb{R}+$), debt obligations ($b \in \mathbf{B} \subset \mathbb{R}+$), and realized aggregate productivity ($z \in \mathbf{Z} \subset \mathbb{R}+$). After assessing the current state, the municipality addresses its operating costs and debt repayments, and makes strategic decisions regarding taxation, borrowing, and investment.

Below, we outline the process of municipal infrastructure accumulation—referred to as the municipal capital stock—and the financing options available to the municipality, and then formulate the municipality's problem.

4.2.1 Investment

In every period t, the municipality invests in public capital, with the evolution of the capital stock governed by the following law of motion:

$$q' = (1-\delta)q + I. \tag{6}$$

represents the capital share in the production function, while $1-\eta$ is the share of labor. The firm's objective is to maximize profits π, by choosing the optimal level of labor n, given the wage rate w and holding capital k constant. The firm's profit maximization problem can be expressed as:

$$\pi = \max_n \left\{ z k^{\eta} n^{1-\eta} - wn \right\}.$$

The solution to this maximization problem gives the optimal labor demand function.

In this equation, I represents investment, and the parameter $\delta \in (0, 1)$ denotes the depreciation rate of municipal capital. The adjustment of capital stock incurs costs associated with both the expansion and sale of infrastructure. For example, expanding or downsizing existing public parks can disrupt their normal usage and lead to additional costs. To capture these frictions, we draw on the corporate investment literature and model the capital adjustment costs as:

$$A(q, q') = \gamma_{1,q} q \mathbb{1}_{q' \neq q} + \frac{\gamma_{2,q}}{2} \left(\frac{q' - (1 - \delta)q}{q} \right)^2 q, \tag{7}$$

where the adjustment cost function comprises two components. The first term, $\gamma_{1,q} q \mathbb{1}_{q' \neq q}$, represents a linear cost incurred whenever the municipality adjusts its capital stock, proportional to the existing stock size. The second term, $\frac{\gamma_{2,q}}{2} \left(\frac{q' - (1-\delta)q}{q} \right)^2 q$, captures convex adjustment costs that increase quadratically with the size of the investment relative to the current capital stock. This specification reflects the idea that small adjustments are relatively inexpensive, while large-scale expansions or reductions become disproportionately costly due to operational disruptions and planning constraints faced by municipalities.

4.2.2 Financing

The municipality can finance its routine operations and infrastructure investments using current-period tax revenue. Since revenues from property taxes, sales and use taxes, and other taxes generally increase with local household income, we model tax revenue as the product of the tax rate and household income, denoted by $\tau w N$. Here, the average tax rate τ represents all sources of tax revenue available to the municipality, including sales and use taxes, motor fuel taxes, lodging taxes, rental and leasing taxes, state-shared taxes, and other applicable taxes.

We assume that the government can adjust tax rates each period, though such changes come with adjustment costs given by

$$A(\tau, \tau_{-1}) = \frac{\gamma_t}{2} \left(\frac{\tau - \tau_{-1}}{\tau_{-1}} \right)^2 \tau_{-1}, \tag{8}$$

where "-1" indicates variables from the previous period. We assume convex adjustment costs, where the cost increases disproportionately with the size of tax changes. Small changes typically involve routine council approvals and public notices, while large changes trigger greater public scrutiny, organized opposition, and additional requirements such as public hearings, legal reviews, and stakeholder consultations. These procedural requirements make substantial tax adjustments disproportionately burdensome. This convex cost structure reflects the fiscal inertia commonly observed in U.S. local governments, which tend to favor incremental changes over abrupt policy shifts.

In addition to tax revenue, the municipality generates income from charges for public services, which provides another internal source of funds. We assume that this source of revenue is proportional to local infrastructure stock, represented as λq, where λ denotes the average price of public services.

The municipality also has access to external financing options, primarily through debt issuance to cover expenses. However, states often set maximum borrowing limits for municipalities. To approximate these limits, we assume that the municipality issues risk-free debt while facing a borrowing constraint given by $\chi(1-\delta)q'$. Here, $\chi \in (0,1)$ represents the resale price of public infrastructure, acknowledging that long-lived capital assets are often illiquid and typically sell for less than their purchase price.[12] This constraint implies that the municipality can borrow up to the net market value of its capital stock. To simplify the model and focus on core mechanisms, we assume all debt is short-term. This avoids the complexities of modeling long-term debt dynamics while still capturing municipalities' flexibility and responsiveness to economic shocks, as they frequently adjust financial strategies.

Alternatively, in cases of severe fiscal distress, the municipality may declare a fiscal emergency and seek households' approval for a temporary tax increase as a last resort. Following Myers (2022), we model this process by allowing the municipality to request voter authorization for a temporary increase in taxes. This process, however, is costly, and the associated costs are captured by the following reduced-form function:

$$\Phi(e) = \phi_0 - \phi_1 e. \tag{9}$$

In this function, $e < 0$ denotes the additional tax revenue raised, $\phi_0 > 0$ represents fixed costs, and $\phi_1 > 0$ reflects linear costs that vary in proportion to the amount of tax revenue generated.[13]

4.2.3 The municipal government's problem

We now turn to formally define the municipality's optimization problem. As corporations maximize shareholder value by maximizing the expected discounted net cash flow streams—distributing dividends when net cash flows are positive and issuing equity when net cash flows are negative, municipal governments seek to maximize the expected discounted streams of public services and net cash flows—transferring payments when net cash flows are positive and declaring emergency calls for additional funds when net cash flows are negative.

Specifically, at the beginning of each period, upon observing the economic shock z, the municipality addresses its obligations by repaying debt (b), covering operating costs, and making

[12] Most state-imposed borrowing limits are based on assessed property values. In the absence of a housing market, we assume that the borrowing capacity is proportional to local infrastructure.

[13] Emergency declarations differ from regular tax increases in that they may bypass some of the procedural steps typically required for tax changes, allowing for a quicker response to financial crises. However, they still often necessitate approval from the municipal council or state authorities. Declaring an emergency can incur costs related to the approval process, legal considerations, and oversight, as well as additional expenses associated with managing a more complex budget environment. Furthermore, emergency tax increases are usually temporary and come with built-in expiration dates, while regular tax increases, once approved, tend to be permanent adjustments to the municipality's revenue base.

infrastructure investments (q'). These expenses can be financed through multiple sources: setting the current-period tax rate (τ), applying service charges, issuing new debt (b'), or, if necessary, declaring a fiscal emergency.

We assume operating costs consist of two components: a fixed cost, c_0, and a variable cost, $c_1 q$. The fixed cost c_0 includes expenses like public officers' salaries, while the variable cost $c_1 q$ reflects the expenses associated with maintaining public services, such as safety, environmental maintenance, and parks and recreation.

With these elements in place, the municipality's net cash flow can be expressed as follows:

$$e = \underbrace{wN(z,q,\tau)\tau}_{\text{tax revenue}} + \underbrace{\lambda q}_{\text{service charges}} + \underbrace{b' - (1+r)b}_{\text{change in debt}} - \underbrace{(c_0 + c_1 q)}_{\text{operating costs}} - \underbrace{[q' - (1-\delta)q]}_{\text{investment}} - \underbrace{[A(q,q') + A(\tau,\tau_{-1})]}_{\text{adjustment costs}}, \tag{10}$$

where r denotes the risk-free interest rate. The net cash flow, e, is the difference between the municipality's total cash inflows and total cash outflows. Cash inflows consist of tax revenue, service charges, and changes in debt balance, while cash outflows include operating costs, infrastructure investments, and any capital or tax adjustment costs. The net cash flow can be either positive or negative. When it is positive, the municipality transfers funds to residents. When it is negative, it raises funds from residents, incurring additional costs.

We summarize the municipality's problem as follows: Let $V(z,q,\tau_{-1},b)$ denote the value function for the municipality, which reflects its objective of maximizing the expected discounted streams of services and net cash flows. This can be expressed using the following Bellman equation:

$$V(z,q,\tau_{-1},b) = \max_{q',\tau,b'} \left\{ N(z,q,\tau)q^{\psi} + e - \Phi(e)\,\mathbb{1}_{e<0} + \beta \mathbb{E}_{z'|z} V(z',q',\tau,b') \right\} \tag{11}$$

subject to

$$e = wN(z,q,\tau)\tau + \lambda q + b' - (1+r)b - c_0 - c_1 q - [q' - (1-\delta)q] - A(q',q) - A(\tau,\tau_{-1}),$$

$$b' \leq \chi(1-\delta)q'.$$

The parameter β represents the constant discount rate and is defined as $\frac{1}{1+r}$.

4.3 Optimal municipal financing policies

In this subsection, we characterize the optimal financing policies for the municipality, offering insights into the inherent tradeoffs.

4.3.1 Optimal debt financing

Assuming that $V(z, p, \tau_{-1}, b)$ is once differentiable, we can derive the condition for optimal debt financing as follows:

$$1 + \phi_1 \mathbb{1}_{e<0} = \mathbb{E}\{1 + \phi_1 \mathbb{1}_{e'<0}\}, \tag{12}$$

and subject to the borrowing constraint $b' \leq \chi(1-\delta)q'$.

Debt issuance is limited by the borrowing constraint. Under this condition, the left-hand side of Equation (12) gives the local government's marginal benefit of issuing an additional dollar of debt. If the transfer payment is positive ($\mathbb{1}_{e<0} = 0$), the marginal benefit of issuing debt corresponds to the additional dollar increase in transfer payments for the current period. In the scenario where the transfer payment is negative, implying the local municipality declares an emergency call ($\mathbb{1}_{e<0} = 1$), the marginal benefit is the saved costs associated with the emergency call. Although the fixed cost of the emergency call, ϕ_0, does not directly enter Equation (12), it does exert an influence on the municipality's optimal debt policy through its impact on the extensive margin of emergency declaration.

The right-hand side of Equation (12) represents the municipality's marginal cost of issuing debt, which equals the value of foregone transfer payments ($\phi_1 \mathbb{1}_{e'<0} = 0$) or the costs associated with declaring an emergency call ($\phi_1 \mathbb{1}_{e'<0} = 1$) in the subsequent period.

4.3.2 Optimal tax policy

Next, we turn our attention to the tax policy. Solving model (11) yields the optimal condition, which is expressed as follows:

$$-\frac{\partial N(z,q,\tau)}{\partial \tau} q^{\psi} + (1+\phi_1 \mathbb{1}_{e<0}) \frac{\partial A(\tau, \tau_{-1})}{\partial \tau} + \beta \mathbb{E}\{(1+\phi_1 \mathbb{1}_{e'<0}) \frac{\partial A(\tau', \tau)}{\partial \tau}\} = (1+\phi_1 \mathbb{1}_{e<0}) \frac{\partial wN(z,q,\tau)\tau}{\partial \tau}, \tag{13}$$

where $\frac{\partial N(z,q,\tau)}{\partial \tau} = \frac{\theta N(z,q,\tau)}{\tau}$, and $\frac{\partial wN(z,q,\tau)\tau}{\partial \tau} = z(1-\eta)N(z,q,\tau)^{1-\eta}[1 + (1-\eta)\theta]$.

For simplicity and clarity, we set aside the emergency call scenario while retaining generality. The left-hand side of Equation (13) represents the marginal cost of raising an additional unit of the tax rate. This cost consists of the loss of utility from services due to population decline, the increase in current-period tax adjustment costs, and the discounted expected rise in tax adjustment costs in the subsequent period.

The right-hand side of Equation (13) reflects the changes in total tax revenue resulting from an additional unit increase in tax rates. Whether this represents a cost or a benefit—determined by the sign of the tax revenue change—depends on the elasticity of mobility with respect to tax rates θ. Specifically, when $(1-\eta)\theta < -1$, a 1% increase in tax rates leads to a decline in tax base by more than 1%, resulting in a net decrease in total tax revenue. When $(1-\eta)\theta = -1$, the increase in tax rates corresponds to a proportional decrease in tax base, effectively offsetting each other; in this case, changes in tax rates do not affect total tax revenue. When $-1 < (1-\eta)\theta < 0$, an increase in tax rates results in a smaller proportional decrease in tax base. Therefore, this scenario leads to an increase in total tax revenue.

When the tax elasticity of mobility is elastic ($\theta < -1$), it becomes optimal to cut tax rates, with zero being the optimal rate in the steady state. This decision involves weighing the tax adjustment costs against the improvements in social welfare and the potential increases in tax revenue that arise from lowering tax rates, which in turn encourages in-migration and broadens the tax base. In contrast, when the tax elasticity of mobility is inelastic ($-1 < \theta < 0$), the optimal tax rate is determined by balancing the marginal costs of a tax increase—specifically, the loss of social welfare due to out-migration and the adjustment costs—against the marginal benefits gained from increased total tax revenue.

4.3.3 The choice between debt and taxation

The optimal tax policies have important implications for the municipality's choices between debt and taxes.

The optimal tax policy shows that when the tax elasticity of mobility is high, raising tax rates brings only costs without any corresponding benefits. In such cases, it is more effective to issue debt within acceptable limits rather than raise taxes to meet expenditure needs. This strategy allows the municipality to improve the quality and accessibility of public services while avoiding the negative consequences of deterring residents or imposing significant tax burdens.

Conversely, when the tax elasticity of mobility is low, raising tax rates becomes an effective strategy to meet funding requirements. Although increasing tax rates may lead to our-migration and a decline in tax base, the adverse impacts tend to be limited, resulting in overall tax revenue growth. This allows the municipality to sustain essential services without placing excessive debt burdens on its residents.

When the tax-elasticity of mobility θ is zero, the Euler equation for optimal tax rates simplifies to the following:

$$(1+\phi_1 \mathbb{1}_{e<0})\frac{\partial A(\tau,\tau_{-1})}{\partial \tau} + \beta\mathbb{E}\{1+\phi_1\mathbb{1}_{e'<0}\}\frac{\partial A(\tau',\tau)}{\partial \tau} = (1+\phi_1\mathbb{1}_{e<0})z(1-\eta)N(z,q)^{1-\eta}. \quad (14)$$

In this case, migration is no longer influenced by tax rates. This condition is in line with the tax-smoothing theory (Barro, 1979), which suggests that adjusting tax rates in response to temporary fluctuations in government spending or economic conditions may not be optimal, particularly when there are significant costs associated with such adjustments, as shown on the left-hand side of Equation (14).

In summary, the tax elasticity of mobility θ plays a crucial role in shaping the choices between debt and tax financing. Our theory suggests that when the tax elasticity of mobility is low (inelastic), raising taxes may be more favorable than issuing debt to finance increased expenditures. This strategy enables municipalities to align their fiscal health with the well-being of their residents. In addition, the low elasticity of mobility with respect to tax rates provides a plausible explanation for the empirical findings discussed in the preceding section.

5 Model Estimation

In this section, we apply the model outlined above to empirical data by calibrating it to match city-level U.S. data from 2008 to 2021. Model parameters fall into two categories: the first includes those with standard values in the literature or can be directly estimated from available data, while the second comprises parameters estimated jointly by minimizing the distance between selected data moments and simulated model moments. Time period t corresponds to one year.

5.1 Parameterization

We calibrate the time discount factor, β, to match a long-run annual real interest rate of 2.00%, based on the average rate from 1984 to 2021. This corresponds to a discount factor of 0.98. We extend the sample back to 1984, marking the beginning of the Great Moderation, as the recent period has experienced persistently negative real interest rates, which complicates model computation.

Next, we calibrate the capital-income share η in the production function, along with the stochastic process for city-level productivity shocks. Since city-level GDP data is unavailable, we use county-level data and derive county-level productivity shocks as proxies for city-level fluctuations. The estimation involves the following steps. We assume that firms within each county are identical, each combining a predetermined capital stock k and labor l to produce a homogeneous numeraire good y, which serves for both consumption and investment. We specify a Cobb–Douglas value-added production function for each county i at time t:

$$y_{i,t} = \beta_0 + \beta_k k_{i,t} + \beta_l l_{i,t} + \phi_i + \tau_t + \epsilon_{i,t}, \tag{15}$$

where $y_{i,t}$ is the logarithm of real GDP, $k_{i,t}$ is the logarithm of capital stock, and $l_{i,t}$ is the logarithm of employment. County fixed effects ϕ_i capture time-invariant characteristics, while time fixed effects τ_t account for aggregate shocks. The error term $\epsilon_{i,t}$ represents county-specific productivity, denoted as z in the model. Because direct county-level capital stock data are unavailable, we proxy for capital stock using the county-level lagged number of establishments, assuming it is proportional to capital stock. Estimating this regression yields a capital-income share of $\hat{\beta}_k = 0.32$, consistent with values commonly found in the macroeconomic literature. Accordingly, we set $\eta = 0.32$.

We then use the residuals from regression model (15) to estimate an AR(1) process, capturing the continuous Markov process of county-specific productivity:

$$\hat{\epsilon}_i' = \rho_z \hat{\epsilon}_i + \varepsilon_i', \tag{16}$$

where $\varepsilon_i' \sim N(0, \sigma_z^2)$. Our estimation results indicate a persistence of productivity shocks at $\rho_z = 0.76$ and a standard deviation of $\sigma_z = 0.032$.

We further use the estimated county-level productivity to examine the elasticity of labor mobility with respect to economic conditions κ, along with the infrastructure elasticity α, and tax elasticity of labor mobility θ. To maintain consistency with our empirical analysis, and given that our theoretical model does not consider retirement, we use the logarithm of working-age population as the dependent variable. Specifically, we estimate the following regression model:

$$\log N_{i,t} = a_0 + \kappa \log \hat{z}_{i,t} + \alpha \log q_{i,t-1} + \theta \log \tau_{i,t} + \mu_t + \phi_i + \varepsilon_{i,t}, \tag{17}$$

where $N_{i,t}$ represents the working-age population in municipality i at time t, $\hat{z}_{i,t}$ denotes the estimated county-level productivity, $q_{i,t-1}$ is the beginning-of-period capital assets for municipality i, and $\tau_{i,t}$ is the tax millage rate in municipality i at time t. To address the potential endogeneity of tax rates $\tau_{i,t}$, which may be influenced by factors correlated with labor migration, we use the lagged county-level property tax, as compiled by Baker et al. (2025), as an instrumental variable. This approach helps isolate the causal impact of tax rates on labor mobility. In addition, we control for both municipality and time fixed effects to account for unobserved time-invariant characteristics at the municipal level and common shocks over time. The estimation results yield coefficients of $\kappa = 0.043$, $\alpha = 0.034$, and $\theta = -0.14$, with all signs consistent with expectations.

Our empirical findings indicate that the tax elasticity of labor mobility is low, consistent with the estimates reported by Young et al. (2016).[14] Specifically, a 1% increase in tax rates leads to only a 0.14% decrease in working-age population. This is associated with a 0.11% drop in tax base, while total tax revenue increases by approximately 0.89%. These results suggest that taxation is an effective instrument for generating municipal revenue.

We set the annual depreciation rate of capital stock at 0.05, based on the average value observed in our sample period. In the absence of established estimates for the fixed and linear costs associated with declaring a fiscal emergency, we assign both parameters an arbitrarily large value of 1 to ensure that such declarations are rare. These two values suggest that fixed costs are 6.7 times higher than regular fixed operating costs, while the variable costs associated with a temporary tax increase amount to 100% of the tax generated. Lastly, we set λ to 0.08 to match the average ratio of service charges to capital in our sample.

[Table 9 about here.]

[14] Young et al. (2016) demonstrate that general population migration shows minimal sensitivity to tax rates, though millionaires are more responsive, with a semi-elasticity of -0.07.

We estimate the remaining parameters by matching them with specific data moments from our sample. In particular, we target the following moments: the frequency of fiscal deficits, the average operating surplus (or deficit) as a percentage of total income, the average tax income-to-capital ratio, the average investment-to-capital ratio, the average debt-to-capital ratio, the average operating expenses-to-capital ratio, and the average tax income-to-total income ratio. Moreover, we aim to target the standard deviations of the investment-to-capital ratio and the tax income-to-capital ratio, as well as the frequency of tax rate adjustments.

The frequency of fiscal deficits provides information for identifying the fixed operating cost, c_0. Higher fixed operating costs increase the likelihood of fiscal deficits by raising the cost that municipalities must cover, irrespective of capital stock size. Moreover, given the fixed costs c_0, the average total operating expenses-to-capital ratio is informative to identify the linear operating cost parameter, c_1.

The parameter ψ, which governs the curvature of the municipal preference function, can be estimated using the average capital investment rate, given the depreciation rate. A higher value of ψ implies that the marginal utility from infrastructure declines more gradually, which incentivizes municipalities to raise their capital investment. The standard deviation of the capital investment rate is used to estimate the quadratic capital adjustment cost parameter, $\gamma_{2,q}$. Higher quadratic adjustment costs encourage municipalities to smooth their capital investments over time, thereby reducing investment volatility. Moreover, linear adjustment costs on capital stock, $\gamma_{1,q}$, impose further constraints on the municipality, which can be inferred from the average budget surplus (or deficit) as a percentage of total income.

The resale price of capital, χ, is inferred from the average leverage ratio, taking into account the borrowing constraints in the model. This parameter reflects the liquidity and potential value recovery from capital assets, influencing municipalities' financing decisions.

Finally, the quadratic tax adjustment cost, γ_t, reflects the increasing marginal costs associated with adjusting tax rates. This cost directly affects how frequently tax rates are adjusted, making the observed frequency of tax adjustments an important element in estimating this parameter.

To improve the robustness of the estimation, we also incorporate additional moments, including the standard deviation of the tax income-to-capital ratio and the average tax income-to-capital ratio. These extra moments add information and flexibility to the estimation process, ensuring a better alignment between the model's predictions and observed municipal behavior. Table 9 summarizes the parameter choices.

5.2 Model moments

Table 10 compares the moments generated by our model with their empirical counterparts. These moments include the mean and standard deviation of key variables such as taxes, debt financing, capital investment, and operating income. These variables serve as the primary targets for jointly estimating the model parameters: ψ, $\gamma_{1,q}$, $\gamma_{2,q}$, γ_t, χ, c_0, and c_1.

The data moments are constructed using a sample of U.S. municipalities, as detailed in Section 3. To derive the model moments, we use simulated data generated by our model, which we calculate as follows. Total income is defined as the sum of tax revenue and service charges, where tax revenue equals the product of wage income, population size, and the tax rate $wN\tau$, and service charges are given by λq. Total expenses are the sum of capital expenditures, operating expenses, and debt service fees. The difference between total income and total expenses defines the operating surplus (or deficit). Detailed definitions of these variables are provided in the second column of Table 10.

To simulate the model, we create an economy consisting of 1,000 cities, simulating data over 50 periods. The initial 25 periods are discarded to minimize the effects of initial conditions. This simulation process is repeated 100 times to ensure robust moment estimates. By comparing the simulated moments with their empirical counterparts, we are able to evaluate the model's ability to replicate real-world municipal financial patterns.

[Table 10 about here.]

Table 10 demonstrates successful model calibration, with simulated moments closely aligning with empirical targets. The model effectively captures key patterns, such as the frequency of fiscal deficits and tax rate adjustments, with only minor discrepancies. The first moments of tax revenue, investment, debt financing, and operating expenses also reflect real-world municipal financial behaviors, indicating the model's reliability.

Our calibration produces slightly overestimation of tax income, with both tax income-to-capital and tax income-to-total income ratios above their empirical targets. This bias reflects the model's prioritize match operating surplus-to-income ratios and deficit frequencies, where lower tax income would generate larger deviations from observed values.

In addition, the model generates a lower standard deviation of the tax income-to-capital stock ratio than what is observed empirically. A plausible explanation for this dampened tax volatility lies in the estimated large quadratic adjustment costs in the model. These adjustment costs impose significant penalties on large tax rate changes, discouraging abrupt fiscal adjustments and smoothing tax dynamics. As a result, the model exhibits lower tax revenue volatility than the data.

Overall, the model successfully replicates empirical patterns, validating both the theoretical framework and parameter calibration.

5.3 Financial responses to economic shocks

We next use the parameterized model to analyze how municipalities' real and financial behaviors respond to a positive economic shock. This exercise allows us to assess whether the model can replicate the financing patterns documented in the empirical analysis in Section 3.2.1. Specifically, we examine the dynamics of key variables, including municipal investment rate, debt financing, taxation, total revenue, total expenses and population. Particular attention is given to the debt-to-income ratio and tax rates, as these two variables provide critical insights into the municipalities' financing adjustments.

To evaluate these responses, we introduce a temporary 2.5% positive shock and track the percentage changes in each variable relative to their steady-state values. The results capture the municipalities' short-term and medium-term adjustments, illustrating how fiscal and demographic aspects evolve in response to improved local economic conditions. The percentage changes and dynamic trajectories for each variable are presented in Figure 3, with the shock occurring in period three.

[Figure 3 about here.]

As illustrated, the debt-to-income ratio declines while the tax rate increases immediately following a positive shock. These responses are consistent with our empirical observations and reflect a shift from debt financing to tax financing. Evidently, the decline in the debt-to-income ratio exceeds the percentage rise in total income, indicating an absolute reduction in the reliance on debt to meet financial needs.

Moreover, capital expenditure, total income, total expenses, and population all increase in response to the positive shock. The rise in productivity stimulates labor demand, which attracts migration to the municipality. This population growth heightens the demand for public infrastructure, prompting increased capital investment and expenditures.

The influx of new residents expands the tax base, and the low tax elasticity encourages municipalities to modestly raise tax rates to capitalize on the increased population. The combination of a higher tax rate, a larger tax base, and greater program revenues driven by the expanded infrastructure stock leads to a significant rise in total income. This increase in income outpaces the growth in total expenses, strengthening municipal finances and reducing reliance on debt.

In summary, our model effectively captures the key financing patterns observed at the municipal level in response to positive economic shocks. These results enhance the model's credibility as a reliable framework for conducting counterfactual analyses.

6 Model Implications

6.1 The role of elasticity of labor migration

In this section, we use the validated model to explore how the elasticity of labor migration influences municipal financing choices. To this end, we conduct the following counterfactual analyses. First, we eliminate all migration elasticities to simulate a scenario of perfect immobility, a common assumption in national and subnational studies. Next, we reintroduce each of the three migration elasticities—economic conditions, public infrastructure, and tax—individually to assess their respective impacts, with a particular focus on the effect of tax elasticity.

6.1.1 Perfect immobility

We begin by examining the impact of migration on municipal finance through simulations using two model specifications. The first is the benchmark model, which incorporates labor migration elasticities ($\kappa = 0.043$, $\alpha = 0.034$, $\theta = -0.14$). The second is a modified model with zero migration elasticities ($\kappa, \alpha, \theta = 0$), representing a scenario of perfect immobility and a fixed population.

By comparing the key moments generated by these two models, we evaluate how migration influences municipal decision-making and fiscal outcomes. This comparison highlights the extent to which labor mobility affects municipalities' reliance on different financing methods and their overall fiscal health. The results, summarized in the "perfect immobility" column of Table 11.

[Table 11 about here.]

Compared to the benchmark case, the results under the perfect immobility scenario reveal striking differences. First, municipalities are much less likely to run fiscal deficits: the share of municipalities in deficit drops from 0.258 in the benchmark model to zero. At the same time, the operating surplus-to-income ratio improves dramatically, rising from a deficit of -0.024 to a surplus of 0.423. These outcomes suggest that when labor mobility is eliminated, fiscal imbalances are effectively eliminated as well, making it far easier for municipalities to balance revenues and expenditures. Moreover, taxation becomes a more attractive and reliable financing tool relative to the benchmark case. This is reflected in substantial increases in both the tax income-to-capital ratio and the tax share of total income.

The underlying reason for these changes lies in the assumption of a fixed population, that is, zero elasticity of population with respect to public services and tax rates. With no population response to policy changes, municipalities lose the incentive to use public service improvements as a tool for attracting new residents and expanding the tax base. As a result, they invest less in public infrastructure, leading to a lower average capital stock. This, in turn, reduces both variable operating costs and service charge revenues.

At the same time, with tax rates having no effect on population size, the cost of relying on taxation as a financing tool is much lower. Municipalities can gradually raise tax rates without risking outmigration. Over time, rising tax rates translate into higher revenues, eventually reaching levels that are sufficient to cover both fixed operating costs and infrastructure expenditures. In equilibrium, tax revenue becomes the dominant source of municipal income, easily covering all spending needs and generating a large fiscal surplus.

6.1.2 Economic-condition elasticity of labor migration

We reintroduce the elasticity of labor mobility with respect to economic conditions into the model, restoring it to its baseline value. The results, shown in the fourth column of Table 11, reveal relatively minor changes compared to the perfect immobility scenario. Specifically, municipalities show an even stronger preference for taxation over debt financing, reflected in higher values for the tax income-to-capital ratio, the tax share of total income, and the operating surplus-to-total income ratio.

The intuition is as follows: the reintroduction of positive economic-condition elasticity enhances the fiscal benefits of positive productivity shocks without exacerbating the fiscal consequences of negative shocks. Specifically, with population remaining insensitive to tax rates (i.e., zero tax elasticity of population), municipalities can rely on tax adjustments to buffer against negative productivity shocks while capitalizing on positive shocks to further boost tax revenues. This asymmetry improves the overall fiscal position, with the operating surplus-to-income ratio increasing from 42.3% under perfect immobility to 47.4% in this case.

In addition, a positive elasticity of labor mobility with respect to economic conditions amplifies population fluctuations in response to economic changes. These shifts in population increase the variability in the demand for public services and municipal expenditures, prompting municipalities to adjust tax rates more frequently to stabilize their budgets. As a result, the frequency of tax rate adjustments rises, allowing municipalities to better manage fiscal imbalances in a more volatile environment.

6.1.3 Infrastructure elasticity of labor migration

Next, we examine the role of public infrastructure elasticity in shaping fiscal outcomes. To do this, we remove the elasticity of labor migration with respect to economic conditions while introducing positive elasticity with respect to public infrastructure, setting $\alpha = 0.034$. This adjustment allows municipalities to expand their tax base through infrastructure investment, which effectively raises the marginal returns to public infrastructure spending.

As reported in the fifth column of Table 11, the preference for taxation as the primary financing tool weakens slightly. This is reflected in modest declines in both the tax income-to-capital ratio and the tax share of total income, alongside a small increase in the debt-to-capital ratio relative to the perfect immobility scenario.

The intuition behind these results is straightforward. By introducing positive infrastructure elasticity, municipalities gain a mechanism to attract in-migration through infrastructure development. This incentivizes greater investment in public infrastructure, which in turn expands the local population and tax base. The resulting population growth boosts both tax revenues and service charge income, easing fiscal pressure during negative economic shocks while amplifying the fiscal benefits of positive shocks through higher local wages and tax collections.

As municipalities increasingly rely on infrastructure-driven growth rather than solely on tax adjustments, the need for aggressive tax policy interventions diminishes. This shift leads to a modest reduction in operating surpluses as municipalities balance increased infrastructure spending with the benefits of a more stable tax base.

6.1.4 Tax elasticity of labor migration

In the final step, we introduce only the tax elasticity of labor mobility, setting it to the baseline value, and report the results in the last column of Table 11. The findings show a sharp deterioration in fiscal outcomes compared to both the perfect immobility scenario and other cases where tax elasticity is absent. Specifically, the proportion of municipalities running deficits rises substantially, while the operating surplus-to-income ratio falls dramatically.

Compared to the scenario of perfect immobility, introducing tax elasticity increases the marginal cost of using taxation as a fiscal tool, especially during negative economic shocks. When faced with adverse conditions, municipalities can no longer raise tax rates freely to offset revenue shortfalls, as higher taxes would trigger out-migration, a constraint absent in the perfect immobility case. At the same time, during economic booms, the ability to capitalize on positive conditions through tax increases is also limited, as higher rates risk driving away potential in-migrants. This constraint on tax policy makes it much harder for municipalities to stabilize their budgets, leading to a higher frequency of deficits and a larger average deficit-to-income ratio.

6.1.5 Discussion

A comparison across the five columns in Table 11 reveals that the tax elasticity of labor mobility plays the most significant role in shaping municipalities' fiscal performance. This is evident from the close alignment of model moments between the baseline scenario and the tax-elasticity-only case.

In addition, there are important interaction effects between the three types of migration elasticities.

Positive infrastructure elasticity enhances the returns to public infrastructure investment, encouraging capital accumulation in both good and bad times. In contrast, tax elasticity raises the marginal cost of taxation, particularly during downturns, discouraging municipalities from relying on tax increases to cover fiscal shortfalls. As a result, debt, though constrained by the resale value of future capital stock, becomes a more attractive financing option in bad times, while taxation remains preferable during economic booms.

The economic-condition elasticity reinforces these patterns by amplifying population responses to local economic fluctuations. Stronger population inflows during booms and outflows during downturns make municipal budgets more sensitive to the business cycle. This increased mobility affects the relative attractiveness of financing tools. During economic upswings, a growing tax base makes tax financing more attractive. In downturns, a shrinking population discourages tax increases, making debt a better option. As a result, economic-condition elasticity intensifies the trade-offs between taxes and debt over the business cycle.

6.2 Counterfactual analyses and policy implications

In this subsection, we use our validated model to conduct counterfactual analyses on two representative cities: Detroit and Janesville. Detroit represents a case of fiscal distress, providing an opportunity to evaluate alternative strategies the model would prescribe. Janesville exemplifies sound fiscal management, allowing us to test whether model recommendations correspond with observed best practices.

6.2.1 Detroit case

Detroit's bankruptcy in 2013 marked the largest municipal bankruptcy in U.S. history, fueled by decades of population decline, and reduced tax revenue. Once a thriving industrial hub, Detroit faced significant economic challenges as its population plummeted from 1.8 million in 1950 to under 760,000 in 2008, drastically shrinking the tax base required to sustain city services. Mounting debts, totaling $18 billion in liabilities, were driven by underfunded pensions, excessive borrowing, and declining revenues. The city's essential services deteriorated, with infrastructure failures and safety concerns exacerbating the crisis. Facing these challenges, Detroit filed for Chapter 9 bankruptcy on July 18, 2013 to restructure its obligations.

To assess whether Detroit's bankruptcy might have been avoidable and to explore potential alternative policy responses, we apply our model and its optimal policies to the Detroit case. Using 2009 as a benchmark year, we simulate the city's economy by initializing the model with Detroit's economic conditions in 2009 and feeding in economic shocks experienced by the city from 2010 to 2019.[15] In 2009, Detroit ranked in the 37^{th} percentile for capital stock per capita and the 91^{st} percentile for tax millage among U.S. cities, with a debt-to-capital ratio of 0.7 which is well above the sample average. These values inform the model's initial state. The initial productivity level is set at 0.94, which reflects the significant financial shock from 2008 and corresponds to roughly two standard deviations from the steady state. Capital stock is initialized at 37% of its upper bound, the tax rate at 91% of its maximum, and debt at 70% of the initial capital stock. The simulation runs for 10 periods, tracking percentage changes relative to these initial values over time.

[Figure 4 about here.]

The results, comparing empirical data to model-generated dynamics, are presented in Figure 4. This figure traces five key variables: capital stock, debt-to-capital ratio, tax rates, total income, and population.[16] The actual data is depicted by a black dashed line, while the model simulations are represented by a blue line with circles.

Facing fiscal distress, Detroit adopted reactive measures that proved counterproductive. The city reduced infrastructure spending while dramatically increasing debt issuance, driving the debt-to-capital ratio up 21% in 2010. Subsequent tax increases beginning in the second period exacerbated the crisis by accelerating population decline and tax base erosion, further weakening the city's fiscal position.

Our model prescribes a different fiscal adjustment strategy. Instead of cutting infrastructure investments, which are essential for retaining residents and human capital, the model prioritizes sustained public infrastructure spending. Given Detroit's excessive debt burden and elevated tax rates in 2009, the optimal strategy involves simultaneously reducing debt reliance and lowering tax rates over time. This approach generates substantial decline in the debt-to-capital ratio while gradually easing tax burdens, promoting long-term fiscal stability and economic recovery.

To finance infrastructural expansion and cover operational costs, our model suggests a proactive and front-loaded adjustment. Specifically, it introduces a one-period emergency tax increase early in the adjustment process to alleviate fiscal pressures. This early intervention creates the fiscal space needed to stabilize the city's finances, and prevent the downward spiral that ultimately led to bankruptcy.

It is important to clarify that while our model formalizes the early intervention as a one-time emergency tax collected from local residents, it serves as a proxy for a structural fiscal overhaul. Such an overhaul would mean gradually lowering long-term tax rates and moving away from excessive borrowing. Meanwhile, it would prioritize investment in infrastructure and essential

[15] Our analysis begins in 2009, as economic shocks constructed from the U.S. Census American Community Survey (ACS) are only available from 2010 onwards.

[16] The debt-to-capital stock ratio is presented in Figure 4 instead of the debt-to-income ratio because calculating the initial income level requires contemporaneous population and wage information for that period, which are unavailable in this simulation.

services to attract and retain residents. Together, these measures would help rebuild the tax base and restore the city's fiscal health.

While historical and political constraints prevented Detroit from implementing optimal policies earlier, which contributed to fiscal collapse, our simulation reveals important lessons. Structural reforms that simultaneously address debt management, infrastructure investment, and taxation prove superior to reactive measures. Such comprehensive strategies, if adopted proactively, could have fundamentally changed Detroit's fiscal outcome.

We then restrict the use of emergency-call as a means of alleviating fiscal pressures and re-evaluate the optimal policy paths for Detroit. Specifically, we double the cost associated with declaring an emergency call and re-simulate the economy. The results from this counterfactual exercise are depicted by the magenta dashed line with stars in Figure 4.

As the figure shows, when the cost of declaring an emergency call rises by 100%, Detroit shifts away from this option and leans more on alternative fiscal tools. In particular, both tax rates and leverage decline less sharply than in the benchmark simulation, while the size of the emergency tax collection is reduced. Meanwhile, growth in capital stock and total income remains comparable to the benchmark case with low costs but follows a smoother trajectory. These findings further support the model's proposed fiscal adjustment strategy.

6.2.2 Janesville case

Janesville, Wisconsin, presents a sharp contrast to Detroit's experience. A small industrial city historically reliant on a major General Motors plant, Janesville suffered a serious economic shock when the plant closed in 2008, triggering job losses and economic stagnation. The population, hovering around 63,000, faced mounting out-migration pressures. Yet unlike Detroit, Janesville managed to maintain fiscal stability. City leaders controlled debt levels, preserved core public services, and strategically invested in infrastructure to support local businesses and attract new residents. Through careful financial management and well-timed tax adjustments, Janesville avoided the kind of fiscal breakdown seen in Detroit.

[Figure 5 about here.]

To examine Janesville's fiscal dynamics within our framework, we simulate its economy starting in 2009, initializing the model with the city's actual conditions and applying its sequence of productivity shocks from 2010 to 2019. At the outset, Janesville ranked in the 61^{st} percentile for capital stock per capita, 53^{rd} percentile for tax millage, and held a debt-to-capital ratio of 0.53. As with Detroit, the model tracks percentage changes from these initial values over a 10-period horizon. The empirical and simulated dynamics are shown side by side in Figure 5.

The model successfully captures the direction of change in Janesville's key fiscal indicators. Movements in infrastructure stock, leverage, income, and population generally follow observed trends, though the simulated magnitudes tend to exceed their empirical counterparts. One key difference, however, arises in tax policy. Starting in 2014, Janesville raised its tax rates, whereas the model advises reducing them from the sixth period onward. In our baseline simulation, temporary emergency tax hikes are used to stabilize fiscal conditions, thereby avoiding sustained tax increases.

To address this discrepancy, we re-run the simulation with doubled emergency call costs to assess whether the model better matches Janesville's policy choices. The results (magenta dashed line in Figure 5) confirm this expectation. Higher emergency costs prompt substitution toward tax adjustments, producing tax rates that closely track the empirical path. Emergency calls become less frequent and smaller, while capital stock and debt-to-capital fluctuations diminish, yielding a more stable adjustment path consistent with observed data. Fiscal adjustment shifts toward gradual tax changes rather than frequent emergency interventions.

Our model further suggests that Janesville would benefit from declaring an emergency call early in the period to ease fiscal pressures and stabilize its finances. In reality, a comparable adjustment took place in 2011 when the city carried out a city-wide property revaluation. Property values rose by 9.2% accordingly, while the growth in the total property tax levy required to meet that year's budget was 3.2%. This allowed the property tax rate to decline by 5.6%. The fiscal effects of this reassessment closely mirror those of the early emergency tax measure proposed by the model. Both approaches provide a timely fiscal adjustment that reduces tax rates and debt burdens while maintaining stable revenues. These early interventions improve fiscal sustainability without undermining essential services or increasing reliance on debt.

6.3 Model extension

After presenting the main results, we extend our model by incorporating a risky municipal bond, allowing cities to default on their debt obligations. This extension enables us to examine whether the main findings remain robust when municipalities have the additional option of default in response to fiscal stress.

In our benchmark model, municipal borrowing is subject to a collateral constraint, which limits the amount of debt a municipality can issue based on the value of its infrastructure. This assumption captures the stylized fact that municipalities rarely default. As an extension, we relax this constraint by allowing municipalities to issue risky debt. Specifically, we assume that the municipality borrows from competitive and risk-neutral lenders who have perfect information about the government and the economy. As such, the one period bond yields expected zero profits. Given the payoffs in case of defaults and repayment are $\chi(1-\delta)q'$ and b', respectively, the lenders' expected zero profit condition gives the price of debt as follows:

$$p'(z', q', \tau, b')b' = \frac{1}{1+r}\mathbb{E}\{b'\mathbb{1}_{V'\geq 0} + \chi(1-\delta)q'\mathbb{1}_{V'<0}\}, \tag{18}$$

where the indicator function $\mathbb{1}_s$ equals 1 if the event s occurs and zero otherwise.

We then re-estimate the model under this relaxed borrowing environment and examine its implications for the dynamics of municipal leverage and tax rates in response to a positive economic shock that induces in-migration. The presence of risky borrowing alters the municipality's intertemporal trade-offs, allowing it to partially smooth fiscal adjustments by issuing higher-cost debt when collateral constraints would otherwise bind. To focus on the quantitative implications of this extension, we calibrate the model using the same set of target moments as in the benchmark case. The newly estimated parameters, along with the corresponding model-generated moments, are reported in Table 12.

[Table 12 about here.]

As shown in Table 12, the parameter estimates remain broadly consistent with those from the benchmark case. The model-generated moments exhibit modest adjustments under the relaxed borrowing environment. In particular, the frequency of fiscal deficits and the average operating surplus-to-total income ratio move closer to the empirical targets, reflecting improved model performance in capturing municipal fiscal behavior. In addition, tax rate adjustments become less frequent, while debt rises as a share of the capital stock. This pattern reflects the municipality's enhanced ability to absorb fiscal shocks through increased, though more expensive, borrowing rather than relying on immediate tax policy changes.

We further examine the dynamic response of municipal fiscal choices to a positive 2.5% economic shock and illustrate how tax rates and leverage adjust over time following the shock. The impulse response functions, displayed in Figure 6, trace the dynamics of these key variables, capturing the municipality's fiscal adjustment process under the relaxed borrowing environment.

[Figure 6 about here.]

The results indicate that allowing for risky borrowing does not alter the direction of fiscal adjustments in response to a positive economic shock, though it does affect the magnitude of those adjustments. Specifically, we continue to observe increases in infrastructure investment, tax rates, total income, and total expenditure, along with a decline in municipal leverage. However, the drop in leverage is notably smaller under the relaxed borrowing environment, as municipalities rely more on debt issuance to finance the fiscal expansion rather than solely adjusting tax policy.

In addition, we examine the response of municipal bond yields to the shock. As reported in Figure 6, following the positive economic shock and resulting in-migration, municipal bond yields decline by approximately 0.5%. This reduction reflects improved fiscal capacity and reduced default risk associated with stronger economic conditions and a larger infrastructure stock. This finding is consistent with evidence from several empirical studies documenting that in-migration is associated with lower municipal borrowing costs (Zimmerschied, 2025).[17]

Overall, while the extension moderates the magnitude of certain fiscal adjustments, it does not alter the qualitative dynamics of the model. Municipalities continue to respond to positive economic shocks with increases in tax rates, accompanied by a reduction in leverage. The extended model also retains its ability to match key empirical moments and bond yield responses, reaffirming the robustness of our findings to alternative borrowing assumptions.

6.4 Suggestive evidence for model mechanisms

Our model highlights the importance of the tax elasticity of labor mobility in shaping municipalities' financing responses to in-migration, debt financing vs. tax financing. Specifically, when the tax elasticity of labor mobility is high, increases in tax rates are more likely to prompt out-migration, discouraging tax-based financing and encouraging greater reliance on debt. Conversely, when tax elasticity is low, municipalities are more inclined to adjust tax rates rather than increase debt. In this subsection, we provide empirical evidence to test this key mechanism proposed by our theory.

To implement this test, we exploit cross-sectional variation in labor mobility across municipalities, determined by the composition of their local industries. Specifically, we classify each city in our sample into a 2-digit sector based on its workforce mobility level, assigning scores of 3 (high mobility), 2 (medium mobility), or 1 (low mobility), following the criteria presented in Table A4. Using these sector-level scores, we construct a workforce mobility index for each city by taking the weighted average of sector mobility scores, with employment shares in each sector as weights. This calculation is performed for the year 2010 to capture pre-shock labor market conditions. We sort municipalities by their workforce mobility index and present the results in Figure 7. This choropleth map illustrates geographic differences in workforce mobility across U.S. cities. Each city is shown as a point, colored according to its mobility score on a continuous scale, where higher values represent greater workforce mobility and lower values indicate a more locally anchored labor force.

[Figure 7 about here.]

Figure 7 reveals clear and intuitive patterns. University towns such as Ann Arbor, MI; Davis, CA; Palo Alto, CA; Chapel Hill, NC; and South Bend, IN consistently exhibit low workforce mobility,

[17]Cornaggia et al. (2025) find that the impact of unauthorized immigration on municipal bond yields depends significantly on local labor market conditions. In regions facing structural labor shortages, unauthorized immigrants fill critical workforce gaps, thereby lowering municipal bond yields. Conversely, in areas without labor shortages, unauthorized immigration increases municipal expenditures without a matching rise in revenue, leading to higher bond yields. Our model highlights that the key determinant of unauthorized immigrants' effect on municipal bond yields is their economic contribution to the local labor market.

reflecting their roles as innovation hubs anchored by stable, specialized employment bases. In contrast, cities with large service-oriented economies, including Las Vegas, NV; Palm Springs, CA; and Miami, FL, display distinctly higher labor mobility. Among major metropolitan areas, there is considerable heterogeneity: cities like Boston, MA; Cedar Rapids, IA; Detroit, MI; Chicago, IL; and Cleveland, OH rank lower in mobility, while New York, NY; Austin, TX; Salt Lake City, UT; and Seattle, WA fall toward the higher end of the workforce mobility scale.

Based on the resulting distribution of city-level mobility indices, we next classify municipalities as high-mobility if their index falls above the 66th percentile and low-mobility if it falls below the 33rd percentile, and run debt and tax regression models for these two groups of cities, separately. Estimation results are presented in Table 13.

[Table 13 about here.]

The results reveal significant differences in fiscal adjustment patterns across cities with varying degrees of workforce mobility. In cities with high workforce mobility, the financing patterns documented in Section 3 appear considerably weaker. Specifically, their leverage ratios show little response to in-migration, with the coefficient on changes in the working-age population statistically insignificant. Likewise, tax rates in these cities rise by a much smaller magnitude than the average effect observed in the full sample.

In contrast, cities with low workforce mobility display adjustment patterns closely aligned with those documented in Section 3. These municipalities experience both a significant reduction in leverage and an increase in tax rates following positive labor migration, reflecting their heavier reliance on tax-based financing when workforce mobility constraints limit the risk of out-migration caused by taxation.

Taken together, these findings provide suggestive empirical support for the key mechanisms embedded in our theoretical framework. They highlight the role of labor mobility in shaping how municipalities balance tax and debt financing in response to demographic and economic shocks.

7 Conclusion

We investigate the role of labor mobility in municipal finance, documenting a new and key empirical regularity: in-migration following positive economic shocks prompts municipalities to shift from debt toward tax financing. This finding challenges both classical public finance predictions and existing empirical evidence.

We develop a structural model to rationalize these empirical observations, featuring endogenous population responses to economic conditions, infrastructure, and tax policies. Positive economic shocks generate labor demand and in-migration, affecting municipal leverage through three competing mechanisms. The tax base expansion channel increases revenues and reduces debt dependence. The infrastructure demand channel raises capital investment requirements and financing needs. The borrowing capacity channel relaxes debt constraints through expanded infrastructure. We find that when the tax elasticity of mobility is low, the tax base expansion effect dominates by improving the returns to taxation. Municipalities respond to in-migration by raising tax rates, and the resulting revenue gains more than offset the increased financing demands, explaining our key empirical results.

We explore policy implications through counterfactual analysis of Detroit's fiscal crisis. Rather than the reactive measures Detroit actually employed, our model suggests fiscal stability required: sustained infrastructure investment, reduced debt dependence, lower tax rates, and early structural reforms addressing financial distress. This proactive strategy emphasizes early intervention, sound debt management, targeted tax relief, and strategic infrastructure development to maintain population and economic vitality. The approach aligns with successful recovery patterns observed in communities like Janesville during and after the Great Recession.

Our study provides valuable guidance for policymakers in designing responsive and sustainable fiscal policies tailored to the needs of their communities. However, our framework also raises important questions for further research, such as how potential China Shock 2.0 and Trump 2.0 influence municipal financial decisions and what their distributional impacts are for local governments. Addressing these questions presents opportunities for future exploration.

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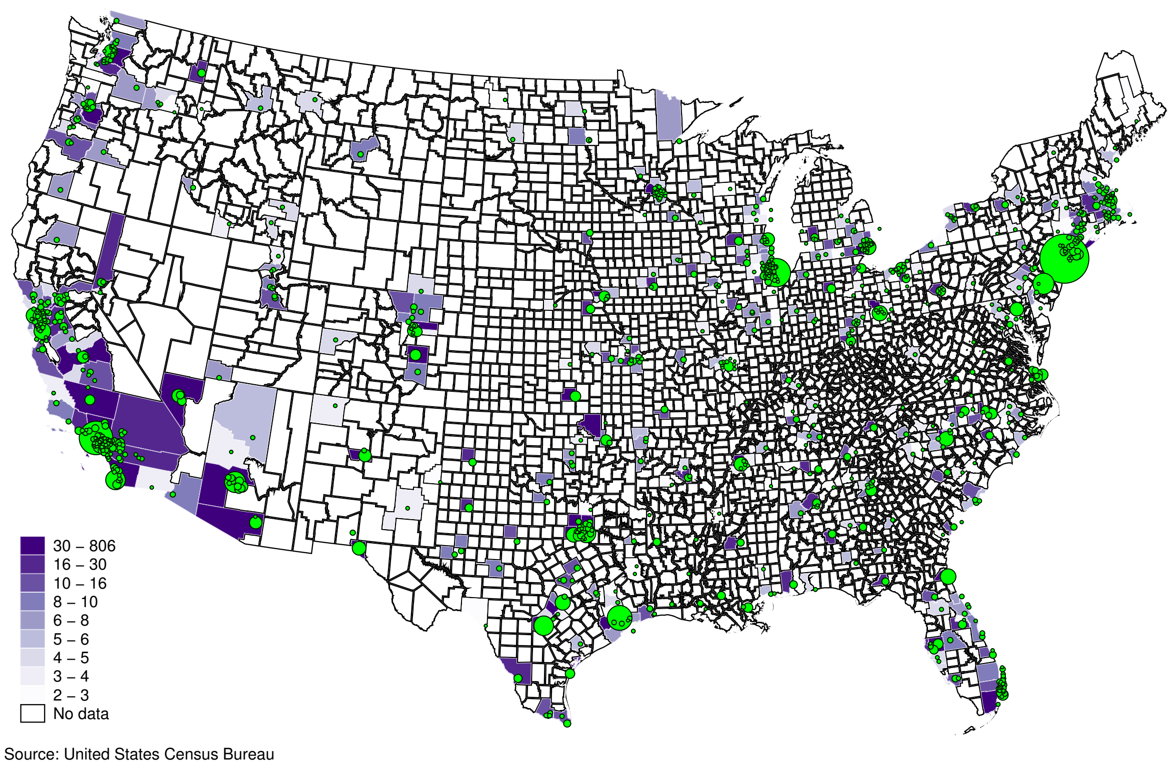
Figure 1: **Distribution of Sampled Municipalities.**



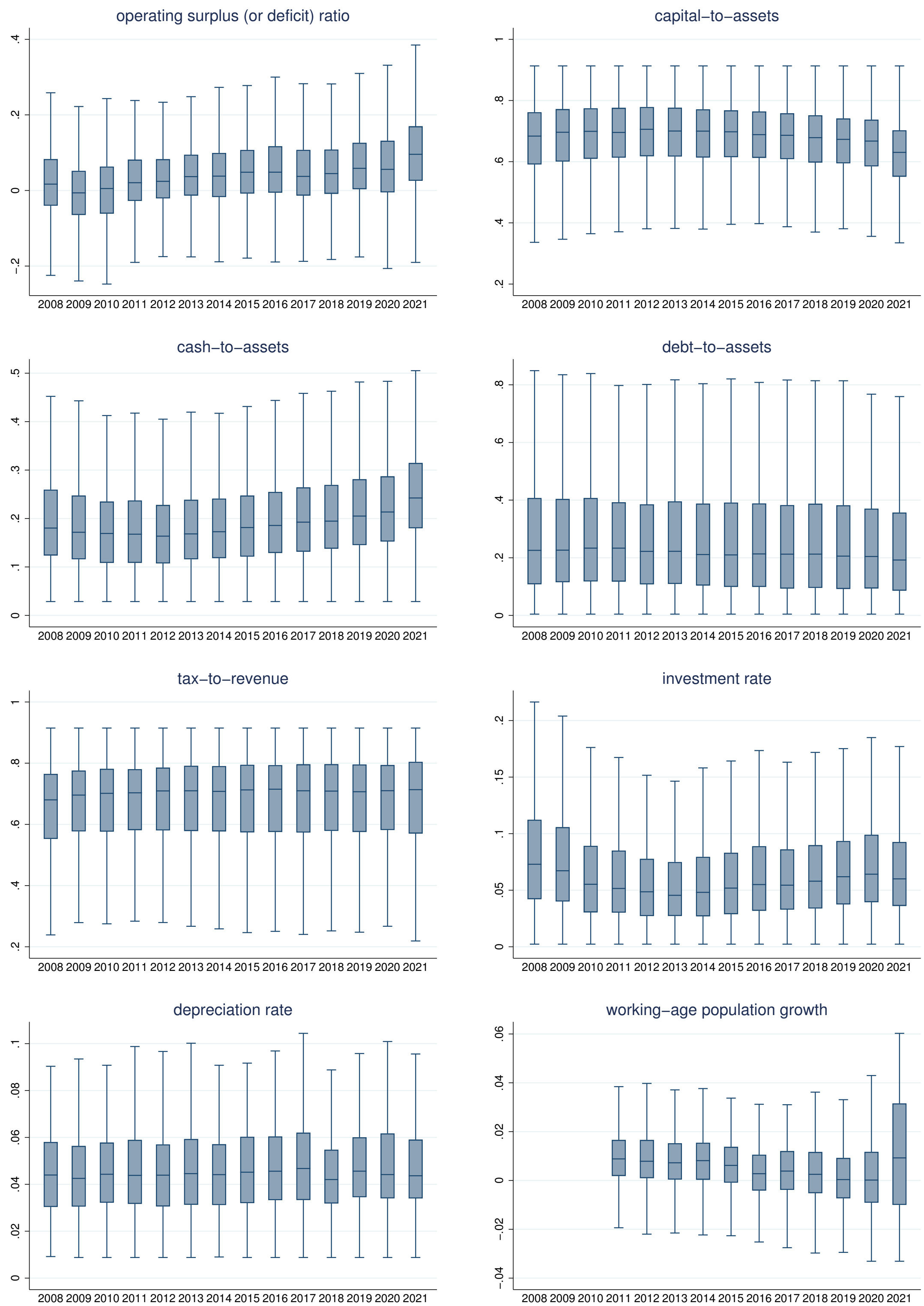


Figure 2: **Over-time Dynamics of Municipal Financials and Working-age Population (2008–2021).** The figure displays the dynamics of key municipal financials and working-age population from 2008 to 2021. The center line in each box represents the median (50^{th} percentile) of each variable. The box's lower and upper edges indicate the 25^{th} and 75^{th} percentiles, respectively, with the interquartile range being the difference between these two quartiles. The lower "whisker," known as the lower adjacent value, equals the 25^{th} percentile minus 1.5 times the interquartile range, while the upper "whisker," or upper adjacent value, equals the 75^{th} percentile plus 1.5 times the interquartile range.

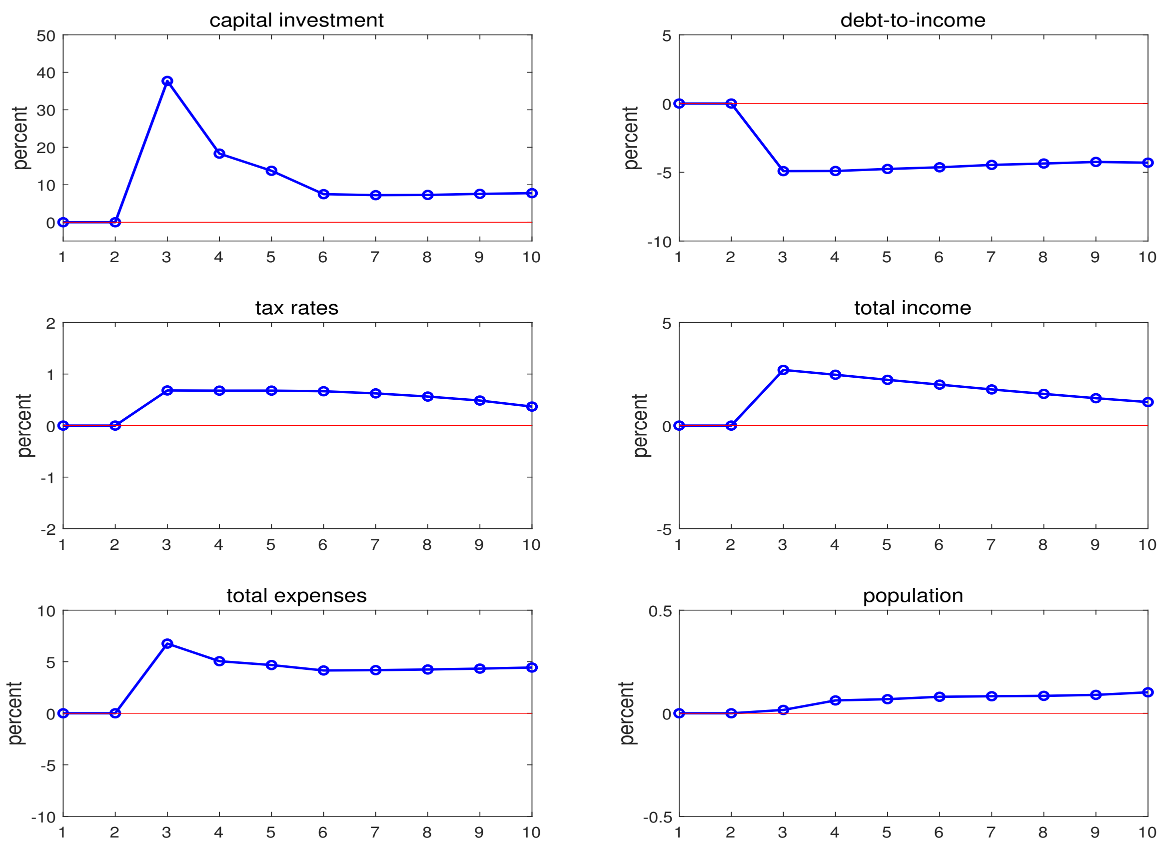


Figure 3: **Impulse Responses to Positive Shocks.** The figure depicts the dynamic responses of investment, the debt-to-income ratio, tax rates, total income, total expenses, and population to a temporary 2.5% positive shock introduced in period three.

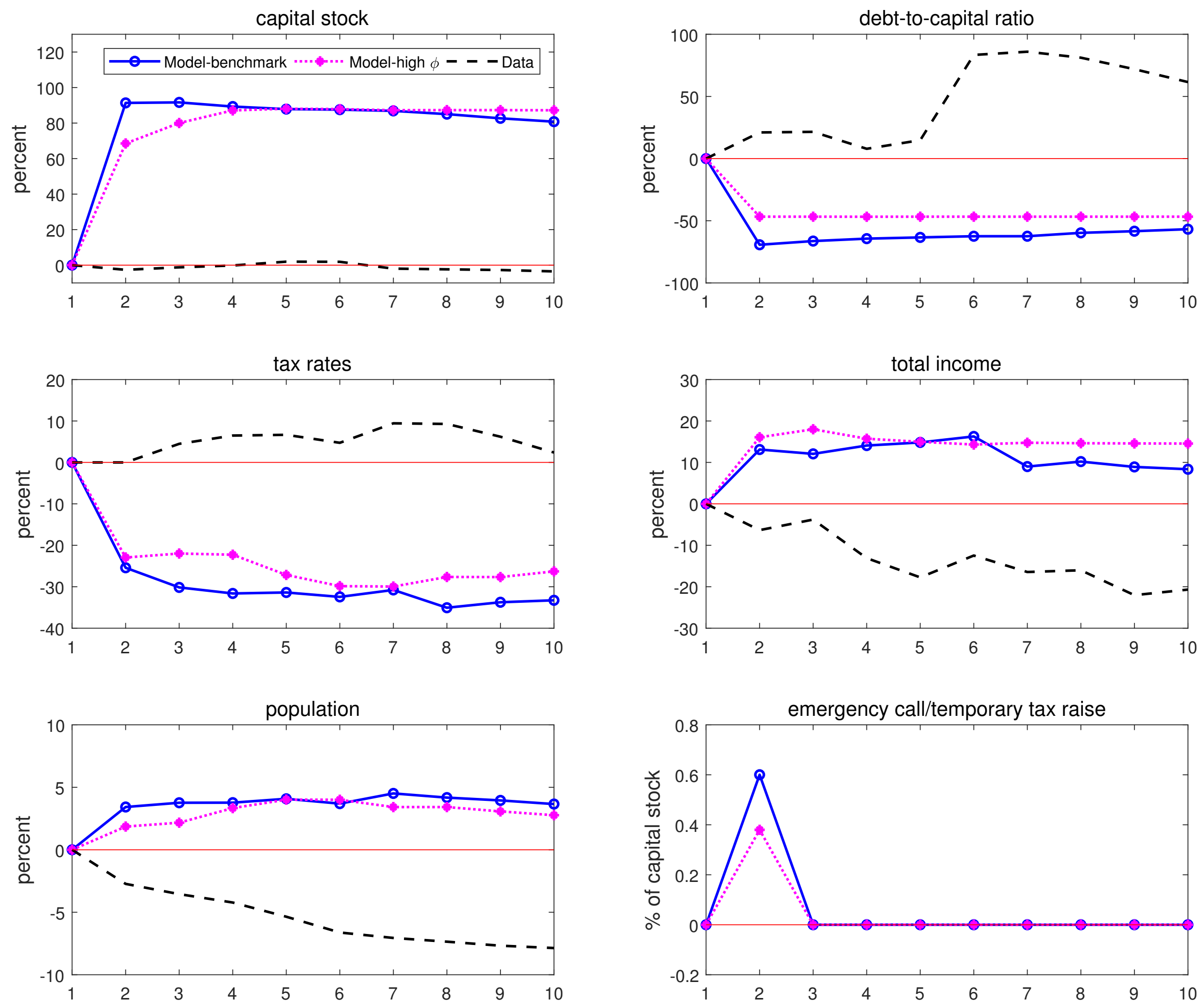


Figure 4: **Detroit and Model Implications.**The figure presents the actual and model-simulated dynamics of investment, the debt-to-capital ratio, tax rates, total income, and population in Detroit from 2009 to 2019. Actual data are shown by a black dashed line, the benchmark model simulation is depicted by a blue line with circles, and the model simulation with high emergency call costs is represented by a magenta dashed line with stars. A solid red line marks the zero baseline for reference.

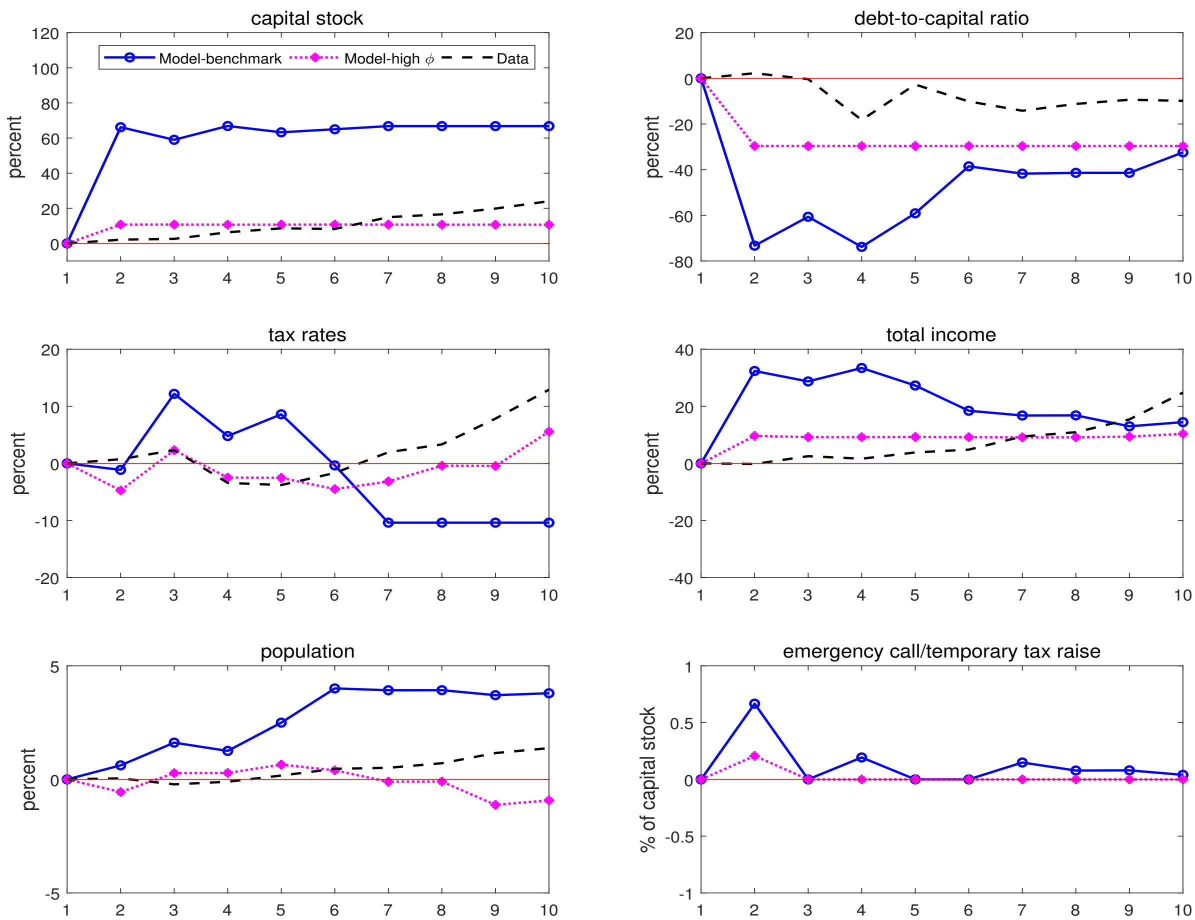


Figure 5: **Janesville and Model Implications.** The figure illustrates the actual and model-simulated dynamics of investment, debt-to-capital ratio, tax rates, total income, and population in Janesville from 2009 to 2019. Actual data is represented by a black dashed line, while the benchmark model simulation is shown as a blue line with circles, and the model simulation with high costs associated with emergency call is plotted in a magenta dashed line with stars. A solid red line marks the zero baseline for reference.

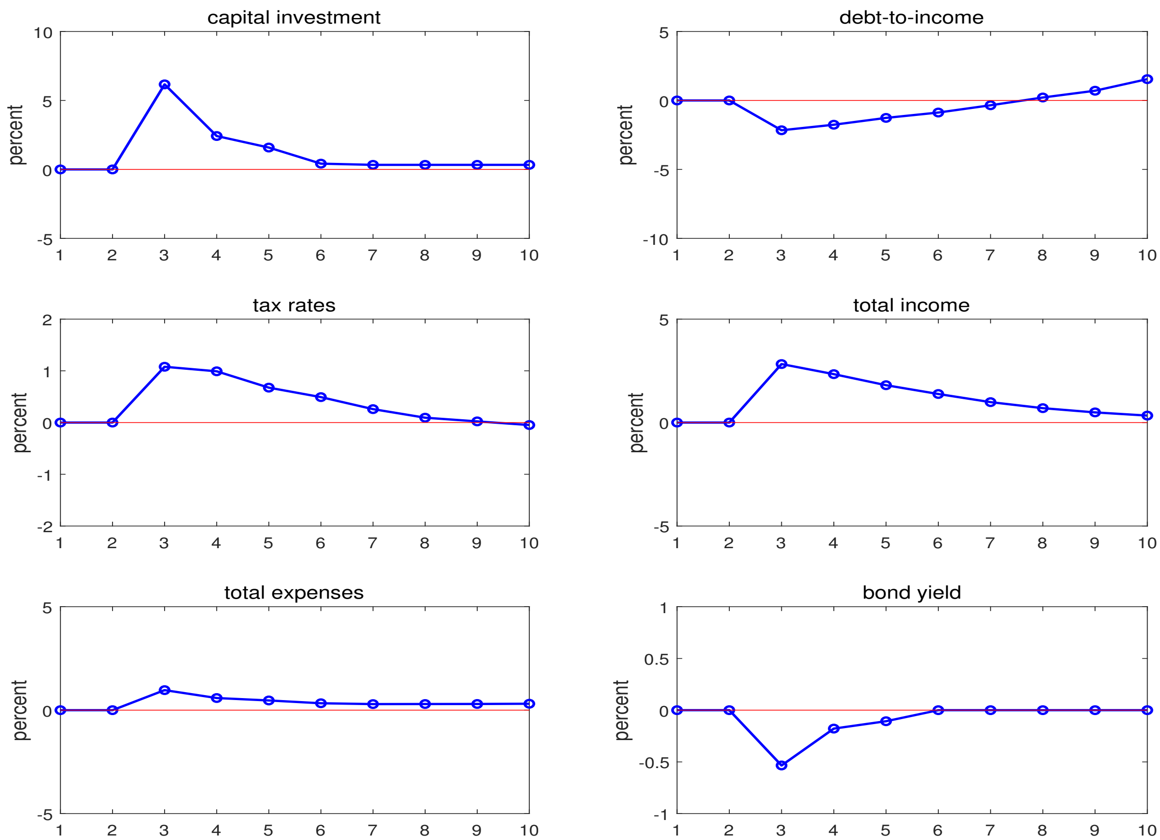


Figure 6: **Impulse Responses to Positive Shocks.** The figure presents the dynamic responses of investment, the debt-to-income ratio, tax rates, total income, total expenses, and bond yield to a temporary 2.5% positive shock introduced in period three. In this extension of the baseline model, we replace the collateral constraint on debt borrowing with a defaultable debt.

Figure 7: **Workforce Mobility Index by U.S. City.** This choropleth map illustrates geographic differences in workforce mobility across U.S. cities. Each city is shown as a point, colored according to its mobility score on a continuous scale, where higher values represent greater workforce mobility and lower values indicate a more locally anchored labor force.

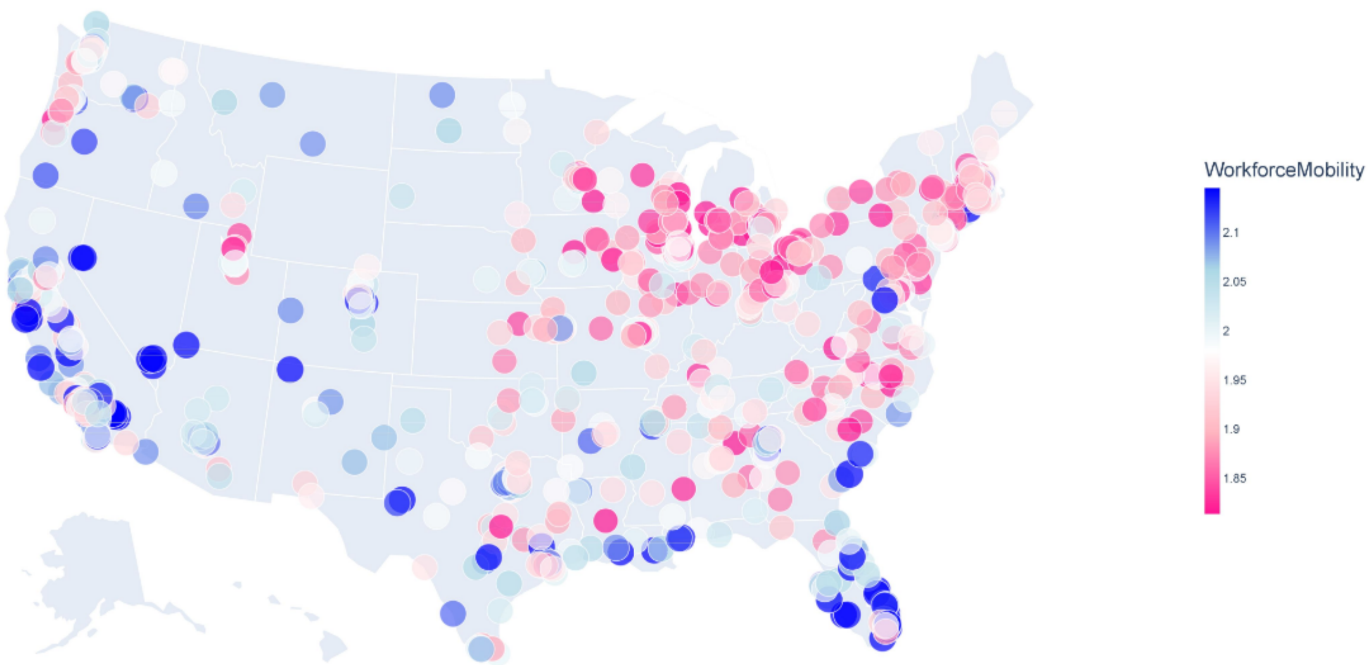


Table 1: **City Coverage and Population Sizes Across States**

State	no. of cities	average population	min	max
AL	13	100,646	26,370	210,083
AR	7	89,282	38,674	197,628
AZ	15	304,480	43,306	1,655,082
CA	206	136,788	31,050	3,981,140
CO	19	158,964	31,939	716,340
CT	31	63,840	26,928	145,012
DE	2	54,331	38,089	70,573
FL	56	125,675	34,778	904,170
GA	17	113,169	32,866	498,772
IA	12	83,980	36,356	216,304
ID	6	87,629	32,812	228,608
IL	67	97,761	24,590	2,700,968
IN	6	120,389	63,384	267,438
KS	10	120,503	36,191	389,527
KY	6	190,244	30,960	618,997
LA	11	125,259	28,879	391,506
MA	53	71,807	30,339	692,048
MD	6	146,840	39,243	603,241
ME	3	44,963	32,168	66,567
MI	54	71,176	24,425	673,658
MN	26	85,505	36,115	424,310
MO	17	107,603	29,197	492,755
MS	8	60,994	29,847	163,784
MT	4	69,363	34,062	109,490
NC	22	162,944	33,731	874,187
ND	4	75,589	47,504	124,504
NE	4	217,279	51,414	477,404
NH	4	69,638	33,562	112,556
NM	7	139,462	38,646	559,677
NV	6	268,206	55,287	644,055
NY	58	233,042	19,807	8,396,614
OH	47	84,127	6,228	891,448
OK	10	167,401	36,432	648,241
OR	14	128,662	39,518	651,154
PA	29	111,302	30,462	1,586,422
RI	9	67,310	32,641	179,569
SC	10	77,231	37,598	136,359
SD	2	128,506	76,363	180,649
TN	16	159,288	39,186	667,772
TX	75	205,742	32,534	2,314,478
UT	11	88,687	33,993	200,492
VA	17	133,123	30,573	450,488
VT	1	42,735	42,735	42,735
WA	30	108,500	32,990	742,889
WI	22	90,485	32,525	591,961
WV	2	36,948	26,762	47,134
WY	1	64,076	64,076	64,076
Total	1,056			

Table 1 reports the number of cities in each state, along with the population sizes of both the smallest and largest cities within each state in 2018.

Table 2: **Summary Statistics of Municipal Financials**

	Mean	Std Dev	Median	Min	Max	No. of Obs
Panel A: **Financial strength**						
Operating surplus (or deficit) ratio	0.04	0.14	0.04	-0.51	0.55	14604
Deficit dummy	0.33	0.47	0.00	0.00	1.00	14650
Panel B: **Assets and liabilities**						
Capital-to-total assets	0.67	0.12	0.69	0.33	0.91	14466
Cash-to-total assets	0.20	0.10	0.19	0.03	0.52	14554
Gross direct debt-to-total assets	0.30	0.27	0.22	0.00	1.00	14650
Total liability-to-total assets	0.54	0.46	0.42	0.04	2.60	14485
Panel C: **Revenue**						
Tax-to-total revenue	0.67	0.16	0.71	0.15	0.91	14560
Service charge-to-total revenue	0.23	0.14	0.20	0.03	0.79	14539
Millage rate (‰)	16.6	31.2	8.15	0.071	225.2	13415
Tax-adjustment frequency	0.55	0.36	0.64	0.00	0.93	13617
Panel D: **Capital investment**						
Investment-to-capital stock	0.07	0.05	0.06	0.00	0.32	12115
Depreciation-to-capital stock	0.05	0.02	0.04	0.01	0.14	3514
Investment-rate volatility	0.03	0.02	0.03	0.002	0.102	14190
Panel E: **Debt issuance**						
Debt issuance-to-tax revenue	0.27	0.65	0.00	0.00	4.49	14570
Debt issuance-to-total revenue	0.16	0.35	0.00	0.00	2.30	14614
Debt service fee-to-noncapital expenditure	0.10	0.07	0.09	0.00	0.35	10623
Panel F: **Demographics**						
Working-age population annual growth	0.006	0.015	0.005	-0.033	0.06	10388

Table 2 reports summary statistics for a range of municipal financial indicators, including government deficits, assets and liabilities, revenue sources, capital investment, and debt issuance. Panel A summarizes the operating surplus (or deficit) ratio and the frequency of deficits. Panel B presents ratios of capital-to-total assets, cash-to-total assets, gross direct debt-to-total assets, and total liabilities-to-total assets. Panels C, D, and E detail the revenue composition, capital investment patterns, and debt financing behaviors, respectively. Panel F shows the growth rate of the working-age population. For each variable, the table reports the mean, standard deviation, median, minimum, maximum, and number of observations, covering the period from 2008 to 2021. We apply winsorization at the 1% bottom and top levels for all variables to mitigate the influence of outliers.

Table 3: **Summary Statistics of Regression Variables**

	Mean	Std Dev	Median	Min	Max	No. of Obs
Δ Leverage ratio$_1$	-0.004	0.015	-0.003	-0.106	0.086	964
Δ Leverage ratio$_2$	-0.010	0.030	-0.010	-0.204	0.216	736
Δ Leverage ratio$_3$	-0.173	0.953	-0.141	-5.660	5.996	969
Δ Millage rate	0.001	0.009	0.000	-0.103	0.113	946
Δ Lagged WA population (log)	0.056	0.085	0.045	-0.139	0.545	939
Δ Lagged surplus ratio	0.068	0.146	0.047	-0.681	0.746	1035
Δ Lagged capital-to-assets	-0.024	0.098	-0.026	-0.441	0.370	1027
Δ Lagged cash-to-assets	0.039	0.086	0.036	-0.343	0.440	1027
Δ Lagged size (log)	0.043	0.343	0.048	-2.478	3.712	1021
Δ Lagged productivity	0.008	0.093	0.003	-0.311	0.311	1033
Δ Lagged housing price (log)	0.057	0.195	0.051	-0.463	0.508	1021
Δ Borrowing Cost	-0.000	0.005	0.000	-0.018	0.032	844
NTR gap (IV$_1$)	5.615	2.671	5.194	0.732	21.74	1049
Δ Import tariffs (IV$_2$)	-0.025	0.014	-0.022	-0.105	-0.003	1049
Δ Chinese imports (IV$_3$)	0.815	0.854	0.797	-4.310	11.12	1041

Table 3 presents summary statistics for the variables used in our regressions, including leverage ratios, millage rates, working-age population, operating surplus/deficit, capital investment, cash and short-term investments, municipal size, productivity, borrowing costs, and instrument variables related to Chinese imports. For each variable, the table provides the mean, standard deviation, median, minimum, maximum values, and the number of observations.

Table 4: **Labor Migration and Leverage: Baseline Analysis**

	I. OLS			II. WLS		
	(1)	(2)	(3)	(4)	(5)	(6)
Δ WA population (log)	-0.028***	-0.020***	-0.021***	-0.027***	-0.019***	-0.020**
	(0.005)	(0.007)	(0.008)	(0.004)	(0.007)	(0.008)
Δ Surplus (or deficit) ratio		-0.013***	-0.012***		-0.013***	-0.013***
		(0.003)	(0.004)		(0.003)	(0.004)
Δ Capital-to-assets		-0.030***	-0.028***		-0.030***	-0.029***
		(0.008)	(0.009)		(0.008)	(0.009)
Δ Cash-to-assets		-0.030***	-0.027***		-0.030***	-0.028***
		(0.008)	(0.009)		(0.008)	(0.009)
Δ Size (log)		0.004*	0.004		0.004*	0.004
		(0.002)	(0.003)		(0.002)	(0.003)
Δ Productivity		0.005	0.008		0.004	0.008
		(0.005)	(0.006)		(0.005)	(0.006)
Δ Housing price (log)		-0.006*	-0.006*		-0.006*	-0.007*
		(0.003)	(0.004)		(0.003)	(0.004)
Δ Debt borrowing cost			0.024			0.020
			(0.177)			(0.181)
R-squared	0.030	0.088	0.072	0.028	0.087	0.071
No. of Obs.	864	827	696	864	827	696

Table 4 presents the estimation results of the impact of labor migration on leverage. Other independent variables including operating surplus-to-revenue ratio, capital-to-assets ratio, cash-to-assets ratio, size, productivity, housing prices, and debt borrowing costs. The estimation follows a first-difference specification. We report heteroskedasticity-consistent standard errors in parentheses. Significance levels are indicated by *, **, and *** for 10%, 5%, and 1%, respectively.

Table 5: **Labor Migration and Leverage: Robustness**

	OLS			WLS		
	(1)	(2)	(3)	(4)	(5)	(6)
	A. Alternative Numerator					
Δ WA population (log)	-0.052***	-0.042***	-0.048***	-0.050***	-0.042***	-0.048***
	(0.011)	(0.014)	(0.015)	(0.011)	(0.014)	(0.015)
Δ Surplus (or deficit) ratio		-0.014*	-0.014		-0.014*	-0.014
		(0.008)	(0.009)		(0.008)	(0.009)
Δ Capital-to-assets		-0.044**	-0.035*		-0.047**	-0.036*
		(0.019)	(0.018)		(0.019)	(0.018)
Δ Cash-to-assets		-0.070***	-0.058***		-0.071***	-0.058***
		(0.018)	(0.017)		(0.019)	(0.017)
Δ Size (log)		0.015***	0.019***		0.015***	0.019***
		(0.006)	(0.007)		(0.006)	(0.007)
Δ Productivity		-0.002	0.012		-0.002	0.013
		(0.016)	(0.014)		(0.016)	(0.014)
Δ Housing price (log)		-0.016**	-0.018**		-0.015**	-0.017**
		(0.007)	(0.008)		(0.007)	(0.009)
Δ Debt borrowing cost			-0.195			-0.185
			(0.303)			(0.312)
R-squared	0.029	0.092	0.089	0.026	0.090	0.086
No. of Obs.	686	668	561	686	668	561
	B. Alternative denominator					
Δ WA population (log)	-1.632***	-1.012**	-0.931**	-1.607***	-0.989**	-0.908**
	(0.354)	(0.432)	(0.458)	(0.357)	(0.435)	(0.461)
Δ Surplus (or deficit) ratio		-0.992***	-0.841***		-1.001***	-0.857***
		(0.235)	(0.253)		(0.235)	(0.254)
Δ Capital-to-assets		-1.731***	-1.365***		-1.756***	-1.390***
		(0.486)	(0.485)		(0.481)	(0.482)
Δ Cash-to-assets		-1.239**	-0.895*		-1.254**	-0.891*
		(0.495)	(0.500)		(0.495)	(0.498)
Δ Size (log)		0.075	0.092		0.075	0.091
		(0.114)	(0.143)		(0.115)	(0.144)
Δ Productivity		0.353	0.517		0.332	0.508
		(0.320)	(0.378)		(0.324)	(0.382)
Δ Housing price (log)		-0.352*	-0.270		-0.350*	-0.268
		(0.189)	(0.207)		(0.190)	(0.208)
Δ Debt borrowing cost			-0.903			-1.057
			(3.929)			(3.967)
R-squared	0.030	0.090	0.056	0.028	0.089	0.056
No. of Obs.	869	825	694	869	825	694

Table 5 presents the results of our robustness tests, which assess the impact of labor migration on municipal leverage using alternative definitions of the leverage ratio. In Panel A, we modify the numerator by measuring debt as the sum of gross direct debt and net applicable overlapping debt. In Panel B, we alter the denominator, using total revenue in place of total personal income. The other independent variables remain the same, including operating surplus-to-revenue ratio, capital-to-assets ratio, cash-to-assets ratio, size, productivity, housing prices, and debt borrowing costs. All regressions are estimated using a first-difference specification. Significance levels are indicated by *, **, and *** for 10%, 5%, and 1%, respectively.

Table 6: **Labor Migration and Leverage: IV Estimators**

	Unweighted			Weighted		
	(1) IV_1	(2) IV_2	(3) IV_3	(4) IV_1	(5) IV_2	(6) IV_3
	A. 2SLS second stage estimates					
Δ WA population (log)	-0.087***	-0.076***	-0.069**	-0.089***	-0.078***	-0.072**
	(0.024)	(0.022)	(0.032)	(0.025)	(0.023)	(0.033)
Δ Surplus (or deficit) ratio	-0.005	-0.007	-0.007	-0.005	-0.007	-0.007
	(0.005)	(0.004)	(0.005)	(0.005)	(0.004)	(0.005)
Δ Capital-to-assets	-0.036***	-0.035***	-0.035***	-0.037***	-0.036***	-0.035***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Δ Cash-to-assets	-0.030***	-0.030***	-0.030***	-0.030***	-0.030***	-0.030***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Δ Size (log)	0.010***	0.009**	0.008**	0.010***	0.009**	0.008**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Δ Productivity	0.005	0.005	0.005	0.005	0.005	0.004
	(0.007)	(0.007)	(0.006)	(0.007)	(0.007)	(0.007)
Δ Housing price (log)	0.004	0.003	0.001	0.004	0.003	0.002
	(0.004)	(0.004)	(0.006)	(0.005)	(0.004)	(0.006)
	B. 2SLS first stage estimates					
Instrument	0.005***	-1.076***	0.018***	0.005***	-1.031***	0.018***
	(0.001)	(0.157)	(0.005)	(0.001)	(0.154)	(0.005)
F-Statistic	46.32	47.09	14.82	44.45	44.73	14.47
No. of Obs.	826	826	819	826	826	819

Table 6 presents the instrumental variable (IV) estimation results, assessing the impact of labor migration on leverage. Trade liberalization serves as an exogenous shock to local employment opportunities. In addition to working-age population, the model includes other key variables such as the operating surplus-to-revenue ratio, capital-to-assets ratio, cash-to-assets ratio, size, productivity, housing prices, and debt borrowing costs. The estimation follows a first-difference specification. Heteroskedasticity-consistent standard errors, clustered at either the county or community-zone level depending on the instrument used, are reported in parentheses. Significance levels are indicated by *, **, and *** for 10%, 5%, and 1%, respectively.

Table 7: **Labor Migration and Taxation**

	Unweighted			Weighted		
	(1)	(2)	(3)	(4)	(5)	(6)
	A. OLS estimates					
Δ WA population (log)	-0.001	0.012***	0.016***	-0.001	0.012***	0.016***
	(0.001)	(0.004)	(0.003)	(0.001)	(0.004)	(0.003)
Δ Surplus (or deficit) ratio		0.003**	0.004**		0.003**	0.004**
		(0.001)	(0.002)		(0.001)	(0.002)
Δ Capital-to-assets		-0.006	-0.009		-0.006	-0.009
		(0.007)	(0.009)		(0.007)	(0.009)
Δ Cash-to-assets		-0.001	-0.004		-0.001	-0.004
		(0.007)	(0.008)		(0.007)	(0.008)
Δ Size (log)		-0.009***	-0.012***		-0.009***	-0.012***
		(0.003)	(0.002)		(0.003)	(0.002)
Δ Productivity		0.002	0.004		0.002	0.003
		(0.003)	(0.003)		(0.003)	(0.004)
Δ Housing price (log)		-0.004***	-0.005**		-0.004***	-0.005**
		(0.002)	(0.002)		(0.002)	(0.002)
Δ Debt borrowing cost			0.072			0.074
			(0.079)			(0.079)
R-squared	0.0001	0.105	0.128	0.0001	0.103	0.127
No. of Obs.	853	815	667	853	815	667
	B. IV estimates					
	IV_1	IV_2	IV_3	IV_1	IV_2	IV_3
Δ WA population (log)	0.031**	0.028**	0.024**	0.033**	0.030**	0.026**
	(0.014)	(0.012)	(0.010)	(0.014)	(0.013)	(0.010)
Δ Surplus (or deficit) ratio	0.001	0.001	0.002	0.001	0.001	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Δ Capital-to-assets	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
	(0.008)	(0.007)	(0.008)	(0.008)	(0.007)	(0.008)
Δ Cash-to-assets	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Δ Size (log)	-0.011***	-0.011***	-0.011***	-0.012***	-0.011***	-0.011***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Δ Productivity	0.002	0.002	0.002	0.002	0.002	0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Δ Housing price (log)	-0.007**	-0.007**	-0.006**	-0.007**	-0.007**	-0.006**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
No. of Obs.	814	814	806	814	814	806

Table 7 presents the estimation results for the impact of working-age population dynamics on taxation, incorporating several independent variables: operating surplus-to-revenue ratio, capital-to-assets ratio, cash-to-assets ratio, size, productivity, housing prices, and debt borrowing costs. The analysis follows a first-difference specification, with Panel A utilizing OLS and Panel B employing an IV approach. We use trade-related variables as instruments to account for local employment fluctuations. Heteroskedasticity-consistent standard errors, clustered at the county or community-zone level depending on the instrument used, are provided in parentheses. Significance levels are denoted by *, **, and *** for 10%, 5%, and 1%, respectively.

Table 8: **Corporations vs. Municipalities**

	Corporation	Municipality
Objective	maximize shareholder value	maximize community welfare
Investment	profitable projects	public infrastructure and services
Capital structure	debt vs. equity	debt vs. taxation
Cost of “equity”	purchase of shares	payment of taxes
Benefit of holding “equity”	future dividend payments	access to services and transfer payments

Table 9: **Model Parameterization**

Table 9 summarizes the parameter values used to solve the model. The sample period covers 2008 to 2021.

Parameter	Value
Preference	
discount factor (β)	0.98
curvature of preference function(ψ)	0.53
Elasticity of working-age population	
economic-condition elasticity (κ)	0.043
public-infrastructure elasticity (α)	0.034
tax elasticity (θ)	−0.14
Technology and shocks	
capital share (η)	0.32
persistence of productivity shock (ρ_z)	0.76
standard deviation of productivity shock (σ_z)	0.032
Capital adjustment, depreciation, and charge	
linear capital adjustment costs ($\gamma_{1,q}$)	0.05
quadratic capital adjustment costs ($\gamma_{2,q}$)	0.20
resale price for disinvestment (χ)	0.40
capital depreciation rate (δ)	0.05
service charge (λ)	0.08
Financial and operation frictions	
fixed operating costs (c_0)	0.13
linear operating costs (c_1)	0.24
quadratic tax adjustment costs (γ_t)	1.16
fixed costs of emergency declare (ϕ_0)	1.00
linear costs of emergency declare (ϕ_1)	1.00

Table 10: **Model Moments**

Table 10 presents the targeted moments used in our estimation. The data moments are calculated from our sample of U.S. municipalities spanning the period from 2008 to 2021. The model moments, on the other hand, are obtained by solving and simulating the baseline model.

Moments	Definition	Data	Model
frequency of fiscal deficits	$\mathbb{1}_{wN\tau+\lambda q<I+c_0+c_1q+rd}$	0.327	0.258
frequency of tax rate adjustments	$\mathbb{1}_{\tau\neq\tau_{-1}}$	0.563	0.409
average operating surplus-to-total income ratio	mean$(\frac{wN\tau+\lambda q-I-c_0-c_1q-rd}{wN\tau+\lambda q})$	0.039	−0.024
average tax income-to-capital ratio	mean$(\frac{wN\tau}{q'})$	0.272	0.331
average debt-to-capital ratio	mean$(\frac{d'}{q'})$	0.398	0.425
average investment-to-capital ratio	mean$(\frac{I}{q'})$	0.068	0.051
average operating expenses-to-capital ratio	mean$(\frac{c_0+c_1q}{q'})$	0.313	0.281
average tax income-to-total income ratio	mean$(\frac{wN\tau}{wN\tau+\lambda q})$	0.667	0.737
standard deviations of the investment-to-capital ratio	sd$(\frac{I}{q'})$	0.034	0.010
standard deviations of the tax income-to-capital ratio	sd$(\frac{wN\tau}{q'})$	0.042	0.022

Table 11: **The Role of Migration**

Table 11 presents model moments under different assumptions. We compare five cases: the baseline model, a model with a fixed population, a model featuring only $\kappa = 0.043$, a model with only $\alpha = 0.034$, and a model with only $\theta = -0.14$. By analyzing the behavior of each model, we assess the impact of different labor migration elasticities.

Moments	Baseline	Perfect Immobility	$\kappa = 0.043$ only	$\alpha = 0.034$ only	$\theta = -0.14$ only
frequency of fiscal deficits	0.258	0.000	0.000	0.000	0.428
frequency of tax rate adjustments	0.409	0.019	0.088	0.054	0.150
average operating surplus-to-total income ratio	−0.024	0.423	0.474	0.407	−0.557
average tax income-to-capital ratio	0.331	0.546	0.614	0.532	0.286
average debt-to-capital ratio	0.425	0.454	0.442	0.467	0.397
average investment-to-capital ratio	0.051	0.050	0.050	0.050	0.051
average operating expenses-to-capital ratio	0.281	0.289	0.294	0.287	0.277
average tax income-to-total income ratio	0.737	0.866	0.880	0.861	0.613

Table 12: **Parameterization and Moments: Risky Bond**

Table 12 reports the parameter values used in the extended model with a risky bond (Panel A) and the corresponding moments (Panel B). The calibration is based on data from 2008 to 2021.

Panel A: Parameters estimated by matching moments		Value
curvature of preference function(ψ)		0.54
linear capital adjustment costs ($\gamma_{1,q}$)		0.05
quadratic capital adjustment costs ($\gamma_{2,q}$)		0.18
resale price for disinvestment (χ)		0.34
service charge (λ)		0.08
fixed operating costs (c_0)		0.13
linear operating costs (c_1)		0.25
quadratic tax adjustment costs (γ_t)		1.06
Panel B: Moments	Data	Model
frequency of fiscal deficits	0.327	0.302
frequency of tax rate adjustments	0.563	0.174
average operating surplus-to-total income ratio	0.039	0.054
average tax income-to-capital ratio	0.272	0.294
average debt-to-capital ratio	0.398	0.476
average investment-to-capital ratio	0.068	0.053
average operating expenses-to-capital ratio	0.313	0.278
average tax income-to-total income ratio	0.667	0.777
standard deviations of the investment-to-capital ratio	0.034	0.010
standard deviations of the tax income-to-capital ratio	0.042	0.028

Table 13: **Labor Migration and Municipal Finance: Mechanism Test**

	Unweighted		Weighted	
	(1) high mobility	(2) low mobility	(3) high mobility	(4) low mobility
		A. Leverage		
Δ WA population (log)	-0.013	-0.026**	-0.012	-0.026*
	(0.011)	(0.013)	(0.011)	(0.013)
Other controls	Yes	Yes	Yes	Yes
No. of Obs.	278	275	278	275
		B. Taxes		
Δ WA population (log)	0.008**	0.019***	0.008**	0.019***
	(0.004)	(0.007)	(0.004)	(0.007)
Other controls	Yes	Yes	Yes	Yes
No. of Obs.	287	264	287	264

Table 13 reports the estimation results examining the impact of labor migration on municipal leverage (Panel A) and tax rates (Panel B), separately for cities with high and low workforce mobility. The regressions control for a set of fiscal and economic covariates, including the operating surplus-to-revenue ratio, capital-to-assets ratio, cash-to-assets ratio, city size, productivity, housing prices, and debt borrowing costs. All specifications are estimated using a first-difference approach to account for unobserved time-invariant heterogeneity. Heteroskedasticity-consistent standard errors are reported in parentheses, and statistical significance is denoted by *, **, and *** for the 10%, 5%, and 1% levels, respectively.

A Appendix

A.1 the City of Auburn, Alabama's 2021 ACFR

In this section, we provide excerpts from key parts of the City of Auburn, Alabama's 2021 ACFR, covering the fiscal year ending on September 30, 2021. These excerpts serve to illustrate the type of information found in a typical government ACFR.

Figures A1 and A2 present the *Statement of Net Position*, which breaks down the municipality's assets and liabilities, with the net position representing the difference between these two categories. This statement gives a snapshot of the city's overall financial standing at the fiscal year, illustrating the resources it holds (assets) and the obligations it is responsible for (liabilities).

[Figure A1 about here.]

[Figure A2 about here.]

Figure A3 presents the *Statement of Activities*, which outlines the changes in the city's net position over the most recent fiscal year. This statement tracks how revenues and expenses have affected the city's financial health, offering a detailed view of its operational performance. Importantly, all changes in net position are recorded on an accrual basis, meaning they are recognized when the events triggering the changes occur, not when the related cash is received or paid.

[Figure A3 about here.]

Figure A4 presents the *Statement of Revenues, Expenditures, and Changes in Fund Balance*, which provides a detailed account of the city's financial activities related to its funds. This statement highlights the various revenue sources, including those for which cash is received either during the fiscal year or shortly thereafter. It also reports expenditures, reflecting the cost of goods and services that have been received, with payments due either within the fiscal year or soon after.

[Figure A4 about here.]

A.2 Variable definitions and construction

In this paper, we define the variables used in the regression analysis as follows:

Leverage ratio$_1$ is defined as the municipality's gross direct debt divided by its total personal income.

Gross direct debt includes the total amount incurred by the municipality through direct borrowing.

Total personal income is the product of city-level population and the average income per capita.

Leverage ratio$_2$ is defined as the sum of gross direct debt and net applicable overlapping debt over total personal income.

Net applicable overlapping debt refers to the financial obligations of one political jurisdiction that also falls partly on a nearby jurisdiction.

Working-age population is the total number of people between the ages of 18 and 64.

Surplus(or deficit)ratio is the difference between total revenue in the general fund and total expenditures in the general fund as a share of total revenue in the general fund.

Capital-to-assets ratio is proportion of total government activities capital assets (net) to total assets.

Cash-to-assets ratio is measured as the ratio of cash, cash equivalents, and short-term financial investment to total assets.

Size is defined as the logarithm of assessed taxable property value scaled by GDP deflator.

Productivity is the county-level total factor productivity (TFP), which captures the unexplained portion of value-added in county-level GDP that cannot be accounted for by changes in local private capital stock, labor inputs, macroeconomic shocks, or county-specific time-invariant characteristics.

Housing price is the logarithm of the county-level median property price index.

Debt borrowing cost is estimated by regressing bond offering yields on a set of bond characteristics, including a callable bond dummy, a pre-refunded bond dummy, a bank-qualified dummy, a general obligation bond dummy, an insured bond dummy, bond size, a negotiated offering dummy, a numeric credit rating, a rated bond dummy, an investment-grade dummy, time to maturity, state fixed effects, county fixed effects, and year-month fixed effects. The residual from this regression serves as our measure of characteristics-adjusted borrowing costs, covering both GO and revenue bonds. Due to the infrequent issuance of municipal debt and sparse yield observations, missing values are imputed using the municipality's most recent bond issuance yield.

IV$_1$ is the NTR gap, which measures the change in U.S. tariffs on Chinese imports that would have occurred if China's Normal Trade Relations (NTR) status had not been renewed in 1999. This is calculated at the county level by weighting industry-level tariff gaps with 1990 industry employment shares.

IV$_2$ is the county-level average change in Chinese import tariffs between 1996 and 2005, weighted by 1990 industry employment shares.

IV$_3$ is the change in the value of Chinese goods imported by non-U.S. high-income countries in each industry during the 2010s, weighted by 2000 industry employment in each U.S. commuting zone.

Millage rate is a property tax rate defined as the amount per $1,000 of assessed property value levied in taxes. Table A1 provides a detailed summary of variable construction.

[Table A1 about here.]

A.3 Labor Migration and Municipal Finance: Robustness

In this section, we present additional robustness tests by replacing the working-age population with the total population from the US Census American Community Survey (ACS) to assess its impact on municipal finance. The OLS and IV estimation results for leverage are shown in Table A2, while the results for taxation are presented in Table A3. As shown, the coefficient estimates for population are consistent with those in Tables 4, 6, and 7, further reinforcing the robustness of our findings on municipal finance.

[Table A2 about here.]

[Table A3 about here.]

Using population data from the US Census estimates, the results are similar. The OLS and first IV estimates for the effect of population on leverage are -0.021 and -0.068, respectively. Likewise, the corresponding estimates for the effect of population on taxation are 0.011 and 0.024.

A.4 Workforce Mobility by Economic Sector

To explore how labor mobility differs across cities and shapes municipal fiscal behavior, we classify economic sectors into three categories based on their typical workforce mobility: high, medium, and low. The specific classification criteria are detailed in Table A4. This framework enables us to test whether cities with a greater concentration of high-mobility industries respond differently to local migration changes in their tax and debt financing decisions compared to cities dominated by low-mobility sectors.

[Table A4 about here.]

Figure A1: **Auburn, Alabama's 2021 Statement of Net Position: Assets.**

CITY OF AUBURN, ALABAMA
STATEMENT OF NET POSITION
AS OF SEPTEMBER 30, 2021

	Primary Government			
	Governmental Activities	Business-type Activities	Total	Component Units
ASSETS	$	$	$	$
Current assets:				
Cash and cash equivalents	48,242,732	14,740,226	62,982,958	73,172,246
Certificates of deposit	178,479	-	178,479	59,466
Receivables, net	14,579,558	2,672,789	17,252,347	2,301,956
Accrued interest receivable	-	-	-	138,678
Due from component units	513,700	284,323	798,023	-
Inventories	286,279	48,757	335,036	586,125
Current portion of assessments receivable	182,910	-	182,910	-
Current portion of mortgages and notes receivable	133,355	-	133,355	-
Current portion of net investment in capital leases	-	-	-	1,195,923
Property tax receivable	-	-	-	9,683,054
Due from other governments	-	-	-	4,462,239
Due from primary government	-	-	-	1,890,925
Other current assets	688,708	50,258	738,966	188,348
Restricted cash	23,302,064	2,397	23,304,461	116,088
Total current assets	88,107,785	17,798,750	105,906,535	93,795,048
Noncurrent assets:				
Restricted assets				
Cash and cash equivalents	-	-	-	2,277,894
Mortgages and notes receivable, net of current portion	1,605,620	-	1,605,620	-
Investments	59,765,615	-	59,765,615	-
Net investment in capital leases, net of current portion	-	-	-	21,706,462
Property for resale	4,131,127	-	4,131,127	8,815,601
Capital assets not being depreciated	45,128,351	5,373,051	50,501,402	80,414,048
Capital assets net of accumulated depreciation	243,471,319	77,818,108	321,289,427	276,546,645
Total noncurrent assets	354,102,032	83,191,159	437,293,191	389,760,650
Total assets	442,209,817	100,989,909	543,199,726	483,555,698
DEFERRED OUTFLOWS OF RESOURCES				
Deferred amount on refunding	2,565,553	1,903,007	4,468,560	1,821,252
Pension related	10,697,581	926,342	11,623,923	23,037,317
OPEB related	2,282,864	255,931	2,538,795	23,896,564
Total deferred outflows of resources	15,545,998	3,085,280	18,631,278	48,755,133

Figure A2: **Auburn, Alabama's 2021 Statement of Net Position: Liabilities.**

CITY OF AUBURN, ALABAMA
STATEMENT OF NET POSITION
AS OF SEPTEMBER 30, 2021
CONTINUED

	Primary Government			
	Governmental Activities	Business-type Activities	Total	Component Units
LIABILITIES	$	$	$	$
Current liabilities:				
Liabilities payable from restricted assets:				
Due to other government	-	-	-	849
Current portion of long-term debt	-	-	-	1,353,475
Accrued interest payable	-	-	-	223,111
Accounts payable and other accrued liabilities	5,932,252	392,403	6,324,655	7,988,199
Payable to other governments	17,350	-	17,350	-
Due to component units	1,853,705	37,221	1,890,926	-
Accrued interest payable	2,982,835	123,665	3,106,500	-
Salaries and benefits payable	710,380	99,381	809,761	7,233,882
Claims payable	335,597	-	335,597	-
Customer deposits	262,887	708,789	971,676	595,000
Unearned revenue	10,607,070	-	10,607,070	1,417,368
Current portion of long-term debt	11,468,670	3,475,000	14,943,670	5,831,874
Due to primary government	-	-	-	798,023
Total current liabilities	34,170,746	4,836,459	39,007,205	25,441,781
Noncurrent liabilities:				
Long-term debt and other liabilities	254,339,467	25,913,444	280,252,911	76,734,032
Net pension liability	42,554,218	3,120,703	45,674,921	89,257,217
Net OPEB liability	6,396,068	689,526	7,085,594	48,324,124
Total noncurrent liabilities	303,289,753	29,723,673	333,013,426	214,315,373
Total liabilities	337,460,499	34,560,132	372,020,631	239,757,154
DEFERRED INFLOWS OF RESOURCES				
Future property tax revenue	-	-	-	9,683,054
Pension related	-	62,101	62,101	1,882,126
OPEB related	226,263	21,991	248,254	32,830,824
Total deferred inflows of resources	226,263	84,092	310,355	44,396,004
NET POSITION				
Net investment in capital assets	238,127,410	55,737,271	293,864,681	295,508,085
Restricted for :				
Capital projects	1,104,254	2,098,948	3,203,202	2,277,894
Debt service	9,300,463	-	9,300,463	-
Federal and state grants	3,780,381	-	3,780,381	-
Investments	1,531,881	-	1,531,881	-
Other Projects	-	-	-	4,577,985
Special revenues (gas tax and road projects)	194,461	-	194,461	-
Special revenues (education)	47,589,638	-	47,589,638	-
Special revenues (public safety)	584,947	-	584,947	-
Unrestricted (deficit)	(182,144,382)	11,594,746	(170,549,636)	(54,206,291)
Total net position	120,069,053	69,430,965	189,500,018	248,157,673

Figure A3: **Auburn, Alabama's 2021 Statement of Activities.**

CITY OF AUBURN, ALABAMA
STATEMENT OF ACTIVITIES
FOR THE FISCAL YEAR ENDED SEPTEMBER 30, 2021

		Program Revenues			Net (Expense) Revenue and Changes in Net Position			
					Primary Government			
Functions/Programs	Expenses	Charges for Services	Operating Grants and Contributions	Capital Grants and Contributions	Governmental Activities	Business-type Activities	Total	Component Units
Primary government:	$	$	$	$	$	$	$	$
Governmental activities:								
General government and administration	13,125,800	17,806,914	5,522,148	-	10,203,262	-	10,203,262	
Public works	9,696,921	-	1,089,752	4,862,574	(3,744,595)	-	(3,744,595)	
Environmental services	1,790,534	-	-	-	(1,790,534)	-	(1,790,534)	
Public safety	27,140,426	6,602,975	241,204	73,640	(20,222,607)	-	(20,222,607)	
Library	2,426,778	15,059	21,351	-	(2,390,368)	-	(2,390,368)	
Parks and recreation	7,205,293	857,168	-	325,033	(6,023,092)	-	(6,023,092)	
Development services	5,606,773	75,593	3,000	988,460	(4,539,720)	-	(4,539,720)	
Social and economic development	7,537,644	-	1,120,847	1,039	(6,415,758)	-	(6,415,758)	
Human resources	8,458,394	4,849,194	-	-	(3,609,200)	-	(3,609,200)	
Risk management	1,326,150	-	-	-	(1,326,150)	-	(1,326,150)	
Education (payments to Board of Education)	39,554,189	-	-	-	(39,554,189)	-	(39,554,189)	
Interest on long-term debt	8,513,776	-	-	-	(8,513,776)	-	(8,513,776)	
Total governmental activities	132,382,678	30,206,903	7,998,302	6,250,746	(87,926,727)	-	(87,926,727)	
Business-type activities:								
Sewer Fund	9,526,755	12,719,791	-	919,620		4,112,656	4,112,656	
Solid Waste Management Fund	5,349,988	5,378,599	1,103	-		29,714	29,714	
Total business-type activities	14,876,743	18,098,390	1,103	919,620		4,142,370	4,142,370	
Total primary government	147,259,421	48,305,293	7,999,405	7,170,366	(87,926,727)	4,142,370	(83,784,357)	
Component units:								
Board of Education	107,089,246	6,849,877	59,479,318	5,628,218				(35,131,833)
Water Works Board	11,858,871	12,769,531	-	2,037,560				2,948,220
Industrial Development Board	4,887,274	2,953,642	-	599,580				(1,334,052)
Public Park & Recreation Board	847,697	174,303	854	-				(672,540)
Downtown Redevelopment Authority	16,750	-	-	-				(16,750)
Total Component Units	124,699,838	22,747,353	59,480,172	8,265,358				(34,206,955)
General revenues								
Taxes:								
Sales taxes					50,902,320	-	50,902,320	10,347,335
Occupational license fees					14,345,721	-	14,345,721	-
Property taxes					35,374,100	-	35,374,100	20,847,621
Motor fuel taxes					430,315	-	430,315	-
Lodging taxes					2,409,917	-	2,409,917	-
Rental and leasing taxes					962,586	-	962,586	-
Cigarette taxes					51,860	-	51,860	-
Alcoholic beverage taxes					310,976	-	310,976	666,173
Other taxes					-	-	-	58,131
Appropriations from the City of Auburn					-	-	-	29,168,623
Grants and contributions not restricted					-	-	-	1,140
Interest and investment earnings					144,884	28,179	173,063	1,081,832
Gain/(Loss) on disposal of assets					36,346	-	36,346	59,804
Sale of property					-	-	-	175,000
Miscellaneous					65,258	31,692	96,950	1,290,753
Transfers					108,253	(108,253)	-	-
Total general revenues and transfers					105,142,536	(48,382)	105,094,154	63,696,412
Change in net position					17,215,809	4,093,988	21,309,797	29,489,457
Net position - beginning					103,355,512	65,336,977	168,692,489	218,668,216
Prior period adjustment					(502,268)	-	(502,268)	-
Net position - beginning, as restated					102,853,244	65,336,977	168,190,221	218,668,216
Net position - ending					120,069,053	69,430,965	189,500,018	248,157,673

Figure A4: **Auburn, Alabama's 2021 Changes in Fund Balance.**

CITY OF AUBURN, ALABAMA
STATEMENT OF REVENUES, EXPENDITURES, AND CHANGES IN FUND BALANCES
GOVERNMENTAL FUNDS
FOR THE FISCAL YEAR ENDED SEPTEMBER 30, 2021

	General Fund	Special School Tax Fund	CV Local Fiscal Recovery Fund	Other Governmental Funds	Total Governmental Funds
	$	$	$	$	$
Revenues					
Sales and use taxes	50,902,320	-	-	-	50,902,320
Occupational license fees	14,345,722	-	-	-	14,345,722
Motor fuel taxes	847,065	-	-	-	847,065
Lodging taxes	2,409,917	-	-	-	2,409,917
Rental and leasing taxes	962,586	-	-	-	962,586
Other taxes	362,836	-	-	-	362,836
Licenses and permits	15,242,735	-	-	-	15,242,735
General property taxes	7,375,310	21,616,809	-	6,381,979	35,374,098
Charges for services	13,631,070	-	-	-	13,631,070
Fines and forfeitures	1,164,876	-	-	142,835	1,307,711
State shared taxes	5,089,892	-	-	670,501	5,760,393
Contributions from the public	941,080	-	-	66,674	1,007,754
Grants	-	-	-	2,517,156	2,517,156
Program income	-	-	-	243,812	243,812
Interest	72,251	20,946	1,326	50,360	144,883
Miscellaneous	65,267	-	-	394	65,661
Total revenues	113,412,927	21,637,755	1,326	10,073,711	145,125,719
Expenditures					
General government and administration	5,951,627	-	-	-	5,951,627
Public works	4,398,783	-	-	2,500	4,401,283
Environmental services	1,751,207	-	-	-	1,751,207
Public safety	26,232,798	-	-	99,058	26,331,856
Library	2,236,869	-	-	21,351	2,258,220
Parks and recreation	5,761,152	-	-	-	5,761,152
Development services	5,204,928	-	-	3,000	5,207,928
Social and economic development	3,988,248	-	-	1,063,405	5,051,653
Human Resources	8,407,879	-	-	-	8,407,879
Risk management	416,940	-	-	-	416,940
Total departmental	64,350,431	-	-	1,189,314	65,539,745
Non-Departmental	2,906,138	683,047	-	288,832	3,878,017
Debt service					
Administrative charges	2,020	227,855	-	1,631	231,506
Interest	2,051,178	2,041,547	-	4,953,253	9,045,978
Principal retirement	5,236,437	5,309,705	-	1,534,000	12,080,142
Capital outlay	19,589,707	-	-	9,816,229	29,405,937
Intergovernmental	1,073,620	-	-	-	1,073,620
Payments to component units	15,678,980	25,143,747	-	449,580	41,272,307
Total expenditures	110,888,511	33,405,901	-	18,232,839	162,527,252
Excess (deficiency) of revenues over expenditures	2,524,416	(11,768,146)	1,326	(8,159,128)	(17,401,533)
Other financing sources (uses)					
Debt issuance	-	17,915,000	-	-	17,915,000
Debt refunding	-	10,955,000	-	-	10,955,000
Premium on debt issued	-	2,249,346	-	-	2,249,346
Payment to refunded bond escrow agent	-	(10,857,256)	-	-	(10,857,256)
Sale of surplus assets	572,417	-	-	-	572,417
Transfers in	1,131,512	-	-	108,263	1,239,775
Transfers out	(22,997)	-	-	(1,108,525)	(1,131,522)
Total other financing sources (uses)	1,680,932	20,262,090	-	(1,000,262)	20,942,760
Net changes in fund balances	4,205,348	8,493,944	1,326	(9,159,390)	3,541,227
Fund balances, beginning of year	65,875,160	39,095,692	-	23,204,487	128,175,339
Prior period adjustment	(1,334,680)	-	-	832,643	(502,037)
Fund balances, beginning, as restated	64,540,480	39,095,692	-	24,037,130	127,673,302
Fund balances, end of year	68,745,828	47,589,636	1,326	14,877,740	131,214,530

Table A1: **Variable Construction**

Variable	**Construction/Definition**
Leverage ratio_1	municipality's gross direct debt/total personal income;
Gross direct debt	total amount incurred by the municipality through direct borrowing;
Total personal income	product of city-level population and average income per capita;
Leverage ratio_2	(gross direct debt + net overlapping debt)/total personal income;
Overlapping debt	financial obligations of one jurisdiction that also falls partly on a nearby jurisdiction;
Leverage ratio_3	municipality's gross direct debt/total revenue;
Working-age population	the total number of people between the ages of 18 and 64;
Surplus(or deficit) ratio	(total revenue-total expenditures)/total revenue in general funds;
Capital-to-assets ratio	total government activities capital assets (net)/total assets;
Cash-to-assets ratio	(cash+cash equivalents+short-term financial investment)/total assets;
Size	log(assessed taxable property value/GDP deflator);
Productivity	the county-level total factor productivity (TFP);
Housing price	the logarithm of county-level median property price index;
Debt borrowing cost	yield on new municipal bonds - the synthetic Treasury yield;
Municipal bond yield	a residual from regressing bond offering yields on a set of bond characteristics, along with state, county, and time fixed effects;
NTR gap (IV_1)	change in U.S. tariffs on Chinese imports that would have occurred if China's Normal Trade Relations (NTR) status had not been renewed in 1999, weighted with 1990 industry employment shares;
Tariff changes (IV_2)	average change in Chinese import tariffs between 1996 and 2005, weighted by 1990 industry employment shares;
Chinese imports changes (IV_3)	change in the value of Chinese goods imported by non-U.S. high-income countries in each industry during the 2010s, weighted by 2000 industry employment in each U.S. commuting zone;
Millage rate	property tax rate defined as the amount per $1,000 of assessed property value levied in taxes.

Table A2: **Labor Migration and Leverage: Robustness**

	Unweighted			Weighted		
	(1)	(2)	(3)	(4)	(5)	(6)
	A. OLS estimates					
Δ Population (log)	-0.028***	-0.021***	-0.024***	-0.027***	-0.021***	-0.024***
	(0.005)	(0.007)	(0.008)	(0.005)	(0.007)	(0.008)
Δ Surplus (or deficit) ratio		-0.012***	-0.011***		-0.012***	-0.011***
		(0.003)	(0.004)		(0.003)	(0.004)
Δ Capital-to-assets		-0.030***	-0.028***		-0.031***	-0.029***
		(0.008)	(0.009)		(0.008)	(0.009)
Δ Cash-to-assets		-0.029***	-0.026***		-0.030***	-0.026***
		(0.008)	(0.009)		(0.008)	(0.009)
Δ Size (log)		0.004*	0.005*		0.004*	0.005*
		(0.002)	(0.003)		(0.002)	(0.003)
Δ Productivity		0.005	0.009		0.005	0.009
		(0.005)	(0.006)		(0.005)	(0.006)
Δ Housing price (log)		-0.006*	-0.006		-0.006*	-0.006
		(0.003)	(0.004)		(0.003)	(0.004)
Δ Debt borrowing cost			0.042			0.039
			(0.177)			(0.180)
R-squared	0.035	0.091	0.078	0.032	0.090	0.077
No. of Obs.	864	827	696	864	827	696
	B. IV estimates					
	IV_1	IV_2	IV_3	IV_1	IV_2	IV_3
Δ Population (log)	-0.068***	-0.060***	-0.054**	-0.068***	-0.060***	-0.055**
	(0.017)	(0.017)	(0.024)	(0.018)	(0.017)	(0.024)
Δ Surplus (or deficit) ratio	-0.006	-0.007*	-0.008*	-0.006	-0.007*	-0.008*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Δ Capital-to-assets	-0.036***	-0.035***	-0.034***	-0.036***	-0.035***	-0.035***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Δ Cash-to-assets	-0.027***	-0.028***	-0.028***	-0.028***	-0.028***	-0.028***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Δ Size (log)	0.008***	0.008**	0.007**	0.008***	0.008**	0.007**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Δ Productivity	0.006	0.005	0.005	0.006	0.005	0.005
	(0.007)	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)
Δ Housing price (log)	0.001	-0.000	-0.001	0.001	-0.000	-0.001
	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.005)
No. of Obs.	826	826	819	826	826	819

Table A2 presents the results of our robustness tests, which assess the impact of labor migration on municipal leverage. In this table, we replace working-age population with population. The other independent variables remain the same, including surplus (or deficit) ratio, capital-to-assets ratio, cash-to-assets ratio, size, productivity, housing prices, and debt borrowing costs. The estimation follows a first-difference specification, with Panel A employing OLS and Panel B utilizing an IV approach. Trade liberalization acts as an exogenous shock to local labor market. Heteroskedasticity-consistent standard errors, clustered at either the county or community-zone level depending on the instrument used, are reported in parentheses. Significance levels are indicated by *, **, and *** for 10%, 5%, and 1%, respectively.

Table A3: **Labor Migration and Taxation: Robustness**

	Unweighted			Weighted		
	(1)	(2)	(3)	(4)	(5)	(6)
			A. OLS estimates			
Δ Population (log)	-0.001	0.011***	0.014***	-0.001	0.011***	0.014***
	(0.001)	(0.004)	(0.003)	(0.001)	(0.004)	(0.003)
Δ Surplus (or deficit) ratio		0.003**	0.003**		0.003**	0.003**
		(0.002)	(0.002)		(0.002)	(0.002)
Δ Capital-to-assets		-0.006	-0.009		-0.006	-0.009
		(0.007)	(0.009)		(0.007)	(0.009)
Δ Cash-to-assets		-0.002	-0.005		-0.002	-0.005
		(0.007)	(0.008)		(0.007)	(0.008)
Δ Size (log)		-0.009***	-0.012***		-0.009***	-0.012***
		(0.003)	(0.002)		(0.003)	(0.002)
Δ Productivity		0.002	0.004		0.002	0.003
		(0.003)	(0.003)		(0.003)	(0.004)
Δ Housing price (log)		-0.004**	-0.005**		-0.004**	-0.005**
		(0.002)	(0.002)		(0.002)	(0.002)
Δ Debt borrowing cost			0.066			0.069
			(0.080)			(0.080)
R-squared	0.000	0.103	0.126	0.000	0.101	0.124
No. of Obs.	853	815	667	853	815	667
			B. IV estimates			
	IV_1	IV_2	IV_3	IV_1	IV_2	IV_3
Δ Population (log)	0.024**	0.022**	0.019**	0.025**	0.023**	0.020**
	(0.011)	(0.010)	(0.008)	(0.011)	(0.010)	(0.008)
Δ Surplus (or deficit) ratio	0.001	0.002	0.002	0.001	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Δ Capital-to-assets	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Δ Cash-to-assets	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.007)	(0.007)	(0.006)	(0.007)	(0.007)	(0.006)
Δ Size (log)	-0.011***	-0.010***	-0.010***	-0.011***	-0.011***	-0.010***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Δ Productivity	0.002	0.002	0.002	0.002	0.002	0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Δ Housing price (log)	-0.006**	-0.006**	-0.005**	-0.006**	-0.006**	-0.005**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
No. of Obs.	814	814	806	814	814	806

Table A3 presents the results of our robustness tests, which assess the impact of labor migration on taxation. In this table, we replace working-age population with population. The other independent variables remain the same, including surplus (or deficit) ratio, capital-to-assets ratio, cash-to-assets ratio, size, productivity, housing prices, and debt borrowing costs. The estimation follows a first-difference specification, with Panel A employing OLS and Panel B utilizing an IV approach. Trade liberalization acts as an exogenous shock to local labor market. Heteroskedasticity-consistent standard errors, clustered at either the county or community-zone level depending on the instrument used, are reported in parentheses. Significance levels are indicated by *, **, and *** for 10%, 5%, and 1%, respectively.

Table A4: **Workforce Mobility by Economic Sector**

Sector	Mobility	Reasons
Agriculture and Mining	high	Cyclical, commodity-driven work; mix of migratory labor and labor land-tied households.
Construction	high	Project-based and cyclical; mobile workforce follows regional demand.
Retail Trade	high	Low-skill, low-wage labor market with high turnover; responsive to regional economic shifts; transient young population.
Transportation and Utilities	high	National labor market, often footloose; wage-driven migration is common; but utility jobs are more stable and locally embedded.
Arts, Entertainment, and Food	high	Service-sector volatility, often renters; younger and mobile demographics; urban concentration, demand-driven, high turnover; creative-class migration to cost/tax-friendly regions.
Other Services	high	informal, personal, or gig economy work with fluid movement; limited job stickiness; often composed of migrant or low-wage labor.
Information	mixed	In big cities (e.g., SF), highly mobile; in smaller cities, more anchored; tech and media workers are mobile, remote-work-capable, and responsive to costs and taxes.
Finance and Real Estate	mixed	Professional, mobile workers; often located in hubs with multiple options; highly mobile white-collar workforce.
Professional, Scientific, and Mgmt	mixed	High-skill workers with strong labor market fluidity; remote-friendly; follow quality-of-life and cost signals.
Education and Healthcare	low	High credentialing, long-term employment relationships; credentialing limit cross-state mobility; stable and growing sector.
Public Administration	low	Stable, pension-linked employment; high homeownership; government jobs are locally tied and unionized.
Manufacturing	low	Historically stable; asset-specific human capital; some geographic rigidity.
Wholesale Trade	low	Workers tend to be place-fixed with warehouse infrastructure.