TAX-EXEMPT MUNICIPAL BONDS AND THE FINANCING OF PROFESSIONAL SPORTS STADIUMS

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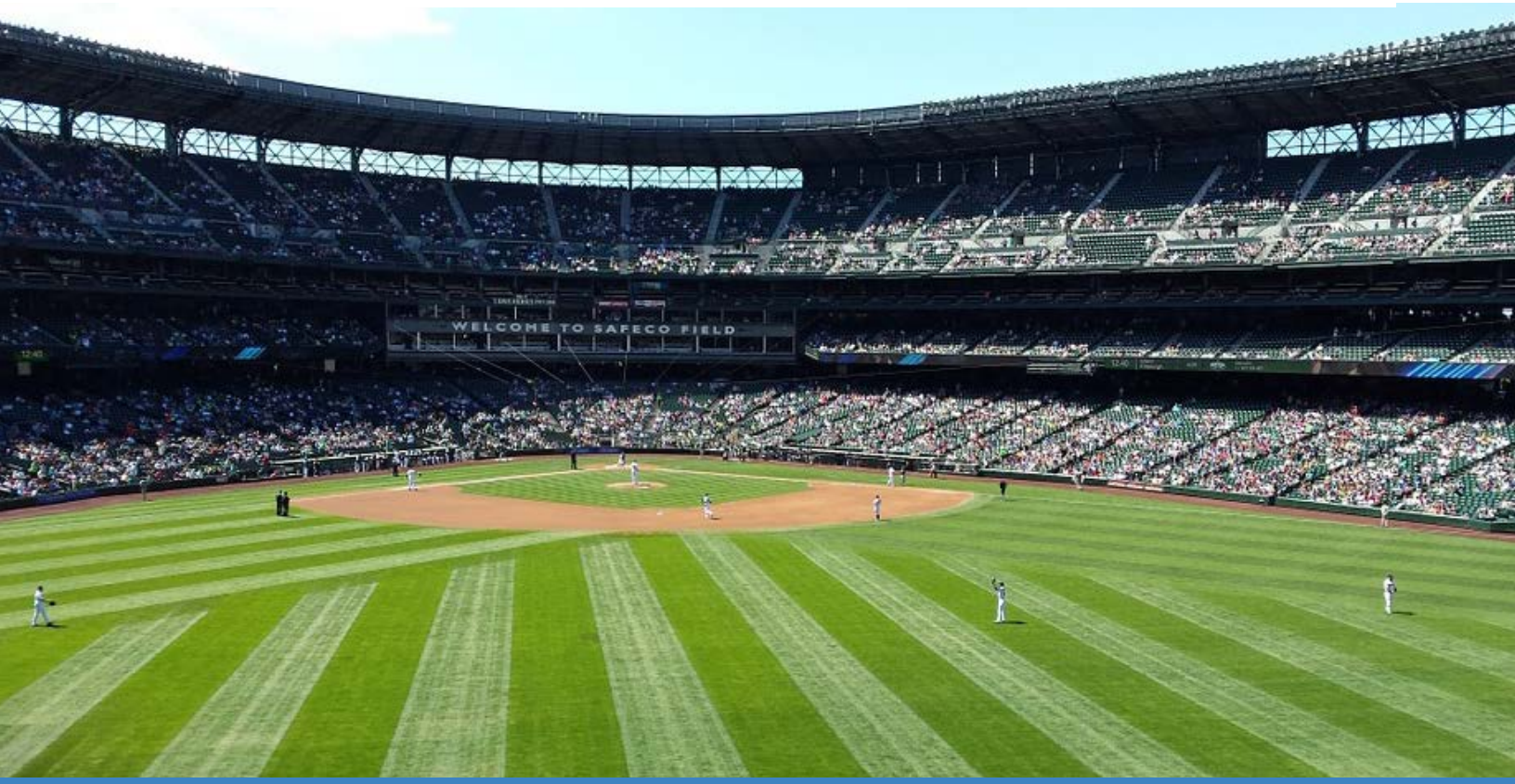

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Introduction

Infrastructure significantly contributes to the nation's prosperity by fostering the functioning of such things as transportation, telecommunications, water supply, waste disposal, schools, hospitals, and utilities. Throughout its history, the United States has grappled with determining the appropriate level of public versus private provision of infrastructure, and government funding for infrastructure has come from various jurisdictional levels, from the local to the state to the federal government.

Table 1 provides estimates of public and private spending in 2014 on different components of transportation and water infrastructure, which accounts for the bulk of federal spending on infrastructure (Congressional Budget Office, 2015; Bureau of Economic Analysis, 2015).[1] Of the roughly $428 billion spent on transportation and water infrastructure projects in the United States, $416 billion came from the public sector, with nearly a quarter of this public funding coming from the federal government. The federal government supports infrastructure investment by spending money directly and by making grants to state and local governments for their capital spending. As also shown in Table 1, about 70 percent of all federal spending on infrastructure is in the form of direct grants and loan subsidies to state and local governments. In addition, the federal government makes significant indirect contributions to infrastructure investment through tax expenditures, which subsidize the borrowing costs of state and local governments, as well as some private entities for qualified activities, to finance certain projects.

This paper begins with a brief overview of the economic justifications for public funding for infrastructure and the optimal share of federal support for infrastructure projects. The particular focus is on the role of federal tax subsidies in the form of preferences granted for bonds that state and local governments issue to finance capital spending on infrastructure. The bulk of the paper examines federal tax expenditures to support a particular type of infrastructure project—sports facilities, which we generally refer to as stadiums. As will be made clear below, the justifications for public funding for stadiums are weak, and the justifications for federal government subsidies are even weaker because to the extent the projects confer any benefits, those benefits are local not national. In addition, relying on tax expenditures to provide these federal subsidies is particularly inefficient.

Indeed, as will be discussed below, in the Tax Reform Act of 1986 (TRA86), Congress attempted to do away with the federal tax subsidy for stadiums, but instead unwittingly provided an incentive for a federal government match for local government subsidies for stadiums. Another unintended consequence of TRA86 was that it provided a disincentive for local governments to finance their subsidies to stadiums with taxes

1 Energy and telecommunications infrastructure is provided primarily by private sector firms, and school facilities and equipment are provided largely by state and local governments. See Congressional Budget Office (2008) for information on spending for other types of infrastructure.

that largely fall on those receiving the benefits of the stadium. For example, in order for a stadium to qualify for the federal tax expenditure, the local government cannot finance the bond by levying a tax on ticket purchases at the stadium. In other words, it cannot directly tax the very users of that benefit.

We examine the size of the subsidy and the federal tax expenditure for all professional sports stadiums newly constructed, majorly renovated, or currently under construction in the United States since the year 2000 for the four largest American sports leagues: Major League Baseball (MLB), the National Football League (NFL), the National Basketball Association (NBA), and the National Hockey League (NHL). Of the 45 stadiums that fit this description, 36 of them were funded, at least in part, with federal tax expenditures in the form of tax-exempt municipal bonds. We estimate that the total tax-exempt bond principal issued to fund these stadiums was approximately $13.0 billion,[2] the present value subsidy to the bond issuers was $3.2 billion (assuming a 3 percent discount rate) or $2.6 billion (assuming a 5 percent discount rate), and the present value federal tax revenue loss was $3.7 billion (3 percent discount rate) or $3.0 billion (5 percent discount rate), with all terms in 2014 dollars. We conclude the paper with suggested reforms to reduce or eliminate this inefficient subsidy for local sports stadiums.

WHAT SHARE OF INFRASTRUCTURE SHOULD GOVERNMENT FUND AND WHICH JURISDICTIONAL LEVEL SHOULD FUND IT?

Generally, public provision of infrastructure is justified if the private sector would fail to provide socially desirable amounts of it—that is, services whose social benefits exceed social costs, but which are privately unprofitable. There are two general reasons why this might occur. The first is that some infrastructure could be considered a public good, meaning that it is nonrival and nonexcludable in consumption. A nonrival good is one for which, once it is provided, the additional resource cost of another person consuming it is zero. A nonexcludable good is one in which it is expensive or impossible to prevent anyone from consuming it. A private market will tend to underprovide a public good since each person has an incentive to free-ride by letting others purchase the good while still enjoying the benefits once it is provided. In other words, a private entity providing a public good is unable to charge all the users a fee based on the benefits they receive. To the extent that infrastructure provides public benefits and the recipients of these benefits cannot be charged for its use, there is a justification for government supplying the infrastructure and recouping the costs through taxation. This assumes that the government is able to discern how much individuals value infrastructure and act upon this information appropriately.

Public provision or economic regulation of infrastructure might also be justified when the activity is subject to continually decreasing average costs, which means that the greater the level of output, the lower the cost per unit. This can occur when there are high up-front costs to build and low marginal costs to operate and maintain. Under such circumstances—referred to as a natural monopoly—a single firm can take advantage of the economies of scale and supply the entire industry output (Winston, 2013). Examples include bridges, water systems, electricity,

2 This calculation includes the costs of ancillary structures, such as parking facilities and infrastructure improvements.

telecommunications, and cable television. A private firm in such a position would likely have monopoly power, and use it to maximize profits by restricting supply and raising prices, which would lead to an underprovision of the good or service. Such infrastructure projects might justify government ownership or at least government oversight in order to maintain the efficient level of providing the good or service.

The degree to which an infrastructure project is likely to be underprovided by private firms suggests the degree of responsibility the government should take in providing the project. This analytical framework also suggests the conceptual basis for determining the appropriate division among federal, state, and local funding of infrastructure. To the extent that the economies of scale or the public benefits cross jurisdictional borders, there is a justification for the larger jurisdiction in which the benefits fall to subsidize the subjurisdiction considering the infrastructure project.

In this context, it is important to note that one possible role for the federal government is to provide incentives to state governments to provide more of the public good than is optimal from the state's perspective. This can be achieved through intergovernmental grants (Gramlich, 1990). The optimal intergovernmental matching grant to the state would lower the price of providing the public good enough to induce the state to invest the efficient amount, accounting for the benefits to the entire nation. Of course, determining the correct level of a matching grant is a difficult task, and too large a subsidy would lead to too much of the public good being provided, meaning a state or local government free-riding off of federal tax revenue.

As shown in Table 1, the federal government currently subsidizes infrastructure through direct expenditures and through grants and loan subsidies. Direct expenditures include such things as spending on the construction of dams by the Army Corps of Engineers or the Bureau of Reclamation, and grants and loan subsidies are primarily provided to the state and local governments to support transportation projects (Congressional Budget Office and Joint Committee on Taxation, 2009). Although state and local governments rely primarily on their own revenues to purchase capital, federal grants are also an important source of funds (Congressional Budget Office, 2013).

The federal government also subsidizes infrastructure investment through tax expenditures, which are subsidies provided through the tax code. The largest federal government subsidy to support infrastructure is the tax exemption for interest earned on bonds issued by state and local governments—known as municipal bonds—to finance government operations and certain qualified private sector activities. The Joint Committee on Taxation (2015, p. 40) estimates that the tax exemption for public-purpose state and local government bonds will amount to $187.7 billion in lost federal tax revenue between 2015 and 2019. As discussed below, the savings afforded to state and local governments is smaller than the lost federal tax revenue.

The extensive use of the tax code to subsidize infrastructure has two budgetary implications. First, the lost tax revenue from the tax-exempt bonds is not part of the computation of federal spending and therefore is not taken into account in the federal budget. This reduces the transparency of federal allocation of resources to these projects. Second, and relatedly, the federal government's control over the tax subsidy is limited because the amount of the tax expenditure is not decided through the annual appropriations process. It is, in effect, a form of entitlement spending whose amount is largely determined by circumstances outside of the control of the federal government (Congressional Budget Office and Joint Committee on Taxation, 2009). Also, as will be discussed later, the use of tax-exempt bonds is an inefficient form of subsidy, since the loss of federal tax revenue exceeds the reduction in the interest costs of the bond issuers.

SHOULD LOCAL, STATE, OR FEDERAL GOVERNMENTS SUBSIDIZE SPORTS STADIUMS?

The remaining focus of this paper is on government subsidies for stadiums for the four major professional sports leagues in the United States. Sports stadiums do not exhibit economies of scale, so there is no natural monopoly justification for government subsidies. Instead, the justification often given for government subsidies for such stadiums—particularly local subsidies—is that there are spillover gains to the local economy from a stadium that are greater than the cost of the subsidies to local taxpayers (Josza, 2003).

The evidence for large spillover gains from stadiums to the local economy is weak. Academic studies consistently find no discernible positive relationship between sports facility construction and local economic development, income growth, or job creation (Baim, 1994; Rosentraub et al., 1994; Baade, 1996; Zimmerman, 1996; Noll and Zimbalist, 1997; Coates and Humphreys, 1999, 2008; Siegfried and Zimbalist, 2000; Josza, 2003). Indeed, after 20 years of academic research on the topic, "Articles published in peer reviewed economics journals contain almost no evidence that professional sports franchises and facilities have a measurable economic impact on the economy" (Coates and Humphreys, 2008, p. 302). And as Siegfried and Zimbalist (2000, p. 103) put it, "Few fields of empirical economic research offer virtual unanimity of findings … that there is no statistically significant positive correlation between sports facility construction and economic development."

This finding should not be surprising, given that team revenues typically constitute a small share of a city's economic output and teams do not employ a substantial number of people. In addition, given that most consumers have a relatively inflexible leisure budget, any economic activity generated while attending a game will largely if not entirely be offset by reduced spending on other local leisure activities. Baade and Sanderson (1997), for instance, observed a reordering of leisure expenditures within cities that acquired new sports teams, but there was no evidence that the new teams brought output or employment growth to the local area.

A more plausible justification for local subsidies for sports stadiums is that there are public good benefits to local residents who never attend the games, in the form of enjoyment from following

the team, watching the games on TV (above and beyond the benefits of watching the other cities' teams play), and talking to fellow local fans of the team. Relatedly, some residents might find value in living in a place considered a "major league" city. These benefits are difficult to estimate, and it is questionable whether they meaningfully exist at all (Siegfried and Zimbalist, 2000).

Even if one believes, contrary to the empirical evidence, that the spillover benefits to the local economy justify taxpayer support, or that the benefits to local residents of following and talking about the home team are substantial, there still remains no economic justification for federal subsidies for sports stadiums. Residents of, say, Wyoming, Maine, or Alaska, gain nothing from the Washington-area football team's decision to locate in Virginia, Maryland, or the District of Columbia. Yet, under current federal law, taxpayers throughout the country could ultimately subsidize the stadium, wherever it is located. In the next section, we discuss how this subsidy came into existence, followed by our estimates of the size of the subsidy and the loss of federal revenue stemming from this subsidy.

THE HISTORY OF FEDERAL SUBSIDIES FOR SPORTS STADIUMS

The federal tax exclusion for interest earned on state and local bonds began with the first modern U.S. income tax in 1913.The justification was that it would be unconstitutional for one level of government to levy taxes on the securities issued by another level of government, a view that was later rejected by the U.S. Supreme Court. The original income tax did not limit the purposes for which state and local governments could issue bonds—although some states were constrained in their uses by their own laws—leading to tax-exempt bonds being issued to finance a host of private activities.

For the first half of the twentieth century, local professional sports franchises funded the construction of most stadiums (Noll and Zimbalist, 1997). With the exception of the Los Angeles Coliseum (built in 1923), Chicago's Soldier Field (built in 1923), and Cleveland's Municipal Stadium (built in 1931), which were all built with the intention of luring the Olympic Games, all major league facilities were constructed exclusively with private funds until 1953. In that year, the first team relocation in Major League Baseball since 1903 occurred when the Boston Braves became the Milwaukee Braves, lured by the new County Stadium, which was built with public funds. The move by the Braves ushered in an era of itinerant franchises (Siegfried and Zimbalist, 2000).

The Revenue and Expenditure Control Act of 1968 placed restrictions on the activities eligible for tax-exempt financing. It declared state and local bonds taxable if more than 25 percent of the bond proceeds was to be used by a nongovernmental entity and if more than 25 percent of the debt service was secured by property used directly or indirectly in a private business. The 1968 law did, however, exempt certain activities that exceeded these 25 percent thresholds, including the financing of sports stadiums (Zimmerman, 1996).

With the Tax Reform Act of 1986, Congress attempted to do away with the tax exemption for bonds financing sports stadiums by eliminating it from the category of private activity bonds exempt from federal taxation. TRA86 categorized a bond as private if it met two conditions: (i) more than 10 percent of the bond proceeds were to be used by a nongovernmental entity, and (ii) more than 10 percent of the debt service was secured by property used directly or indirectly in a private business. The first condition is known as the "private business use test," and the second condition is known as the "private payment test." While there remained a list of private activities specifically exempt from federal taxation, stadiums were excluded from that list. TRA86 also capped the total volume of such exempt bonds that could be issued by a state to the greater of $50 per resident or $150 million.[3]

Under the prevailing law of TRA86, a stadium bond can remain exempt from federal taxation if it violates either the private business use test or the private payment test. Stadium bonds will undoubtedly pass the private business use test, since professional sports teams will almost always consume more than 10 percent of a stadium's useful services. Therefore, in order to be eligible for federal tax exemption, a stadium bond issue must be structured so that no more than 10 percent of its debt service is secured by the property used directly or indirectly by the sports franchise. This sets up a kind of matching incentive, an "artificial financing structure" (U.S. Department of the Treasury, 2015, p. 85), whereby federal tax exemption is granted if the state or local government is willing to finance at least 90 percent of the debt service for the bonds. Additionally, since this 90 percent of financing cannot come even indirectly from private activity if tax exemption is to be maintained, the state and local government cannot rely on stadium-generated revenue, such as a tax on entry tickets to the stadium or event, or even rent collected from the team as tenants.

TRA86 effectively requires that, in order to receive the federal subsidy, a state or local government must finance the bulk of the stadium, and it must rely on tax revenue unrelated to the stadium for the financing, such as general sales taxes, property taxes, income taxes, lotteries, or taxes on alcohol and cigarettes. The most common type of tax imposed to finance sports stadiums is known as a "tourist tax," which is a tax levied on hotel stays and rental cars; this is a particularly attractive option for local authorities because they can advertise to the public that the tax burden will fall primarily on nonresidents. In addition to the inefficiencies of federal subsidies for stadiums described earlier, this prohibition on using even indirect stadium revenue to finance the bonds violates a common criterion of fairness, known as the "benefits-received principle." This principle holds that a publicly provided good or service should be paid for by people in proportion to the benefits they receive from the good or service.[4]

3 Adjusted for inflation, the volume cap for calendar year 2015 is set at the greater of $100 per resident, or $301,515,000 (Internal Revenue Service, 2015).

4 In 2006, after New York taxpayers indicated a reluctance to fund new stadiums for the Yankees and Mets using general tax revenue, the Internal Revenue Service issued two private letter rulings allowing stadium-related tax revenue to be classified as "payments in lieu of taxes" (PILOTs), which could be used to pay the debt service on governmental debt (Internal Revenue Service 2006a, 2006b). These rulings had the advantage of making the financing of these New York stadiums more consistent with the benefits-received principle, but they had the disadvantage of reducing local taxpayer resistance to federally subsidized public financing of stadiums (Zimmerman, 2008). In 2009, PILOT bonds were used to fund a third New York stadium, the Barclays Center.

Absent the subsidies from all levels of government, there would be little incentive for the teams or private investors to finance so many new (and increasingly luxurious) stadiums. However, in addition to the federal tax incentive, professional sports teams have considerable negotiating power with the state and local governments, since the four major professional sports leagues control both the movement of their franchises and the total number of franchises in the leagues, resulting in demand for major sports franchises that exceeds the existing supply. The leagues in effect have monopoly power over the placement and number of major sports teams, and therefore have a strategic incentive to expand the number of teams fast enough to deter the formation of rival leagues, yet slow enough to ensure that threats by existing franchises to relocate are taken seriously (Siegfried and Zimbalist, 2000). This enables them to extract subsidies from the state and local governments that otherwise would not occur.

ESTIMATING THE SUBSIDY AND LOSS IN TAX REVENUE

The federal tax exemption for interest income from municipal bonds enables issuers of such debt to sell bonds that pay lower rates of interest than do taxable bonds, since investors are willing to accept a lower before-tax rate of return than they would receive on taxable bonds. Suppose a bond investor faces an income tax rate of 35 percent on additional income, and the rate of return on taxable bonds is 15 percent. Then, as long as the rate of return on a comparable tax-exempt municipal bond exceeds 9.75 percent, the investor prefers this option to the taxable bond option.[5] More generally, if τ is an individual's marginal tax rate and r_c is the rate of return on taxable bonds, the investor is willing to purchase nontaxable bonds as long as his return exceeds $(1 - \tau)r_c$. Hence, the issuers can borrow funds at rates lower than those prevailing on the market, providing them with a subsidy from the federal government.

The total value of this federal subsidy to the borrowers is computed simply by multiplying the interest savings (the spread between the interest rate of a taxable bond and the interest rate of the tax-exempt bond of similar characteristics) by the bond principal in a given year, summed across the term of the bond (Galper and Toder, 1981; Zimmerman, 1991, 1997; Joint Committee on Taxation, 2008, 2012a, 2012b, 2013). More precisely, for any tax-exempt bond of term length n and principal value b (adjusted to 2014 dollars), with t designating the year since the issuance of the bond and $r_c - r_m$ denoting the interest rate spread between taxable corporate and nontaxable municipal bonds, we compute

$$(1) \qquad Undiscounted\ Value\ of\ Subsidy = \sum_{t=1}^{n} b(r_c - r_m).$$

We then compute the present value of the subsidy, using discount rates (designated as ρ) of 3 and 5 percent, as

5 This assessment assumes that the taxable and nontaxable bonds are comparable with respect to characteristics such as risk, time to maturity, and other factors.

$$(2) \qquad Present\ Value\ of\ Subsidy = \sum_{t=1} \frac{b(r_c - r_m)}{(1+\rho)^t}.$$

Note that these subsidy estimates are computed for the time that the bond is issued with the designated maturity date at the time of issuance. Many tax-exempt bonds are refunded sometime after issuance, wherein the original bonds are recalled and reissued at a lower interest rate. Because of the difficulty of determining whether each bond has been refunded, we elect to only include the initial issuances reflecting the issuance's maturity date. Conceptually, it is ambiguous whether subsidy estimates based on refunded and reissued bonds would lead to higher or lower subsidy estimates, since it is the spread between the taxable and nontaxable interest rates that determines the size of the subsidy, not the level of the interest rate for the nontaxable bond, which presumably decreases between initial issuance and reissuance. Also note that the subsidy computation above assumes that the loan is not amortized, meaning the full principal is paid off at the end of the bond's term (which is common practice for the bonds we examine).

The equations above yield estimates of the subsidy value to the issuer of the tax-exempt bond, but because tax-exempt bonds are an inefficient way to provide a subsidy, the total revenue loss to the federal government exceeds the value of the subsidy to the issuers. To see this, assume there are two taxpaying investors, one who faces a 35 percent marginal tax rate and another who faces a 25 percent marginal tax rate. If the market rate of return on taxable bonds is 15 percent, the after-tax return for the first investor is 9.75 percent and for the second is 11.25 percent. To induce both of them to buy the tax-exempt bond rather than the comparable taxable bond, the net rate of return must therefore be at least 11.25 percent, which is called the "market-clearing return." If the market-clearing return is 11.25 percent, some of the federal tax subsidy is wasted on the first investor who would have been willing to buy the bond at any yield greater than 9.75 percent.

In order to compute the net loss in federal tax revenues, suppose that the borrower issues $100 in bonds at the interest rate of 11.25 percent to the investor who faces an income tax rate of 25 percent. Since the interest rate on the taxable bond is 15 percent, the borrower saves $3.75 from the tax exemption and the federal government loses $3.75 in tax revenue. But now assume the borrower issues $100 in bonds at the interest of 11.25 percent to the investor who faces an income tax rate of 35 percent. The borrower still saves $3.75 from the tax exemption, but the federal government loses $5.25 in tax revenues. Thus, $1.50 of the tax break is not translated into a gain for the borrower, and is instead a windfall gain to the taxpayer in the higher tax bracket, reflecting an efficiency loss of the tax exemption. While all holders of tax-exempt debt benefit, tax exemption provides a larger benefit to high-income taxpayers (Galper et al., 2013).

This efficiency loss is captured by comparing the tax rate that clears the municipal market (τ^*) to the average tax rate of the municipal bond holders ($\bar{\tau}$). The federal revenue loss is then computed by dividing the undiscounted and discounted values of the subsidy (equations 1 and 2) by the ratio of the market-clearing tax rate to the average tax rate of municipal bond holders ($\tau^*/\bar{\tau}$).[6] Following

6 Note that the estimates of revenue loss assume that current holders of tax-exempt bonds would replace their holdings of these bonds with taxable bonds rather than other tax-preferred assets if the tax exemption were eliminated (Poterba and Ramírez Verdugo, 2011).

Zimmerman (1991), we compute $\bar{\tau}$ as the average household and corporate tax rates weighted by household and corporate shares of municipal debt. Poterba and Ramírez Verdugo (2011, Table 5) use the 2004 Survey of Consumer Finances to estimate the shares of municipal debt held by various tax brackets; based on their estimates, we compute the average household marginal tax rate for municipal bond holders to be about 26 percent.[7] The corporate tax rate is 35 percent. We calculate the household and corporate shares of municipal bond holdings based on Table L.212 of the Financial Accounts of the United States (Board of Governors of the Federal Reserve System, 2016, p. 112).[8] The household share ranges from 0.58 (in 1996) to 0.76 (in 2004).

ESTIMATING THE INTEREST RATE SPREAD

The estimates of the undiscounted and present value subsidies to the issuers of the tax-exempt bonds rely on an estimate of the interest rate spread at the time that the tax-exempt bond is issued. The precision of the subsidy and revenue loss estimates therefore rely heavily on the assumption that the characteristics of the tax-exempt bond are comparable to the characteristics of the taxable bond along all dimensions except for whether the interest earned is subject to the income tax. In other words, the appropriate computation of the interest rate spread would compare taxable and nontaxable bond rates that have the same structure (e.g., fixed versus variable), term, credit risk, and liquidity.

Historically, Treasury bonds were considered the taxable alternative to municipal bonds (Poterba, 1986; Heaton, 1986; Mankiw and Poterba, 1996), since both were considered close to riskless. More recent studies have assumed high-grade corporate bonds as the taxable alternative to municipal bonds (Joint Committee on Taxation, 2008, 2012a, 2012b, 2013; Congressional Budget Office and Joint Committee on Taxation, 2009). The Congressional Budget Office and Joint Committee on Taxation (2009) note that although municipal bonds and corporate bonds may vary somewhat in terms of risk, time to maturity, fixed versus variable interest payments, and other bond-specific factors, several potential sources of bias likely offset each other to a large degree.

We follow the more recent literature and use corporate bonds, rather than Treasury bonds, as our taxable alternative to tax-exempt municipal bonds. For each tax-exempt bond issued to finance a stadium, we use the average interest rate for high-grade municipal bonds at the year of issuance in our computation of the spread, rather than rely on the interest rate for the specific tax-exempt stadium bond. We do this because the individual tax-exempt stadium bond is determined by a host of characteristics that make it challenging to control for in a comparison with taxable bonds. Following Zimmerman (1991), we use average yields for 20-year municipal bonds rated Aa by Moody's Investors Service, and for the comparable taxable bonds we use average yields for seasoned corporate bonds rated Aa by Moody's.[9]

By computing averages of the two broadly similar categories of bonds, the goal is to capture similarities across the groups in terms of risk, liquidity, maturity, fixed versus variable payments, and other characteristics. If, for example, the tax-exempt bonds are considered higher risk or less liquid than the high-grade corporate bonds, then their yields will include a premium that would lead to an underestimate of the interest rate spread used in the calculations.

Figure 1 shows the interest rate spread between Moody's Aa-rated corporate bond yields and Moody's Aa-rated municipal bond yields from 1996 through 2014.[10] Note that the interest rate spread trends down throughout our period of evaluation. This suggests that subsidy estimates based on refunded and reissued bonds would be lower than our estimates, which are based on the spread at the time of the bond issuance. Similarly, adjusting the subsidy estimates to account for tax-exempt variable rate bonds (which periodically adjust interest rates) would also yield lower estimates. Whether this decrease in spreads over time represents a reduction in the subsidy value (e.g., a change in expected future tax rates or a market-driven change in the volume of tax-exempt bond issuance) or a change in the relative characteristics (e.g., a change in the relative perceived default risk) of the different bond categories is unclear.[11]

PRINCIPAL VALUE AND TERM LENGTH

A municipal bond issuance used to finance a stadium typically consists of a number of individual bonds, each structured in a particular way. They frequently combine three types of bonds: serial bonds, term bonds, and capital appreciation bonds. Serial bonds consist of smaller units that mature gradually over a number of years. Term bonds are single bonds that come due all at once, often with an optional or mandatory early call feature that allows the issuer to purchase bonds off the market at either par value or the current market price, whichever is lower. Many of the term bonds used to finance stadiums use a mandatory sinking reserve fund, where the municipality makes deposits (often annually) into an account that is either held in escrow until the maturity date or immediately used to call some of the bonds.

Capital appreciation bonds are less common than the other two, featured in only 11 stadiums in our data set. For these bonds, the investment return on the initial principal is reinvested at a stated compound rate until maturity. Investors receive a single payment at maturity representing both the principal and the total investment return. Municipalities sometimes prefer capital appreciation bonds because reinvesting of the interest return means that only the original principal amount counts against any debt limit the municipality might have (rather than the much larger par value).

7 Evidence from the Survey of Consumer Finances suggests that the average household marginal tax rate for municipal bond holders has stayed roughly constant post-TRA86. Based on the nine Surveys of Consumer Finances conducted between 1989 and 2013, Bergstresser and Cohen (2016, Table 12) calculate that the marginal tax rate of the median household holding municipal debt has been roughly constant at 28 percent since 1989. Zimmerman (1991, p. 110) also uses 28 percent in his calculations.

8 We define corporate holdings of municipal securities to be the sum of assets held by (i) nonfinancial corporate businesses (line 8), (ii) U.S.-chartered depository institutions (line 12), (iii) property-casualty insurance companies (line 16), and (iv) life insurance companies. Household holdings of municipal securities are defined as the sum of assets held by (i) the household sector (line 8) and (ii) nonfinancial noncorporate businesses (line 10).

9 As we will show later, our results are fairly robust across alternative measures of bond yields.

10 Our interest rate spread calculation starts in 1996, since Miller Park, which completed construction in 2001, began issuing bonds in 1996. A few other stadiums, including American Airlines Center, CenturyLink Field, Comerica Park, Heinz Field, Minute Maid Park, Paul Brown Stadium, PNC Park, and Sports Authority Field also began issuing bonds prior to 2000.

11 See, for example, Poterba and Ramírez Verdugo (2011) and Joint Committee on Taxation (2013), for possible explanations of the declining yield spread. Mankiw and Poterba (1996) consider a model in which tax-exempt investors hold only taxable bonds and equities, while taxable investors hold only tax-exempt bonds and equities. The model predicts that the yield spread between taxable and tax-exempt bonds should be an increasing function of the dividend yield on corporate stocks.

To take just one typical example, FedExForum—home of the NBA's Memphis Grizzlies—which was constructed in 2004, was financed by three separate bond issuances made in 2002. These bond issuances totaled $225 million in financing. They were split into five series, labelled A through E, with A and B appearing in one issuance, C in the second, and D and E in the third. Table 2 shows the value of the five different series (in nominal 2002 dollars, as well as the inflation-adjusted value we use in our computations), and the different types of bonds within each series.

Series A of this bond issuance, which combines both serial and term bonds, is representative of the type of financing frequently used for stadiums. The serial bonds in this issuance mature every year between 2004 and 2023, with the principal amounts increasing over time. As is common, these serial bonds are followed by larger term bonds, which are redeemed over the course of a few years through the use of a mandatory sinking reserve fund.

Figure 2 displays the redemption schedule for the Series A bonds, consisting of the serial bonds and the term bonds. Of the $113.325 million issued in Series A, $70.61 million matures between 2004 and 2023, with the amounts escalating from $0.74 million due in 2004 to $7.145 million due in 2023. These serial bonds are then followed by term bonds totaling $42.725 million in 2028, in redemptions of $7.65 million in 2024, $8.24 million in 2025, $8.87 million in 2026, $9.52 million in 2027, and $8.45 million in 2028. In order to compute the subsidy stemming from the tax exemption for the bonds that make up the Series A issuance, we multiply the interest rate spread in the year of the issuance (2002) by the redemption amount in each individual column in Figure 2, summing across the years until maturity (discounting at 3 or 5 percent). The present value subsidy for Series A is estimated as $41 million or $34 million, corresponding to discount rates of 3 and 5 percent, respectively.

RESULTS

We examine the financing for all professional sports stadiums newly constructed, majorly renovated, or currently under construction since 2000 for Major League Baseball, the National Football League, the National Basketball Association, and the National Hockey League. We obtained estimates of the total costs of the stadiums from various sources, such as local newspaper articles and websites.[12] We obtain the majority of the bond data from the original issuance documentation available through Electronic Municipal Market Access, a service of the Municipal Securities Rulemaking Board. See the Data Appendix for more information.

Table 3 shows descriptive data for the 45 professional sports stadiums constructed or majorly renovated since 2000, consisting of 43 that underwent construction[13] and two that underwent major renovation.[14] The average major renovation cost was $423 million compared to an average construction cost of $618 million. Table 3 also designates the 36 stadiums that were funded, at least in part, with proceeds from tax-exempt municipal bonds. The table also documents the league, the year of construction or major renovation, the year of bond issuance, the total costs, and the amount financed through proceeds from tax-exempt bonds.

Column 6 of Table 3 shows the estimated cost (in 2014 dollars) of constructing or renovating each of the major sports stadiums between 2000 and 2014. The total cost across all the stadiums is nearly $28 billion, and the most expensive stadium was (by far) Yankee Stadium, at over $2.5 billion. Column 7 shows the amount of the costs (in 2014 dollars) financed by tax-exempt bonds for each of the stadiums. The total financing across all the stadiums is roughly $13 billion, and the stadium that relied on the most tax-exempt financing was Yankee Stadium, which relied on nearly $1.7 billion in tax-exempt bonds to finance the stadium and its parking facility.[15]

Table 4 shows federal subsidy and revenue loss estimates for the 45 stadiums, in undiscounted terms and discounted at the 3 and 5 percent levels. Columns 5 and 6 of Table 4 show the present value estimates of the federal subsidy for each stadium, and Columns 7 and 8 show the present value estimates of the federal revenue loss, using discount rates of 3 and 5 percent, respectively. Note that the estimated subsidy value is not in constant proportion to the amount of the costs financed by tax-exempt bonds because the former is also a function of the term structure of the bonds and the interest rate spread at the time of the issuance. For example, construction of US Bank Stadium, which opened in 2016 for the NFL's Minnesota Vikings, was financed with $392 million in tax-exempt bonds issued in 2014, but has a federal subsidy estimate of only about 10 percent of the principal amount. Soldier Field, which was renovated in 2003 for the Chicago Bears, was funded with $399 million in tax-exempt bonds ($533 million in 2014 dollars), but has a federal subsidy estimate of over 30 percent of the principal amount. The different subsidy amounts are partly due to differences in the interest rate spread between when the Soldier Field bonds were issued (2.13 percentage points) and when the US Bank Stadium bonds were issued (0.62 percentage points). They are also due to the different term structures of the bonds, since the Soldier Field bonds are heavily weighted to come due in the far future and the US Bank Stadium bonds will be paid off in installments that slowly escalate in amount. The largest subsidy went to Yankee Stadium, with a subsidy value of $431 million computed at a 3 percent discount rate and $339 million computed at a 5 percent discount rate.[16] Recall that, due to the inefficiency of tax exemption, the subsidy value to the bond issuers is estimated to be only a fraction of the total reduction in tax revenue, because municipal bond holders in higher tax brackets receive windfall benefits.

The first row of Table 5 reproduces the last row of Table 4, reporting the total subsidy and revenue losses across all the stadiums using average yields for 20-year municipal bonds rated Aa by Moody's Investors Service compared to average yields for seasoned corporate bonds rated Aa by

12 Ford Field, home of the NFL's Detroit Lions, is reported to have cost $430 million to build, of which $219 million was financed by tax-exempt revenue bonds issued by Wayne County (Anderson and Pirics, 2015, Appendix 3). We were only able to locate documentation for $16.965 million in bonds issued in 1997 by the City of Detroit. Results for Ford Field, therefore, are likely underestimates.

13 This includes Little Caesars Arena, future home of the NHL's Detroit Red Wings, which is currently under construction.

14 Chesapeake Energy Arena, home of the NBA's Oklahoma City Thunder, was both constructed and renovated since 2000.

15 Citizens Bank Park, FedExForum, Great American Ball Park, Lucas Oil Stadium, Paul Brown Stadium, and Toyota Center relied on tax-exempt municipal bonds to finance at least 90 percent of their total costs.

16 The three New York stadiums financed by PILOT bonds—Yankee Stadium, Citi Field, and the Barclays Center—received nearly one quarter of the total federal subsidies: $739 million and $583 million using discount rates of 3 and 5 percent, respectively.

Moody's. We find that for these 45 stadiums, the total discounted value of the federal tax subsidy is $3.2 billion (using a 3 percent discount rate) or $2.6 billion (using a 5 percent discount rate). Given the inefficiency of the tax exemption, the lost revenue to the federal government exceeds the subsidy amounts, resulting in an estimated revenue loss of $3.7 billion (using a 3 percent discount rate) or $3.0 billion (using a 5 percent discount rate). The other rows of Table 5 compute estimates using alternative measures of bond yields for the municipal bonds and the comparable taxable bonds. The findings are fairly robust with respect to the indexes used.[17]

Table 6 shows the number of stadiums constructed or renovated since 2000 by each major sports league, the number financed by tax-exempt bonds, the average cost of the stadiums, the average financed by tax-exempt bonds, and the average present value subsidies computed at both 3 and 5 percent discount rates (all in 2014 dollars). The NFL stadiums had the highest average cost at $777.5 million, but the MLB had the highest average amount financed by tax-exempt bonds at $449.3 million. The highest subsidies went to the MLB, with an estimated value of $117.6 million computed at a 3 percent discount rate and $94.5 million computed at a 5 percent discount rate.

REFORM OPTIONS

The most direct and simplest reform option would be to eliminate the authority to issue federal tax-exempt governmental bonds for stadiums. As discussed earlier, TRA86 categorized a bond as private if it met two conditions: (i) the private business use test: more than 10 percent of the bond proceeds were to be used by a nongovernmental entity, and (ii) the private payment test: more than 10 percent of the debt service was secured by property used directly or indirectly in a private business. Eliminating the private payment test for stadium financing would mean that bonds to finance stadiums would be taxable private activity bonds if more than 10 percent of the facility is used for private business use, which undoubtedly would be the case. The Joint Committee on Taxation (2005) and the Obama administration's previous two budgets (U.S. Department of Treasury, 2015, 2016) proposed this elimination of the private payment test for stadium financing in order to eliminate the federal subsidy.

An alternative approach would limit rather than eliminate the federal tax subsidy for stadium financing. As mentioned earlier, current law allows the tax exemption for bonds used to finance any of a list of qualified private activities (stadium financing was removed from the list with TRA86), with the total volume of tax-exempt qualified private activity bonds capped for each state. The federal subsidy could be curtailed by denying governmental bond financing for stadiums (by eliminating the private payment test), while allowing stadium financing through tax-exempt qualified private activity bonds.[18] As discussed by Lathrope (1997) and Zimmerman (1997, 2008), this policy change would have several effects, including forcing states to choose between federal tax subsidy for stadium financing versus for other qualified financing under the volume cap; allowing state and local governments to use taxes directed at the beneficiaries of the stadiums to finance the tax-exempt bonds; and eliminating the tax subsidy for stadium luxury boxes, since the law does not allow

17 The bottom two rows are the methodologies used by the Joint Committee on Taxation (2008, 2012a, 2012b, 2013).
18 Gans (2010) proposes a compromise, whereby only renovations to existing stadiums could be considered qualified private activity, and that a stadium may only be renovated every 20 years.

the proceeds from tax-exempt qualified private activity bonds to finance such things. Additionally, current law requires that such bonds be expressly approved by either a voter referendum or by an elected representative after a public hearing following reasonable notice to the public, which would increase the transparency of stadium deals that benefit from tax-exempt financing (Internal Revenue Service, 2016).

The above reform options are targeted specifically at federal subsidies for sports stadiums. A broader reform would deal with the inefficiencies of tax-exempt bond financing in general, not just stadium financing, which would allow the federal government to maintain the current subsidy incentives, but at lower cost to the federal budget. Recall that tax-exempt bonds are an economically inefficient means of providing a subsidy because the value to the bond issuers is only a fraction of the total reduction in tax revenue, as bondholders in higher tax brackets receive windfall gains. This inefficiency could be eliminated by changing the tax exemption to a tax credit, either in the form of what is known as "tax-credit bonds" or "direct-pay bonds."

A tax-credit bond provides a credit against the bondholder's overall federal income tax liability. In addition to eliminating the inefficiency associated with tax-exempt bonds, tax-credit bonds also have the advantage of flexibility, in that the amount of the tax credit could vary depending on the purpose for which the bond is issued (ideally setting the federal subsidy to the amount that is economically justified on public good grounds). There is some, albeit limited and recent, history of federal use of tax-credit bonds. Most recently, the American Recovery and Reinvestment Act of 2009 created Build America Bonds (issued only in 2009 and 2010) that set a tax credit for bondholders of 35 percent of the interest. The bondholder must report both the interest payment and the credit as taxable.

A direct-pay bond provides a credit to the bond issuer in an amount equal to a portion of each of the interest payments the issuer makes to the bondholder. For example, issuers of Build America Bonds can elect to be issued direct-pay bonds and receive a credit equal to 35 percent of the taxable interest paid to the bondholders. In addition to eliminating the inefficiency associated with tax-exempt bonds, direct-pay bonds—since they directly subsidize interest payments—would be subject to the federal government's annual appropriations limit. Tax-exempt municipal bonds are outside of the appropriation process, reducing their transparency and limiting Congress's control over the allocation.[19]

CONCLUSIONS

Proponents of government subsidies for sports stadiums typically justify them on the grounds that stadiums provide spillover gains to the local economy. The evidence for these spillover gains is weak. Academic studies consistently find no discernible positive relationship between sports facility construction and local economic development, income growth, or job creation. Even if one believes, contrary to the empirical evidence, that the spillover benefits to the local economy justify subsidies, there still remains no economic justification for federal subsidies for sports stadiums. Under current

19 For more detailed discussions of tax-credit bonds and direct-pay bonds (also known as a "taxable bond option"), see Congressional Budget Office (2004), Joint Committee on Taxation (2012b), and Congressional Budget Office and Joint Committee on Taxation (2009).

tax law, stadium financing is eligible for tax-exempt status, which amounts to a substantial federal subsidy. What's more, current tax law provides a perverse incentive for a federal government match for state and local government subsidies for stadiums, and it provides a disincentive for local governments to finance the stadium subsidies by taxes that largely fall on those receiving the benefits of the stadium.

We examine the financing for all professional sports stadiums newly constructed, majorly renovated, or currently under construction since 2000 for Major League Baseball, the National Football League, the National Basketball Association, and the National Hockey League. We find that for these 45 stadiums, the discounted value of the federal tax subsidy is $3.2 billion (using a 3 percent discount rate) or $2.6 billion (using a 5 percent discount rate). Given the inefficiency of the tax exemption, the lost revenue to the federal government exceeds the subsidy amounts, resulting in an estimated revenue loss of $3.7 billion (using a 3 percent discount rate) or $3.0 billion (using a 5 percent discount rate).

The simplest and most direct way to address this inefficient federal subsidy would be to eliminate the private payment test for sports stadiums, which would eliminate the authority to issue federal tax-exempt governmental bonds for stadiums. Short of that, an alternative approach would limit the federal tax subsidy by classifying stadium bonds as qualified private activity bonds, which would make them subject to a state-wide volume cap, place additional restrictions on their use, and allow financing of the bonds through taxes directed at the beneficiaries of the stadiums.

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Table 1. Total Expenditures on Transportation and Water Infrastructure, 2014

	Public						
	Federal						
	Direct expenditure	*Grants and loan subsidies*	*Total federal*	*State/local*	*Total public*	*Private*	*Total*
Highways	1.5	44.9	46.4	118.3	164.7	0.0	164.7
Rail	0.3	2.7	3.0	n.a.	3.0	9.7	12.7
Mass transit	0.2	12.3	12.5	52.9	65.4	0.2	65.6
Aviation	12.9	3.2	16.1	20.0	36.1	1.0	37.1
Water transportation	4.2	0.1	4.3	5.6	9.9	0.3	10.2
Water resources	9.8	0.1	9.9	18.3	28.2	0.0	28.2
Water utilities	0.0	4.4	4.4	104.5	108.9	0.8[a]	109.7
Total	**28.9**	**67.7**	**96.6**	**319.6**	**416.2**	**12.0**	**428.2**

Sources: For public investment, Congressional Budget Office (2015); for private investment, Bureau of Economic Analysis (2015).
Notes: Units are billions of 2014 dollars. Total expenditure includes capital investment, and operation and maintenance costs.
a. Includes waste management and remediation services.

Table 2. Bond Issuance Structure for the Funding of FedExForum, 2002

Series	*Total principal value (2002 dollars)*	*Total principal value (2014 dollars)*	*Type of bond*
A	$113,325,000.00	$149,127,888.83	Serial and term
B	$88,965,000.00	$117,071,807.89	Serial and term
C	$18,535,000.00	$24,390,782.43	Term
D	$2,699,414.55	$3,552,243.48	Capital appreciation
E	$1,300,890.80	$1,711,882.63	Capital appreciation

Source: Electronic Municipal Market Access, a service of the Municipal Securities Rulemaking Board.

Table 3. Descriptive Data

(1) Stadium	(2) Team (League)	(3) Use of tax-exempt municipal bonds	(4) Year completed	(5) Year of bond issuance	(6) Total cost of stadium (millions)[a]	(7) Tax-exempt municipal bonds issued (millions)[a]
American Airlines Arena	Miami Heat (NBA)		2000	n.a.	$293	n.a.
American Airlines Center	Dallas Mavericks (NBA)[b]	×	2001	1998	$561	$152
Amway Center	Orlando Magic (NBA)	×	2010	2008	$521	$342
AT&T Center	San Antonio Spurs (NBA)	×	2002	2000	$245	$169
AT&T Park	San Francisco Giants (MLB)		2000	n.a.	$491	n.a.
AT&T Stadium	Dallas Cowboys (NFL)	×	2009	2005	$1,318	$337
Barclays Center	Brooklyn Nets (NBA)[c]	×	2012	2009	$1,031	$564
Busch Stadium	St. Louis Cardinals (MLB)		2006	n.a.	$429	n.a.
CenturyLink Field	Seattle Seahawks (NFL)	×	2002	1999	$515	$142
				2000		$268
Chesapeake Energy Arena	Oklahoma City Thunder (NBA)		2002	n.a.	$117	n.a.
			2008	n.a.	$134	n.a.
Citi Field	New York Mets (MLB)	×	2009	2006	$817	$643
				2009		$91
Citizens Bank Park	Philadelphia Phillies (MLB)	×	2004	2001[d]	$574	$214
Comerica Park	Detroit Tigers (MLB)	×	2000	1997	$412	$127
Consol Energy Center	Pittsburgh Penguins (NHL)	×	2010	2007	$348	$288
FedExForum	Memphis Grizzlies (NBA)	×	2004	2002	$313	$296
Ford Field	Detroit Lions (NFL)	×	2002	1997	$658	$25[g]
Gila River Arena	Arizona Coyotes (NHL)	×	2003	2002	$283	$37
				2003		$64
Gillette Stadium	New England Patriots (NFL)		2002	n.a.	$542	n.a.
Great American Ball Park	Cincinnati Reds (MLB)	×	2003	2000[h]	$418	$386
Heinz Field	Pittsburgh Steelers (NFL)	×	2001	1999[i]	$376	$125
Lambeau Field	Green Bay Packers (NFL)	×	2003	2001	$380	$143
Levi's Stadium	San Francisco 49ers (NFL)		2014	n.a.	$1,310	n.a.
Lincoln Financial Field	Philadelphia Eagles (NFL)	×	2003	2001[d]	$666	$214
Little Caesars Arena	Detroit Red Wings (NHL)	×	2017[e]	2014	$450[f]	$250
Lucas Oil Stadium	Indianapolis Colts (NFL)	×	2008	2005	$792	$485
				2007		$242
				2008		$60
Marlins Park	Miami Marlins (MLB)	×	2012	2009	$654	$347
				2010		$147
MetLife Stadium	New York Jets/Giants (NFL)		2010	n.a.	$1,737	n.a.
Miller Park	Milwaukee Brewers (MLB)	×	2001	1996	$535	$221
				1997		$86
				1999		$60
Minute Maid Park	Houston Astros (MLB)	×	2000	1998	$344	$229
Nationals Park	Washington Nationals (MLB)	×	2008	2006	$846	$446
Nationwide Arena	Columbus Blue Jackets (NHL)		2000	n.a.	$241	n.a.
NRG Stadium	Houston Texans (NFL)	×	2002	2000	$624	$423

Table 3. Descriptive Data (cont.)

(1) Stadium	(2) Team (League)	(3) Use of tax-exempt municipal bonds	(4) Year completed	(5) Year of bond issuance	(6) Total cost of stadium (millions)[a]	(7) Tax-exempt municipal bonds issued (millions)[a]
Paul Brown Stadium	Cincinnati Bengals (NFL)	×	2000	1998	$619	$500
Petco Park	San Diego Padres (MLB)	×	2004	2002	$572	$223
PNC Park	Pittsburgh Pirates (MLB)	×	2001	1999[h]	$350	$125
Prudential Center	New Jersey Devils (NHL)	×	2007	2004	$428	$239
Soldier Field	Chicago Bears (NFL)	×	2003	2001	$755	$533
Sports Authority Field	Denver Broncos (NFL)	×	2001	1999	$536	$348
Target Field	Minnesota Twins (MLB)	×	2010	2007	$591	$171
				2008		$211
Time Warner Cable Arena	Charlotte Hornets (NBA)	×	2005	2003	$321	$229
Toyota Center	Houston Rockets (NBA)	×	2003	2001	$302	$304
University of Phoenix Stadium	Arizona Cardinals (NFL)	×	2006	2003	$534	$286
				2005		$64
US Bank Stadium	Minnesota Vikings (NFL)	×	2016[e]	2014	$1,079[f]	$392
Xcel Energy Center	Minnesota Wild (NHL)		2000	n.a.	$234	n.a.
Yankee Stadium	New York Yankees (MLB)	×	2009	2006	$2,538	$1,107
				2007		$271
				2009		$286
Total		36			$27,833	$13,008

Sources: See the Data Appendix.
Notes: Estimates are in 2014 dollars.
a. Includes ancillary structures, such as parking and infrastructure improvements.
b. Stadium shared with the Dallas Stars (NHL).
c. Stadium shared with the New York Islanders (NHL).
d. Bond split between Citizens Bank Park and Lincoln Financial Field.
e. Projected year of completion; stadium is currently under construction.
f. Projected cost.
g. This is likely an underestimate, and reflects only the bonds issued by the City of Detroit; a substantial amount of bonds (on the order of $100 million) are believed to have been issued by Wayne County, and are missing from our data set.
h. Bond split between Great American Ball Park and Paul Brown Stadium.
i. Bond split between Heinz Field and PNC Park.

Table 4. Subsidy and Revenue Loss Estimates

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Stadium	*Team (League)*	*Undiscounted subsidy (millions)*	*Undiscounted revenue loss (millions)*	*Discounted (3%) subsidy (millions)*	*Discounted (5%) subsidy (millions)*	*Discounted (3%) revenue loss (millions)*	*Discounted (5%) revenue loss (millions)*
American Airlines Arena	Miami Heat (NBA)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
American Airlines Center	Dallas Mavericks (NBA)[a]	$54	$61	$39	$32	$44	$36
Amway Center	Orlando Magic (NBA)	$100	$134	$70	$57	$93	$76
AT&T Center	San Antonio Spurs (NBA)	$53	$56	$41	$36	$44	$38
AT&T Park	San Francisco Giants (MLB)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
AT&T Stadium	Dallas Cowboys (NFL)	$84	$131	$56	$45	$88	$70
Barclays Center	Brooklyn Nets (NBA)[b]	$182	$239	$122	$98	$161	$129
Busch Stadium	St. Louis Cardinals (MLB)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
CenturyLink Field	Seattle Seahawks (NFL)	$118	$127	$94	$81	$101	$88
Chesapeake Energy Arena	Oklahoma City Thunder (NBA)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Citi Field	New York Mets (MLB)	$285	$328	$185	$146	$214	$169
Citizens Bank Park	Philadelphia Phillies (MLB)	$95	$95	$68	$57	$68	$57
Comerica Park	Detroit Tigers (MLB)	$54	$56	$39	$32	$41	$34
Consol Energy Center	Pittsburgh Penguins (NHL)	$88	$90	$64	$53	$65	$54
FedExForum	Memphis Grizzlies (NBA)	$120	$120	$87	$72	$87	$72
Ford Field	Detroit Lions (NFL)	$9	$9	$7	$6	$7	$6
Gila River Arena	Arizona Coyotes (NHL)	$26	$30	$20	$17	$23	$19
Gillette Stadium	New England Patriots (NFL)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Great American Ball Park	Cincinnati Reds (MLB)	$197	$208	$134	$108	$142	$115
Heinz Field	Pittsburgh Steelers (NFL)	$57	$64	$40	$32	$44	$36
Lambeau Field	Green Bay Packers (NFL)	$48	$48	$35	$30	$35	$30
Levi's Stadium	San Francisco 49ers (NFL)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Lincoln Financial Field	Philadelphia Eagles (NFL)	$95	$95	$68	$57	$68	$57
Little Caesars Arena	Detroit Red Wings (NHL)	$35	$71	$25	$20	$50	$41
Lucas Oil Stadium	Indianapolis Colts (NFL)	$237	$311	$163	$131	$214	$172
Marlins Park	Miami Marlins (MLB)	$147	$193	$100	$80	$132	$106
MetLife Stadium	New York Jets/Giants (NFL)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Miller Park	Milwaukee Brewers (MLB)	$145	$163	$104	$85	$117	$96
Minute Maid Park	Houston Astros (MLB)	$100	$113	$69	$56	$78	$63
Nationals Park	Washington Nationals (MLB)	$132	$150	$94	$78	$107	$88
Nationwide Arena	Columbus Blue Jackets (NHL)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
NRG Stadium	Houston Texans (NFL)	$178	$189	$129	$107	$137	$114
Paul Brown Stadium	Cincinnati Bengals (NFL)	$229	$255	$164	$135	$182	$150
Petco Park	San Diego Padres (MLB)	$95	$95	$68	$56	$68	$56
PNC Park	Pittsburgh Pirates (MLB)	$57	$64	$40	$32	$44	$36
Prudential Center	New Jersey Devils (NHL)	$67	$86	$47	$38	$60	$49
Soldier Field	Chicago Bears (NFL)	$304	$304	$205	$163	$205	$163
Sports Authority Field	Denver Broncos (NFL)	$57	$63	$49	$44	$54	$50
Target Field	Minnesota Twins (MLB)	$109	$125	$79	$65	$91	$75
Time Warner Cable Arena	Charlotte Hornets (NBA)	$75	$93	$53	$43	$65	$53
Toyota Center	Houston Rockets (NBA)	$164	$164	$112	$90	$112	$90

Table 4. Subsidy and Revenue Loss Estimates (cont.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Stadium	*Team (League)*	*Undiscounted subsidy (millions)*	*Undiscounted revenue loss (millions)*	*Discounted (3%) subsidy (millions)*	*Discounted (5%) subsidy (millions)*	*Discounted (3%) revenue loss (millions)*	*Discounted (5%) revenue loss (millions)*
University of Phoenix Stadium	Arizona Cardinals (NFL)	$102	$131	$74	$61	$94	$78
US Bank Stadium	Minnesota Vikings (NFL)	$44	$88	$32	$27	$65	$54
Xcel Energy Center	Minnesota Wild (NHL)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Yankee Stadium	New York Yankees (MLB)	$669	$765	$431	$338	$492	$386
Total		$4,610	$5,314	$3,206	$2,609	$3,691	$3,002

Sources: See the Data Appendix.
Notes: Estimates are in 2014 dollars.
a. Stadium shared with the Dallas Stars (NHL).
b. Stadium shared with the New York Islanders (NHL).

Table 5. Results Using Alternative Indexes for Interest Rate Spread

Nontaxable bond index	*Taxable bond index*	*Undiscounted subsidy (millions)*	*Undiscounted federal revenue loss (millions)*	*Discounted (3%) subsidy (millions)*	*Discounted (5%) subsidy (millions)*	*Discounted (3%) federal revenue loss (millions)*	*Discounted (5%) federal revenue loss (millions)*
Moody's Aa-rated 20-year municipal bond average	Moody's Aa-rated corporate bond index	$4,610	$5,316	$3,206	$2,609	$3,692	$3,003
Bond Buyer 20-year Municipal Bond Index	Moody's Aa-rated corporate bond index	$4,326	$5,155	$3,007	$2,447	$3,577	$2,908
Moody's Aaa-rated 20-year municipal bond average	Moody's Aaa-rated corporate bond index	$4,242	$5,088	$2,948	$2,398	$3,535	$2,875
Standard & Poor's high-grade municipal bonds	Moody's Aa-rated corporate bond index	$4,359	$5,314	$3,032	$2,467	$3,691	$3,002
Bond Buyer 20-year Municipal Bond Index	Moody's Aaa-rated corporate bond index	$3,543	$4,931	$2,465	$2,007	$3,422	$2,782
Standard & Poor's high-grade municipal bonds	Moody's Aaa-rated corporate bond index	$3,576	$5,088	$2,490	$2,027	$3,535	$2,875

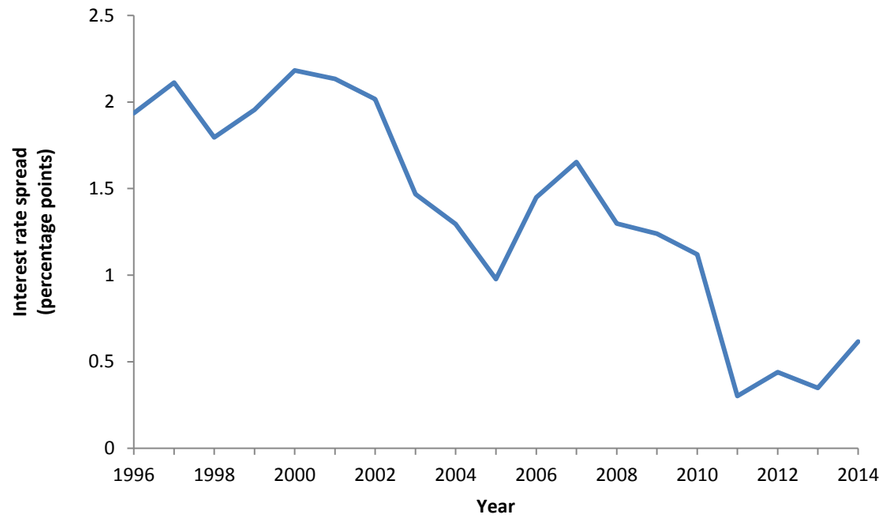
Sources: Authors' calculations, based on data from Moody's Investors Service/Bloomberg, The Bond Buyer, and Council of Economic Advisers (2005, 2015).
Notes: Estimates are in 2014 dollars. The indexes used in rows three and five result in some annual estimates of negative spreads. For those years, we set the spread to 0 and the ratio of the market-clearing tax rate to the average tax rate of municipal bond holders to 1.

Table 6. Summary Statistics for New Stadiums by League, 2000–14

League	*Number of new or renovated stadiums*	*Number financed by tax-exempt bonds*	*Average cost (millions)*	*Average financed by tax-exempt bonds (millions)*	*Average discounted (3%) subsidy (millions)*	*Average discounted (5%) subsidy (millions)*
MLB	14	12	$683.6	$449.3	$117.6	$94.5
NFL	16	13	$777.5	$360.2	$85.8	$70.7
NBA[a]	9	7	$426.6	$293.7	$74.9	$61.1
NHL	6	4	$330.7	$219.4	$38.8	$32.0
Total or average	45	36	$618.5	$361.3	$89.0	$72.5

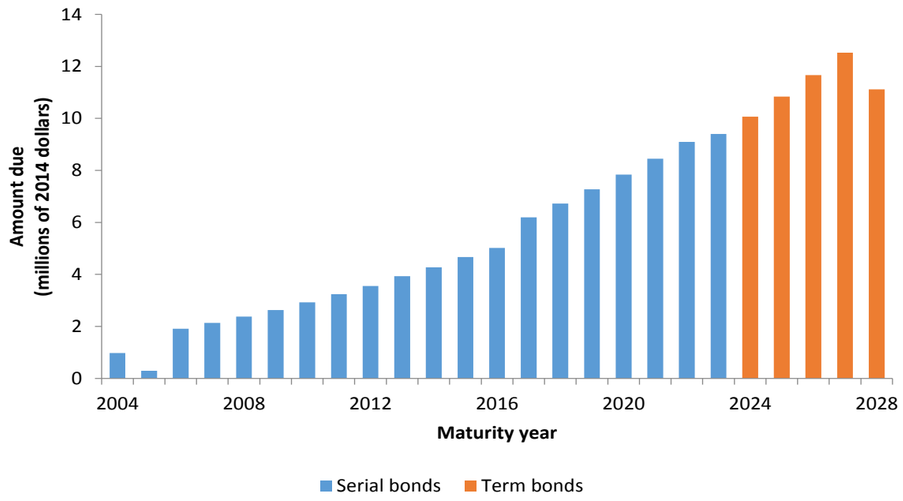
Sources: Authors' calculations; see the Data Appendix.
Notes: Dollar estimates are in 2014 dollars. The estimates in the final three columns exclude stadiums with no tax-exempt financing.
a. Two NBA arenas are jointly shared with NHL teams, and are counted as NBA arenas in these statistics.

Figure 1. Interest Rate Spread between Municipal Bonds and Corporate Bonds, 1996–2014



Sources: Moody's Investors Service/Bloomberg.
Notes: Interest rates are annual averages. All bonds are rated Aa by Moody's, and have maturities of at least 20 years.

Figure 2. Redemption Schedule for the FedExForum Series A Bonds, 2004–28



Source: Electronic Municipal Market Access, a service of the Municipal Securities Rulemaking Board.

Data Appendix

All information about specific stadium bonds comes from official bond issuance documentation, the majority of which is housed on the Electronic Municipal Market Access website at emma.msrb.org. A few bonds were not available on the Electronic Municipal Market Access website, and were instead obtained directly from the issuers. Specifically, the 1999 bond issuance shared jointly with Heinz Field and PNC Park was obtained using a Right to Know request, and was received directly from the Sports & Exhibition Authority; the 2002 bond issuance used to fund Petco Park was obtained directly from the website of the City of San Diego, www.sandiego.gov; the 1997 bond issuance used to fund Ford Field was obtained through email and phone correspondence with a member of the Debt Management Division of the City of Detroit. (All official bond issuance documentation is available in PDF form upon request.)

Estimates for the total costs for the stadium were more difficult to come by than the data on the bonds used to finance them. We collected the cost data primarily from the following websites, and where there were discrepancies across websites on the costs of a specific stadium, we attempted to resolve them by consulting other sources, such as online local newspaper articles.

- *Sports Facility Reports* (Anderson and Pirics, 2015), by the National Sports Law Institute of Marquette University Law School
  - MLB: law.marquette.edu/assets/sports-law/pdf/MLB.15.pdf
  - NBA: law.marquette.edu/assets/sports-law/pdf/NBA.15.pdf
  - NFL: law.marquette.edu/assets/sports-law/pdf/NFL%202015.pdf
  - NHL: law.marquette.edu/assets/sports-law/pdf/NHL.15.pdf

- www.ballparks.com, by Paul Munsey and Cory Suppes
  - MLB: www.ballparks.com/baseball
  - NBA: basketball.ballparks.com
  - NFL: football.ballparks.com
  - NHL: hockey.ballparks.com

- www.stadiumtravelguide.com, by Stadium Travel Guide
  - MLB: www.ballparksofbaseball.com
  - NBA: www.insidearenas.com
  - NFL: www.stadiumsofprofootball.com

- "NFL Stadium Funding Information: Stadiums Opened Since 1997," by Conventions, Sports & Leisure International, cbsminnesota.files.wordpress.com/2011/12/nfl-funding-summary-12-2-11.pdf