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Evaluating the Effect of Differences in Revenue Systems on the Fiscal Health of Large U.S. Cities

Working Paper WP17HC1

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Abstract

Sustainable fiscal health is crucial for cities. To do this, they must be able to generate flows of revenue over time sufficient to pay for needed services, even as the cost of those services grows. These two sides of fiscal health are referred to as expenditure need and fiscal capacity. In this project, I analyze both expenditure need and fiscal capacity over the period 2000–2013. I use the Lincoln Institute of Land Policy's Fiscally Standardized Cities (FiSC) database, merged with housing market data from CoreLogic and Census data on the income and demographic characteristics of cities, to study the effects on spending of population change, density, and intergovernmental aid. On the revenue side, I examine the effect of diversification in tax sources, limitations on the property tax, and state and federal aid. The revenue and expenditure analyses are to investigate changes in city fiscal health over time. The analysis finds a strong business cycle effect on city fiscal stress, a secular increase in fiscal disparities between 2000 and 2013, and a sharp decline in the fiscal health of cities in the aftermath of the Great Recession.

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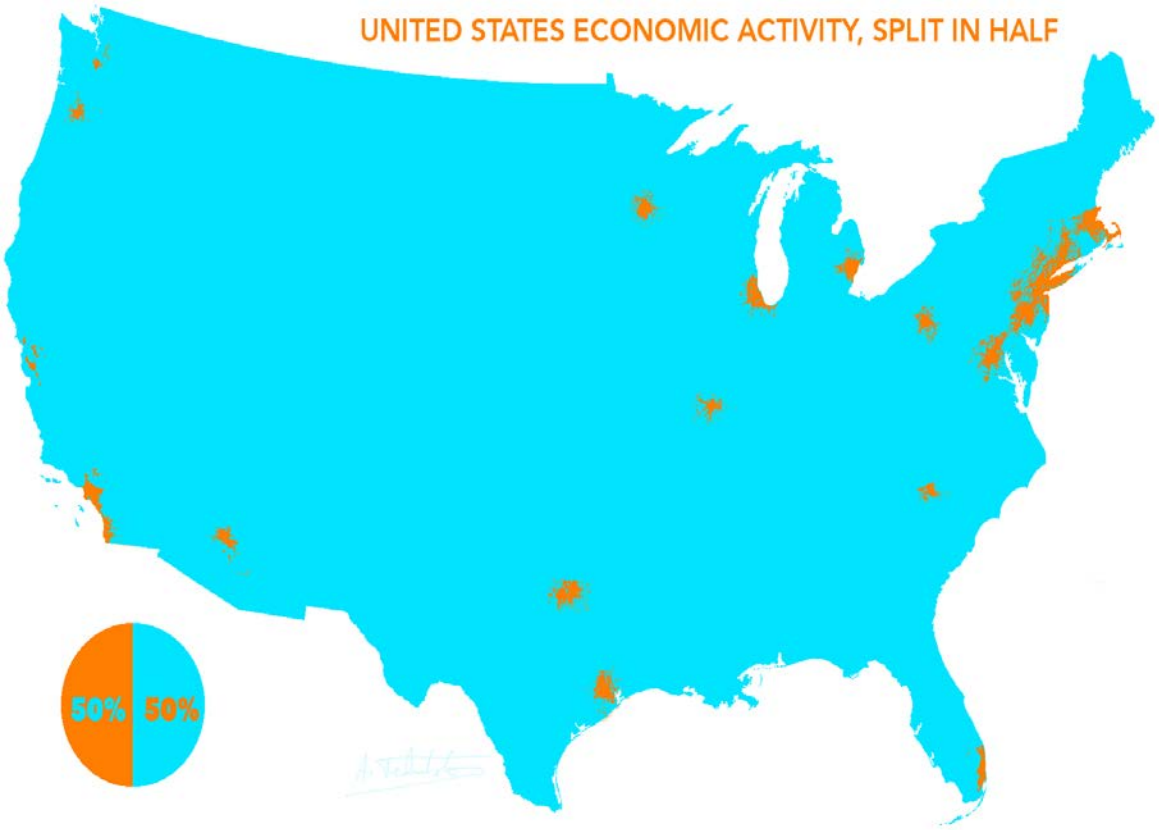
Introduction

The success of cities and their surrounding metropolitan areas are crucial to the well-being of citizens and the economic success of nations. Not only do cities provide a place of residence for a significant share of the population, but they are also the primary geographic locus for entrepreneurship, economic innovation, and productivity growth. The accompanying map provides a vivid illustration of the role of large metropolitan areas in the U.S. economy. The map, based on 2013 data from the Commerce Department's Bureau of Economic Analysis, shows that half of the Gross Domestic Product of the United States is generated in just over 20 metropolitan areas.



Source: http://i.imgur.com/9slRTRJ.png

While the map emphasizes metropolitan areas as the locus of high level economic activity, recent research has pointed to the increasingly tight linkage between the economic fortunes of the central city in metropolitan areas and the success of its suburban areas (Haughwout and Inman 2002). A crucial element of the success of the central city, both as a place to live and a locus of employment and productivity gains, is a public sector that provides quality public services at

competitive tax rates. Public services include the functions that promote the safety, health, and productivity of residents and workers—police and fire protection, courts and jails, sanitation, water supply and sewerage, streets and public transportation, environmental protection, investments in the young—through the provision of elementary and secondary education, and redistributive activities—the provision of housing and other social services to those in need. These services must be financed through taxation of residents and firms, charges for specific activities, and intergovernmental aid from states and the federal government.

The fiscal health of cities depends on the balance between the cost of providing necessary services and the ability of the city to finance those services. The cost of providing a standard level of services is referred to as expenditure need. The ability to finance those services is referred to as fiscal or tax capacity. A city that, in order to provide an average level of public services, must impose a relatively high tax burden to do so is in relatively poor fiscal health. Symmetrically, a city that, if it were to impose an average tax burden, would only be able to provide a below average level of public services, is also in poor fiscal health.

Between 2007 and 2012 the average rate of population change in 150 large U.S. cities was 5.4 percent.[1] However, the variation was substantial, ranging from a population decline of 14 percent in Detroit to an increase of 18 percent in Raleigh, NC. High growth cities face the challenge of financing an expansion of public services and the infrastructure that supports these services. Declining cities face the even more difficult challenge of preserving service levels for the remaining population, and preventing the deterioration of infrastructure.

In this paper, I address changes in fiscal health in terms of both revenue-raising capacity and expenditures need, using a sample of 150 large U.S. cities, from 2000 to 2013.

1. The main topics addressed in this paper are the following:

2. What is fiscal health? What are the conceptual and empirical issues in measuring fiscal health, and in estimating expenditure need and fiscal capacity?

3. Show broad patterns of spending and revenue change in U.S. cities from 2000–2013, and how these patterns are influenced by the business cycle.

4. Does a diversified mix of revenue sources increase stability in revenues over the business cycle?

5. To what extent do constraints on the local revenue system, primarily in the form of property tax limitations, affect levels and growth in revenues? Do limitations on the property tax lead to a shift towards other local revenue sources?

6. How does intergovernmental aid affect spending, own-source revenues, and city fiscal health?

[1] The population data are in the FiSC database. The data source is annual estimates by the U.S. bureau of the Census.

7. The Great Recession has had a severe impact on city finances. Both state aid and taxes fell by at least eight percent from their prior peaks. How has the fiscal health of U.S. cities been affected by the Great Recession?

Roadmap of the Paper

The paper has five sections. The first section discusses the strengths and limitations of the FiSC data in assessing fiscal health, and shows broad patterns of spending and revenue for the FiSC sample. The next section discusses expenditure need, in three parts. The first discusses various conceptual issues in the measurement of expenditure need. The second presents empirical estimates of need. The third part uses the spending estimates, together with actual revenue, to calculate a simplified measure of fiscal stress. The following section examines city revenue, including estimates of the effect of property tax limitations on property tax and other own-source revenues. After that, I compute a second measure of fiscal stress, by comparing median spending change to change in actual revenue change, and relate this second measure of fiscal stress to the composition of city revenues. In the second part of this section, I use a representative tax system approach to calculate fiscal capacity, and use this measure to calculate a third measure of fiscal stress. The last part of this section examines disparities in tax capacity before and after the Great Recession. The final section summarizes and concludes.

The Fiscally Standardized Cities Database

Description

The project uses the Fiscally Standardized Cities (FiSC) database, which I developed in conjunction with Adam Langley and Andrew Reschovsky of the Lincoln Institute of Land Policy. The FiSC database provides information on 150 large central cities, including at least two cities from each state. The FiSC database provides a unique time series on city fiscal data from 1977 through 2013.[2] It permits comparison of city revenue performance both across cities and over time. The advantage of the FiSC data is that it provides a comprehensive accounting of revenues received and expenditures made by all of the units of government that provide services for city residents, including municipalities, school districts, counties, and special districts.

U.S. cities differ dramatically in government organization, with a few cities, such as Baltimore and Boston, responsible for all government services, including education, while other cities, such as Phoenix and Miami, rely heavily on counties and independent school districts for substantial portions of local spending. Comparisons between cities that fail to take account of these organizational differences are inherently flawed. For political jurisdictions such as counties that overlap the city, but are geographically larger than the city itself, the FiSC methodology assigns the revenues and expenditures of the overlying government to the FiSC based on city population shares (in the case of counties, and special districts), and city shares of enrolled public school students, in the case of school districts. The FiSC data are structured so as to provide the building

[2] Following the release of Census Data for 2014 in April of 2017, the FiSC data set was extended by Adam Langley to include 2014. The analysis presented here was completed before the 2014 data were available, hence only going up to 2013.

blocks for the FiSC, i.e. the revenues and expenditures of each of the constituent governments. In this way, the data set permits both overall comparisons along many dimensions of fiscal health, and the building blocks that can help to explain differences across cities. As part of another project, we have added detailed housing market data from CoreLogic, a private real estate information company, to the FiSC fiscal data. We have also supplemented the FiSC database with data from the American Community Survey on the socio-economic and demographic characteristics of the FiSC cities.

Fiscal health is a function of the balance between expenditure need and revenue capacity. Expenditure need is a function of the assignment of service responsibilities to a city, and the cost of providing given levels of particular services. The FiSC approach is explicitly designed to take account of local service responsibility, by aggregating the revenues and spending of the constituent local governments serving the residents of central cities. One of the strengths of the FiSC data is that it includes the spending and revenues of special districts. Special districts are particularly important in the provision of mass transit and hospitals. Since such districts frequently cut across municipal boundaries, the FiSC allocation provides a comprehensive accounting of current and capital expenditures that are made on behalf of city residents but provided by a metropolitan-wide agency.[3]

Limitations of the FiSC Data

A limitation of the FiSC data is that it does not take full account of differences across states in state versus local government responsibility for public services. For example, in a small number of cities, including New York City and Boston, the responsibility for public transit is assigned to a state agency—the Metropolitan Transit Agency for New York, and the Massachusetts Bay Transportation Authority for Boston.[4] Hence, the revenues and spending of those agencies, though important for the functioning of the city, would typically not be included in the FiSC data.[5] In those cities where public authorities are classified by the census bureau as local, they will typically be designated as special districts. An example would be the Southeastern Pennsylvania Transit Authority (SEPTA). In this case, the revenues and spending of SEPTA, both capital and operating, are pro-rated to the FiSC of Philadelphia, based on Philadelphia's share of the total population of the covered by SEPTA.[6]

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[3] The FiSC data are also being updated to include the cost of future pension obligations. When available, we will also use this information to help inform our analysis of expenditure need.

[4] The criterion used by the Census Bureau in assigning an authority to the state or the local level is based on which level of government has the primary authority to appoint members of the Board of Directors.

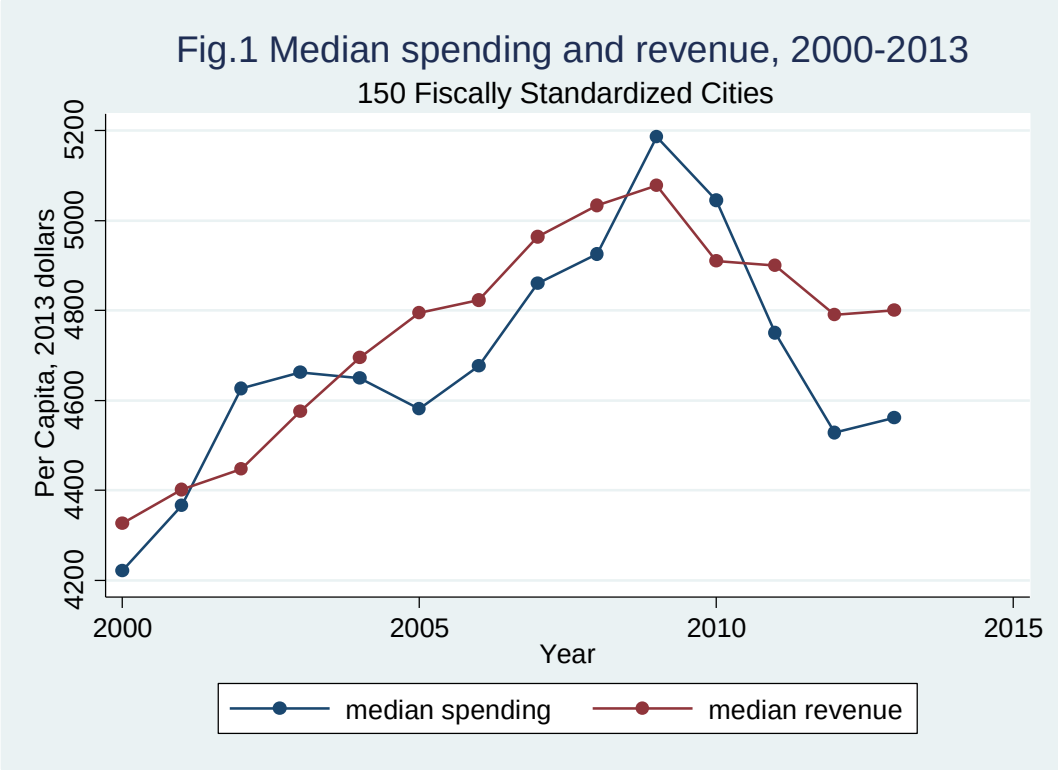
[5] The taxes paid by residents in jurisdictions within the state authority boundaries show up as intergovernmental expenditures in the Census of Governments. However, when such spending is counted as utility expenditures, we do not include the amounts in the FiSC data set. The MTA fiscal flows are clearly the largest amounts in these categories in the U.S. The NYC Independent Budget Office estimates that NYC residents and firms pay at least $3 billion annually to the MTA. At our request, a brief review by Census of Government experts, suggests that the contributions and spending by the MTA are an anomaly in terms of magnitude of fiscal flows from local to state governments. In 2013, The Massachusetts Bay Transportation Authority assessment that Boston pays to the state was only $80 million. Boston also pays about 125 million to the Massachusetts Water Resource Authority annually for sewerage. All of these fiscal flows are in the utilities section of the COG classification, which we have chosen to exclude from the FiSC data set.

[6] However, even in the case of state public authorities, some of the spending may show up under local government or special districts that are included in the FiSC. In NYS it is not uncommon for a public authority to loan its bond

A second limitation stems from lags in data availability. Census of Governments (COG) data by city are only available with a lag of two to three years, so it cannot be used to assess contemporaneous changes in city fiscal conditions.

Revenue and Spending Patterns for FiSC Cities

Figure 1 shows per capita median spending and median general revenue for 150 FiSCs, for the period 2000–2013. Spending rose from $4,220 in 2000 to a peak of $5,185 in 2009, then fell for four straight years, with a cumulative drop of 12.7 percent. There was a slight rise in 2013. While the two series track each other relatively closely, the figure suggests that revenue was somewhat more stable than spending. Spending showed a more rapid rate of increase in periods of growth than revenue and a faster rate decreases in periods of decline. This is somewhat surprising, in that the usual assumption is that revenue growth is more subject to the business cycle than spending. Instead, the picture from figure 1 suggests that when spending growth exceeds revenue growth for any significant time period, this is typically followed by a much larger drop in spending than in revenues.[7]



proceeds to another authority which might be attached to another government. So, if the Dormitory Authority lends money to a NYC authority, which then makes the capital expenditure, the actual capital expenditure is treated in the COG as a NYC expenditure, and would be picked up in the FiSC data. In some states, state bond banks are used to issue debt on behalf of very small municipal entities. FiSC cities are unlikely to use the municipal bond banks.

[7] Chernick and Reschovsky (2016) find that capital expenditures were the most volatile category of spending during the Great Recession. This volatility helps to explain the greater overall volatility of spending as opposed to revenue.

Changes in median values mask considerable diversity in city fiscal patterns over time. To get a sense of this diversity, figures 2 and 3 shows spending and revenue patterns for cities with particularly large changes in spending over the period 2000 to 2013. Figure 2 shows the median change for 10 cities with the largest percentage decreases (22 percent), while figure 3 shows the median increase for the 10 largest increase cities (60 percent). Figure 2 indicates that the major period of decrease for these cities was the Great Recession. Spending changes were modest in the period prior to the Great Recession. A comparison with figure 1 suggests that the major difference in fiscal patterns between cities with large decreases and the median city was that the former did not share in the sustained run-up in spending (and revenue) in the earlier part of the thirteen-year window of observation. The rate of decline in the aftermath of the Great Recession was similar for the decrease cities as for the median. By contrast, for the cities with large increases, spending and revenues rose robustly for most of the period from 2000 to 2008, but showed only small drops in the Great Recession period. These differential spending patterns can be seen more clearly in figure 4, which plots median spending for both the all city median and the highest and lowest growth cities.

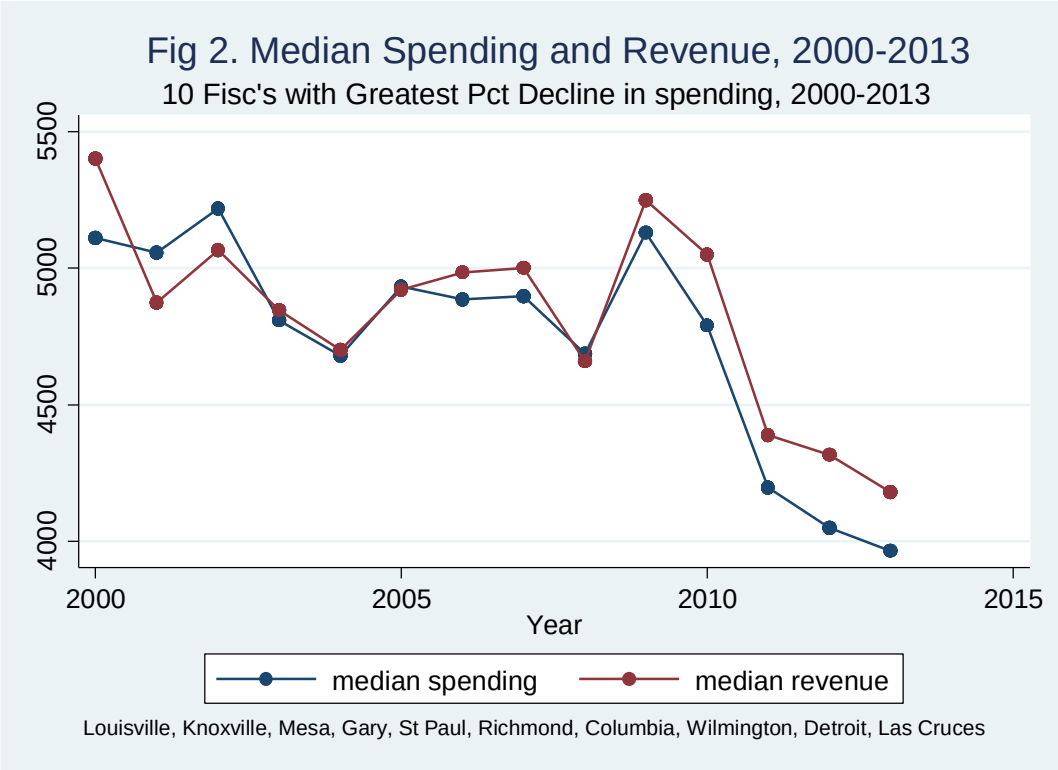
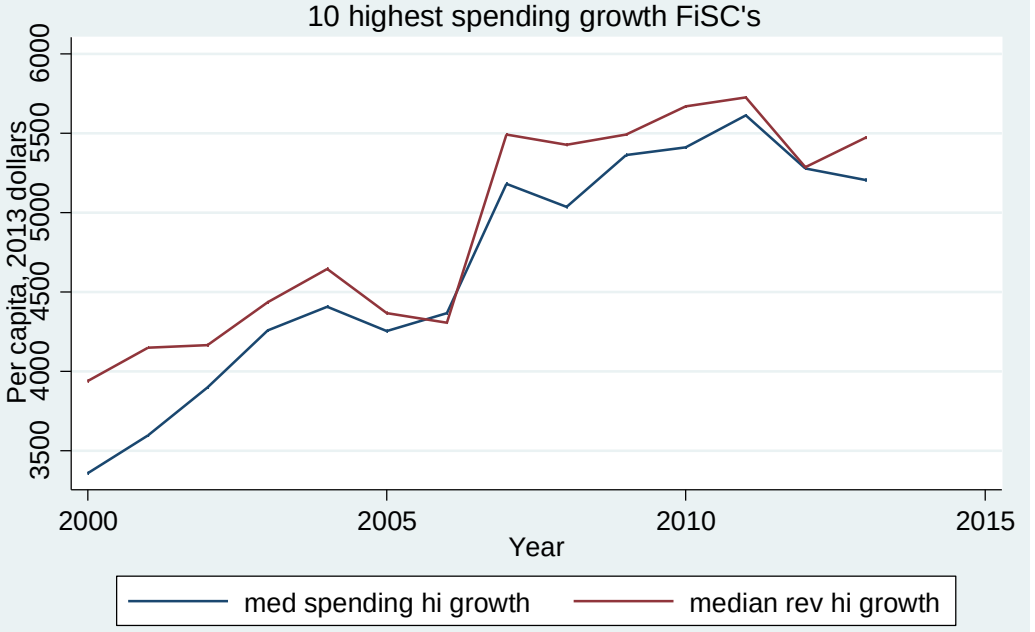


Fig. 3 Median spending and revenue 2000-2013

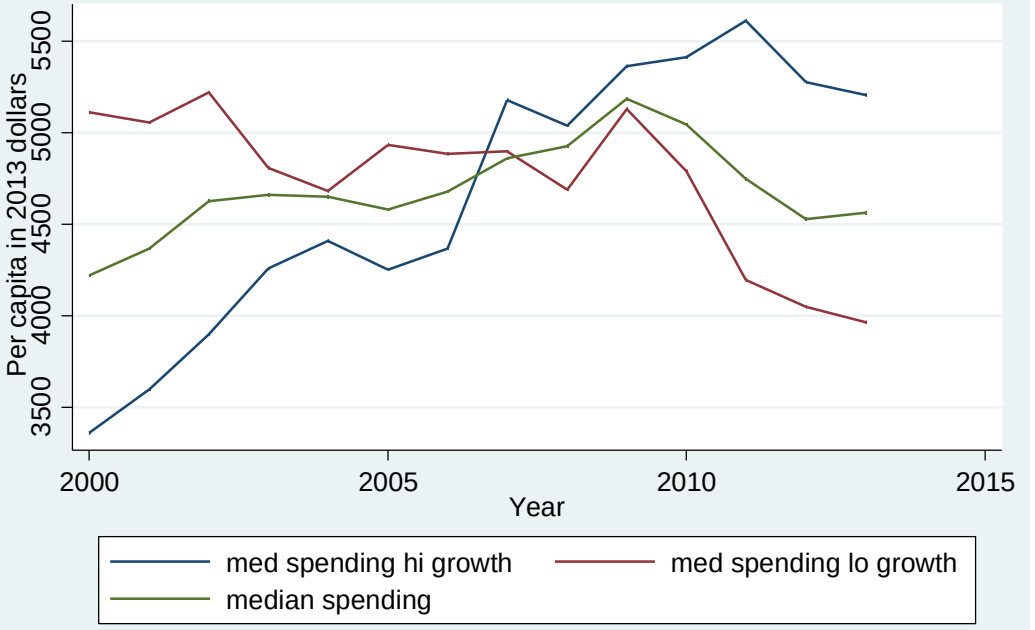
10 highest spending growth FiSC's



Cities: Balt, Prov, Syr, Burl, Cedar Rapids, Montgomery, New Orl., Baton Rouge, Cheyenne, Wash DC

Fig. 4. FiSC General Spending, 2000-2013

Median for all cities, and 10 highest and 10 lowest spending growth cities



Fiscal Gap vs Credit Risk Approach to Fiscal Health

There are a variety of aspects of city fiscal health, and a variety of measures. No single approach or measure can capture all of the facets of fiscal health.[8] The fiscal health measure considered in this paper compares the revenue raising capacity of cities to an approximation of expenditure need. The difference between the two is the fiscal gap or fiscal surplus. This approach, which has a long tradition in public finance, should be viewed as complementary to budgetary and debt-related measures of fiscal stress. The two approaches require different types of data, with different sources.

The Census Bureau public finance statistics are organized to show a government's finances in their entirety, with emphasis on the general government sector. Within the totals of government revenue and expenditure, internal transfers e.g. interfund transactions, are "netted out." Therefore, "general revenue" and "general expenditure" represent only revenue from external sources and expenditures to individuals or agencies outside the government, and do not directly reflect any "transfer" or "contributions" to or from utilities, liquor stores, or insurance trust sectors. Thus, the fund accounting nature of government reports disappears in Census Bureau statistics.

In contrast to Census of Governments data, general fund accounting figures, with rules established by the Government Accounting Standards Board, provide an understanding of the changing character of fund balances for a municipality. An example would be "unassigned" and "undesignated" fund balances, as opposed to "assigned" fund balance). Such fund balance information is highly relevant to the assessment of contemporaneous fiscal capacity and revenue stability.

Changes in short-term debt levels are often a signal of fiscal stress. Internal transactions data, as provided by Comptrollers Annual Financial Reports (CAFRs), annual audits, and annual information statements, are important tools in assessing whether a city is facing immediate fiscal stress. If these indicators show a pattern of excessive internal inter-fund borrowing, or increased reliance on short-term external borrowing, particularly if examined longitudinally, they may provide early warnings as to whether a city is headed towards a fiscal crisis.

In contrast to the Comptrollers Reports, the COG data, while distinguishing between short and long-term debt, only measure the amount of short-term debt at the beginning and the end of the fiscal year. Intra-year short term borrowing, which may be crucial to fiscal solvency in periods of fiscal stress, is completely excluded. High annual growth in short-term debt, while suggestive of increasing fiscal pressure, may be of limited use in predicting or anticipating an actual fiscal crisis.[9]

[8] See the discussion by Bird (2015) of various measures of fiscal health.
[9] See the appendix for an examination of debt patterns in Detroit in the period preceding the declaration of bankruptcy in 2013.

Fiscal monitors focus on structural imbalances between revenues and expenditures.[10] Credit markets rely on bond rating agencies to evaluate whether a city has sufficient fiscal capacity to be able to repay its existing long-term debt, and/or to take on additional debt. Fiscal health is typically measured in terms of the risk of default on bonds. Analysts seek to determine whether a city can meet its debt obligations under current and projected future economic conditions. Typical questions asked include:

- How fiscally vulnerable is a city to shocks to its real estate base, or to reductions, anticipated or unanticipated, in intergovernmental aid?

- Can property tax rates be raised to offset declines in property tax revenues?

- How large are future pension obligations, and to what extent are such obligations funded or unfunded?

While the FiSC data allows us to compare fiscal capacity, and expenditure need over time and across a wide range of cities, the budgetary approach is better suited to the analysis of individual cities. However, the FiSC based analysis may point to particular cities as having relatively large fiscal gaps, and can thus serve as a guide to which cities to choose for intensive analysis of CAFRs, audits, and other current information which are pertinent to a city's budgetary balance.

To illustrate the use of the FiSC data in understanding fiscal crises, the appendix provides an ex post analysis and comparison of spending, revenues, and debt levels in Detroit and Stockton, both of which were forced to seek bankruptcy protection because they were unable to meet their debt obligations.

Expenditure Need

Principles and Review of the Literature

Expenditure need is defined as the cost to cities of providing a standardized bundle of services to city residents and firms that are located within the city. Differences in expenditure need depend on the particular services for which a jurisdiction is responsible, the number of people served, and differences in the cost of providing a given set of services at a given quality level. As discussed above, differences in the services a city must provide are referred to as service assignment. The FiSC approach automatically controls for differences in assignment at the local level, by including all expenditures on behalf of city residents, regardless of whether the providing government is a municipal government, an independent school district, a county, or a

[10] For example, the New York state constitution has a provision that allows for the establishment of a financial control board if the legislature determines that a municipality has been in fiscal difficulty for several years. In 2003, the state legislature established such an authority for the City of Buffalo and its related authorities. The enacted legislation cited several years of fiscal difficulty, caused by a weakened economy, leading to a structural imbalance between revenues and expenditures, and a downgrade of the city's bonds by bond rating agencies. The criteria used by the bond rating agency Fitch (Fitch ratings, no date) to evaluate debt issues by localities focus on the economic base, revenue and expenditure expectations, long-term financial obligations, and resilience of operating performance to the business cycle.

special district. However, the FiSC approach does not take account of functions which are provided at the state level, or legally organized as state entities.

The number of people or residences served are typically referred to as the service loads or service loading factors (Rafuse and Marks 1991). For example, the service load for education depends on the number of children of school age as a proportion of the population, and the proportion of those children attending public schools. The service load for garbage collection is the number of residences, both single and multi-family.

The service load for a number of services, including police and fire, depends on both the resident population (the night-time population), and the number of commuters and visitors to the city. The greater the ratio of commuters to residents, the higher is the expected spending per resident. Ladd and Yinger (1989) find that the larger the proportion of the metropolitan population living outside the central city, which is a proxy for the commuting and visiting population, the higher is city spending. Using a different approach, Chernick and Tkacheva (2002) find a strong statistical relationship between city expenditures and private sector jobs in the city, and estimate that the additional costs from commuters are at least as great, and probably greater, than the additional city tax revenues generated by the jobs they hold.[11]

Costs per service provided may also vary because of differences in topography, climate, and density of population. For example, cities with high levels of snowfall must spend substantial amounts on snow removal. Flatter cities are likely to be able to provide services such as snow removal more cheaply than hillier cities.[12] Denser cities are likely to have higher costs for some services, e.g. police and fire, but lower costs for other services, e.g. garbage collection.

The characteristics of the population, particularly the incidence of poverty, single-parent households, and English as second language also have important effects on costs. Downes and Pogue (1994) estimate that the cost of achieving a standardized level of educational output in the state of Arizona is 34 percent higher if account is taken of the proportion of students who are from low-income families or for whom English is not the first language. In a study of education spending in Texas, Imazeki and Reschovsky (2006) find a similar result. Pack (1995) reports that cities with larger populations (500 thousand to 1 million) spent three times as much on direct poverty-related functions (public welfare, health, and hospitals) as cities in the 300–500 thousand range. She also found that, controlling for income and city size, cities with high concentrations of poor persons spend substantially more than cities with relatively few poor persons. Ladd and Yinger (1989) find particularly large effects of poverty on spending levels for police and fire.

[11] Chernick and Tkacheva (2002) find that an increase of 10 jobs per 100 of population is associated with a 2.5 percent increase in overall expenditures, and a 4.5 percent increase in police and fire expenditures. Applying the statistical estimates to the commuting population of New York City, the additional New York City expenditures associated with the jobs held by non-residents are equal to between 2.2 and 3.8 percent of total spending by the city of New York, or $1.2 to $1.9 billion in 1997.

[12] In personal communication, Richard Bird and Enid Slack of the University of Toronto estimate that each snowfall episode in Toronto costs the city approximately $1 million for snow removal. Meloche and Vaillancourt (2012) finds that hilly areas of the city of Montreal incur greater costs than topographically flatter parts of the city for snow removal.

Haughwout and Inman (2002) emphasize that the costs to cities of providing redistributive services are strongly related to poverty levels.[13]

Costs are also likely to be higher in older cities. The cost of maintaining existing infrastructure and replacing obsolete infrastructure is likely to be higher in cities that reached a certain population threshold earlier than more recently expanding cities. The cost of fire protection may also be higher in cities with an older and denser housing stock. In the model below, we use density as a proxy for age of city.

The empirical challenge in analyzing expenditure need is to identify demand factors, which depend on the fiscal resource base of the city and the willingness of citizens and firms to tax themselves from this resource base, and distinguish such factors from environmental factors which are largely outside the control of local officials. Previous analyses have used measures such as the percent foreign born, the percentage elderly, and the poverty rate, as environmental factors. The most complete empirical attempts to make this separation are in the area of education, where measures of output such as test scores, have been used to identify educational production and cost functions.

The separation between demand forces and cost factors is most problematic for income related measures. Because poverty rates and average or median income levels are highly correlated, higher costs associated with greater concentrations of poverty in cities, which would be expected to increase expenditures, are offset by the lower fiscal capacity in such cities. Further compounding the identification problem is the fact that lower local fiscal capacity is offset to some extent by higher levels of state aid. In the reduced form models presented below, median income is used to proxy for the net effect of these various channels of effect on city spending.

Empirical Specification of Spending Model

The FiSC data has been augmented by including a limited number of variables which can be used to analyze expenditure need. Models are estimated for both the full 150 city data set, and for the more restricted data set of 91 cities to which we have added housing and demographic data. The analysis does not take explicit account of service loads for different expenditure functions. However, under the assumption that service loads for most services are proportional to population, the inclusion of population in the analysis serves as a rough proxy for service loads.

In the full 150 city data set, per capita spending is estimated as a function of the city's population level, the change in population, and population density. Population and population density, which are highly correlated, are proxies for the cost of delivering services. Density is closely related to the age at which a city reached a certain size. Older cities are likely to have a more deteriorated capital stock, implying greater need for maintenance and replacement of the public capital stock. Spending on public safety (police and fire) and health, are all expected to be greater in older, denser cities. Larger cities are also likely to have higher costs to achieve a given level of educational achievement. These higher costs are due to more diverse populations, higher proportions of children for whom English is a second language, and higher proportions of

[13] Haughwout and Inman (2002) argue that on efficiency criteria, such costs should be borne by the entire region, rather than just the central city.

students living in rental housing. The rental housing factor is associated with greater residential mobility, which has been shown to have negative effects on student achievement levels. Social services are also expected to be higher in larger cities.

Intergovernmental aid is the single largest source of revenue for cities. The most important category of aid from states is aid to education, which will be a direct function of the ratio of school age children to the overall population, and in most states, an inverse function of city property values and income. Hence, we also include intergovernmental aid in the spending equations.

The spending regressions are shown in table 1. Summary statistics for the dependent and independent variables are shown in table 2. The first three columns in table 1 are estimated for the full FiSC sample (149 cities).[14] Models (4)–(6) include household median income, which at this time are only available for 90 of the cities in the sample.[15] All models include year and region indicator variables, to control for persistent differences across cities and national economic forces that affect the finances of all cities over time.

Table 1. Per capita general spending and state aid, 2000-2013.

	(1) spending	(2) spending	(3) spending	(4) spending	(5) spending	(6) spending	(7) state aid
City Population	-0.0000289	0.000117**	0.000154**	0.0000231		0.0000627	-0.00000756
	(-0.56)	(3.60)	(4.78)	(0.72)		(1.92)	(-0.38)
L2.pop change ~)	-2060.8**	-414.1	-670.7*	-770.5*	-783.0*	-874.2**	-379.2*
	(-3.48)	(-1.11)	(-2.04)	(-2.42)	(-2.47)	(-2.59)	(-1.98)
L3.pop change ~)	-2339.7**	-447.6					
	(-3.91)	(-1.19)					
pop change (pct)			-620.8	-787.3*	-800.1*	-795.4*	-507.9**
			(-1.90)	(-2.47)	(-2.52)	(-2.35)	(-2.66)
density	0.186**	0.0438**	0.0444**	0.0588**	0.0624**	0.0479**	0.0116*
	(15.30)	(5.42)	(5.46)	(6.80)	(8.74)	(5.62)	(2.17)
state aid		0.843**	0.873**	0.642**	0.642**	0.781**	
		(24.65)	(29.80)	(13.61)	(13.61)	(21.79)	
federal aid		2.558**	2.595**	2.427**	2.425**	2.534**	-0.269**
		(54.23)	(54.61)	(50.79)	(50.86)	(51.18)	(-9.54)
median income				0.0101**	0.0103**	0.0109**	
				(4.04)	(4.13)	(5.14)	
L.median income							-0.0107**
							(-7.06)
Constant	3659.9**	1834.1**	2450.3**	2029.4**	2026.8**	2320.5**	1670.6**
	(24.03)	(16.41)	(47.25)	(11.47)	(11.46)	(18.48)	(20.50)
Observations	2094	2094	2094	1270	1270	1270	1180
Adjusted R-squ~d	0.320	0.732	0.712	0.782	0.782	0.746	0.610

t statistics in parentheses
Models (1), (2), and (3) estimated for 149 Fiscally Standardize Cities. Model (4)-(7) estimated for 90 Fiscally Standardized Cities. Washington, DC excluded from all models. Models (1) -(6) include census division and year indicator variables. Model 7 includes only division indicators.
* p<.05, ** p<.01

[14] Washington DC is excluded because it functions as both a city and a state, hence does not receive state aid.
[15] Income data were added to those FiSC cities for which we were also able to collect information on housing conditions. The housing data were obtained from CoreLogic, a real estate information firm, to analyze the effect of the housing crisis on the fiscal condition of cities (Chernick, Reschovsky, and Newman 2016).

Table 2: Summary Statistics for Variables in Spending Regressions (Table 1)

Variable	Mean	Std dev	Min	Max
Spending	4948	1430	2085	10755
State aid	1626	782	336	4471
Population	422670	778512	16226	8365903
Density	4094	3523	153	27583
Median inc	48057	12110	24609	102102
Percentage change in population (2 YR)				
	.015	.063	–.534	1.78
Federal aid	328	228	10	1956

Source: Lincoln Institute of Land Policy; FiSC dataset.

Density, measured as the population divided by the land area of the city, has a positive and significant effect on spending. Comparing a low to a high-density city (one standard deviation below and above the mean), the high-density city would spend about seven percent more than the low-density city. In analysis not shown here, I found that the spending functions most highly correlated with density are public safety (police and fire), social services, health, and education. The effect of density on public safety spending may reflect a higher ratio of day-time to night-time population in denser cities (more commuters), and is also consistent with the hypothesis that the greater the density, the greater the incidence of crime, and the higher the cost of firefighting. The effects of density on social services, health, and education suggest that denser cities are likely to have greater need for social services, and higher costs of educating their children. While there are likely to be cost-reducing effects of density for some functions, for example economies of scale in solid waste removal and sewerage, the positive effect of density in the regression suggests that cost-increasing effects outweigh cost-reducing effects.

While population density at any point in time is associated with greater levels of spending, cities that are losing population show higher spending levels than cities that are gaining population. This suggests that there is a lag in the downward adjustment of spending to declines in population, and a lag in the upward adjustment of spending to the need to service a larger number of people. In the short run, the ratio of fixed to variable costs for most city services is likely to be quite high. In addition to capital maintenance and equipment expenditures, labor costs, particularly in cities where public employees are unionized, may function as a quasi-fixed cost.[16] Another important component of fixed cost is the pension and health care obligations for

[16] See Ladd (2004) for an analysis of the relationship between population change, and capital and operating expenditures.

retirees. Such obligations constitute a higher share of city spending in cities that are losing population than in growing cities.[17,18]

By far the most important variables in the spending equations in terms of statistical significance are the levels of state and federal aid. Comparing model (1), which excludes intergovernmental aid, to models (2) through (6), all of which include intergovernmental aid, the proportion of the variation in spending explained by model (1) is less than half as great as the other models.

In models (2) and (3), the state aid coefficients are .84 and .87. In models (4)–(6), which are estimated for 90 cities, and include household median income, the state aid coefficient ranges from .64 to .78. Thus, depending on the sample and the specification, an additional dollar of state aid is associated with a 64 to 87 cent increase in FiSC spending. Given that the spending measure is a comprehensive category and the FiSC includes all relevant governmental units, these estimates imply that an extra dollar of state aid leads to a reduction in own-source revenues ranging from three to 36 cents. Thus, more state aid displaces only a relatively small portion of local revenues.

Given the importance of state aid in city spending, model (7) regresses state aid to cities on the same covariates as the spending models. I found that year indicators contribute little to the explanatory power of model (7). Hence they are excluded from the model. By contrast, census division indicators are extremely important in the state aid model. When we exclude them from (7), the adjusted R^{sq} decreases from .61 to .15. This suggests that regional differences in the importance of state aid play a major role in city spending, and that these differences persist across time. Controlling for regional differences, state aid is negatively related to city median income, indicating that across cities and over time state aid is fiscally equalizing. The income coefficient is discussed further below.

Federal aid has a strong positive relationship with spending by the FiSC. The various specifications indicate that an additional dollar of federal aid is associated with an increase in overall spending of about $2.50. Assuming a balanced budget constraint holds over time, this estimate implies that a dollar of federal aid is matched by an additional $1.50 of local revenue. In terms of grant-in-aid terminology, federal aid appears to stimulate rather than substitute for local spending. This result is contrary to the results of many studies of the fiscal effect of federal grants, which suggest that there is substantial substitution of federal for local dollars.[19]

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[17] McGee (2016) reports that in education, retirement costs per pupil are approaching 10% of all education expenditures.

[18] To investigate the relationship between pension costs and population change and spending, I estimated the following regression:

Pension share = –1.5 + .000005(density) – .08(pct change in population) + .0008(year).

(Adj R^{sq} = .22, Observations = 2094. All variables significant at the one percent level)

The population change coefficient implies that a city that lost 2 percent of its population in a two-year period would experience an increase in its pension burden (pension spending as a share of total spending) of 1.6 percentage points.

[19] See for example Howard Chernick, "Fiscal Effects of Block Grants for the Needy: An Interpretation of the Evidence", *International Tax and Public Finance*, 5 (3): 205–233. 1998; and Nora Gordon, The Quest for a Targeted and Effective Title I ESEA: Challenges in Designing and Implementing Fiscal Compliance Rules, *RSF: The Russell Sage Foundation Journal of the Social Sciences, 1*(3), 129–147 (2015).

The revenue equations in table 3 support the expectation that the estimated coefficient on federal aid in the general revenue equation will be quite close to the spending estimate. However, one must be careful not to infer direct causality from the estimate of the spending and revenue effect of federal aid. It is possible that because of the formulae and administrative rules under which federal aid to cities is distributed, more aid goes to cities that would spend more even in the absence of federal aid.[20] In regressions not shown here, we examined the effect of federal aid on various categories of city spending. The strongest relationships are in the areas of social services and welfare, and public safety. Greater need or higher costs for these spending categories may induce greater levels of federal assistance.[21]

The Government Accountability Office (2015) did a study of federal grants in cities such as Detroit that are experiencing high levels of fiscal stress. The study finds that many of these cities have experienced difficulty in accessing and spending federal aid. Fiscally stressed cities may lack the managerial capacity to apply for federal funds and to comply with federal rules governing the use and accounting for federal aid.[22] While these managerial factors undoubtedly play a role in the small number of cities examined by the GAO, the statistical result from the much larger FiSC sample of cities suggests that more general fiscal factors, including poverty-related criteria in formula grants, and local ability to meet matching requirements, are important as well in explaining the fiscal impact of federal aid to cities.

Models (3), (4), and (5) show a positive relationship between median income and city spending. From table 2, a standard deviation difference in median income equals $12,110. A difference of this magnitude would lower or raise predicted spending by about $121 per capita, which is equal to about 2.5 percent of average spending. At first glance, the magnitude of the income effect seems rather small. However, the estimated income effects reflect the net influence of multiple offsetting factors. Assuming that public services are normal goods, higher income levels should increase demand for public spending. However, higher median income levels are also correlated with lower poverty rates, and less poverty should lower the cost of certain public services, hence reducing spending. Finally, the income coefficient is also influenced by the equalization impact of state aid. If higher income leads to lower state aid, then spending will be reduced through the intergovernmental channel.[23] Our estimates suggest that almost half of the additional spending

[20] This result could reflect factors such as poverty rates that are built into the formulae for the distribution of federal block grants to cities, if, as some evidence indicates, cities with higher poverty rates tend to have higher spending levels. Examples of federal grants with poverty factors in their distribution formulae are the Community Development Block Grant, Title I education aid, and the Child Care Block Grant.

[21] A similar result on the effect of federal aid on local spending is reported by Craig et al (2014).

[22] Cities under severe fiscal stress may also fear that accepting federal aid will create a stream of future local funding obligations that they will be unable to meet.

[23] The total effect of per capita income on spending may be expressed as

$$\Delta\text{Spending}/\Delta\text{Income} = .01 = a0(\Delta\text{Demand}/(\Delta\text{Income}) - a1(\Delta\text{Cost}/\Delta\text{Poverty Rate}) * \left(\frac{\Delta Pov\ Rate}{\Delta Income}\right) + (\Delta\text{Spending}/(\Delta\text{StAid}\ \{\approx 0.8\}) * \left(\frac{\Delta StAid}{\Delta Income}\{\approx -.01\}\right)$$

The estimates of the partial effect of income on spending are centered on 0.01. The estimated state aid coefficient indicates that an additional dollar of state aid raises total spending by about 80 cents, while each additional dollar of

associated with an increase in median income is offset by an equalizing reduction in state aid. In this sense, the distribution of state aid constitutes an implicit tax on the fiscal capacity of cities. Whether the implicit tax rate is optimal, or too high or too low, is an important topic for future research.

Calculating Fiscal Stress Using Actual Revenues and Predicted Spending

In this section, we use the estimates from the spending regressions to calculate predicted levels of spending for each city in each year. Predicted spending is the expected level of city spending, given the city's population characteristics and its levels of intergovernmental aid. As discussed above, predicted spending does not correspond precisely to the concept of need, which is the minimum cost of providing a standardized bundle of public services, given the environmental or exogenous cost-related characteristics of the city. Instead, it represents the typical or average spending decisions of all of the constituent governments that provide services to city residents, given measurable characteristics such as population level, density, and population change. In this sense, the spending regressions measure expenditure need by the weighted averages of actual expenditures by all municipalities. This approach is closer to the approach used in certain European countries, for example Sweden, as a basis for distributing intergovernmental aid. (Chernick 2004).

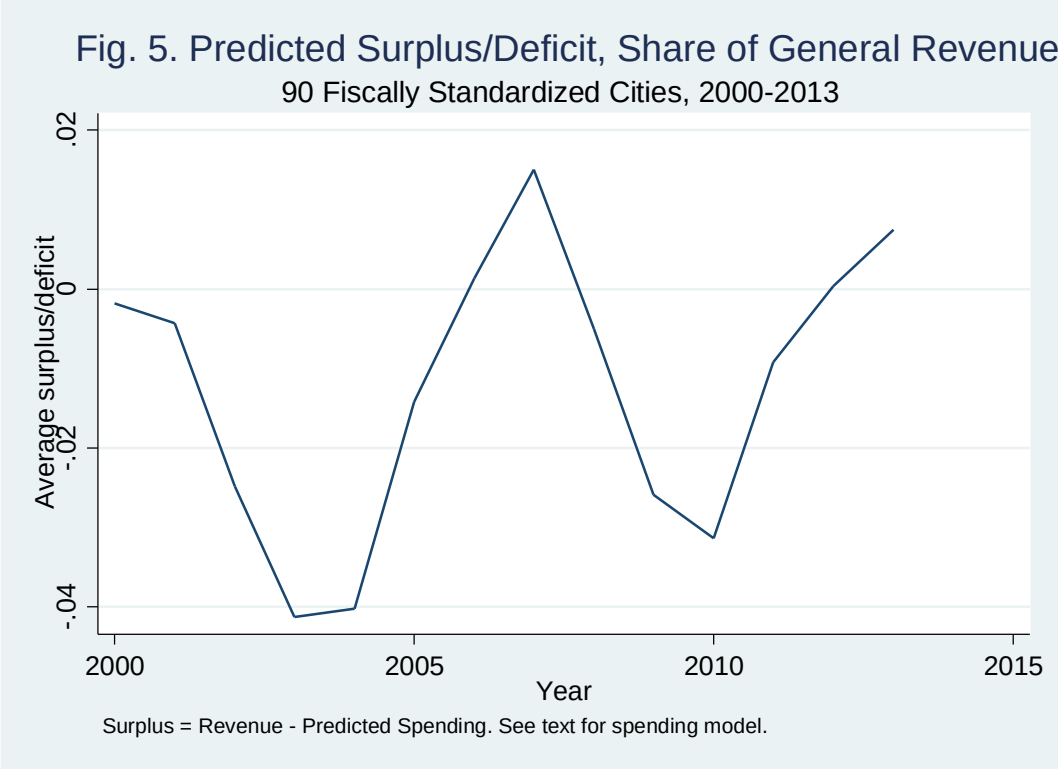
I calculate a city's fiscal surplus as actual revenue minus predicted spending, and use actual revenue to scale this difference. Predicted spending is calculated using the estimates from model (5) in table 1, using the restricted sample of 90 cities for which income data has been added to the FiSC sample. Fiscal stress (I) is measured as

$$\text{Fiscal Stress (I)} = [\text{Revenue} - \text{Predicted Spending}]/\text{Revenue} \qquad (1)$$

Figure 5 shows the mean value of surplus (or deficit) by year, from 2000 to 2013. The smaller the predicted surplus (the larger the predicted deficit), the greater the fiscal stress on cities. Figure 5 suggests considerable cyclical sensitivity in city fiscal position. The average deficit goes from close to zero in 2000 to more than four percent of revenue in 2003.[24] As fiscal conditions changed under the recovery from the 2000 recession and the subsequent housing bubble, the fiscal condition of cities improved, reaching balance in 2005, and rising to a surplus of almost two percent in 2007. The surplus then falls and turns to deficit by 2008, hitting a low point in 2010. According to this measure, cities reach a balanced fiscal position by 2013.

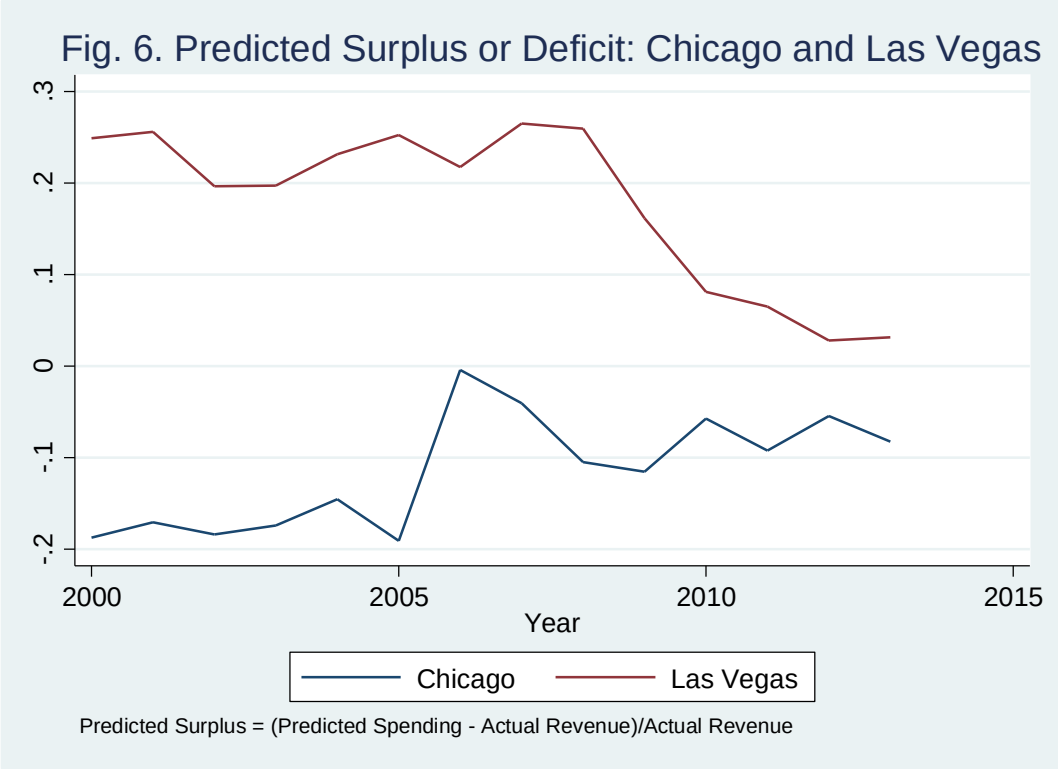
income lowers state aid by about 1 cent. Hence, we can infer that the effect of income on spending, holding state aid and poverty rates constant, is at least 2 cents for each additional dollar of income.

[24] The official length of the 2001 recession was 8 months, beginning in March. It is notable that city fiscal position continued to worsen for two years after the official end of the recession. This suggests that city spending and revenues respond with at least a two-year lag to changes in aggregate economic activity.



The averages in figure 5 conceal substantial variation across cities. Over the same period, the average deficit among the 10 most fiscally stressed cities over the 2000–2013 period was 25 percent, while the average surplus among the least fiscally stressed was over 14 percent. The surplus cities include a number of cities, such as Las Vegas that had robust revenue growth during the early 2000's and the housing bubble period from 2004 through 2007, but suffered very sharp declines in revenue from the bursting of the housing bubble and the Great Recession. Figure 6 (for Las Vegas and Chicago) shows a high surplus share in Las Vegas from 2000–2007, then a sharp drop from 2007–2013. The high level of surplus in Las Vegas prior to the 2007 recession reflects low predicted spending, given the rapid increase in population (an average of over four percent per two years), and the low density of the city, while the very sharp decline from 2007–2013 reflects the dramatic drop in revenues during and after the Great Recession. By contrast, Chicago's population declined at an average rate of 0.8 percent every two years over the 2000–2013 period, leading to an increase in predicted spending per capita. This effect is reflected in sustained fiscal stress, with predicted deficits between eight and 20 percent of revenues throughout the period.[25]

[25] The only year in which Chicago approached budget balance was 2005. While persistent fiscal stress as measured in this section does not indicate that a full-fledged fiscal crisis is imminent, it does point to the need for policy adjustments.



The Determinants of City Revenues

The previous section used actual revenues to examine fiscal stress. In this section, I examine the determinants of revenues. Revenues are modeled as being influenced by the same factors as spending, namely population, population change, and population density, plus variables that characterize legal constraints on the property tax, and an index of the price of residential property. The revenue regressions are presented in table 3. In table 3, the property tax limitation measures, which were compiled by the Lincoln Institute of Land Policy (no date), include both zero-one indicator variables, and percentage change measures.[26] Descriptive statistics for table 3 are presented in table 4.

[26] Additional regression specifications for the property tax were run with various combinations of tax and expenditure limitations. The results, which are available from the author upon request, were inconclusive.

Table 3. Revenue: property tax, other taxes, general revenue. Estimated for 149 or 90 FiSC's, 2000-2013

	(1) property	(2) property	(3) other tax	(4) other tax	(5) gen rev	(6) gen rev
City Population	0.0000358**	0.0000209	0.000159**	0.000141**	0.000183**	0.000121**
	(2.59)	(1.63)	(13.84)	(12.35)	(5.57)	(4.00)
L2.pop chg	-68.33	-210.2	-180.8	-167.7	-443.5	-560.3
	(-0.43)	(-1.44)	(-1.37)	(-1.28)	(-1.17)	(-1.63)
L3.pop chg	2.660	-179.8	-177.5	-90.60	-477.4	-494.7
	(0.02)	(-1.23)	(-1.33)	(-0.69)	(-1.25)	(-1.43)
density	0.0223**	0.00949**	0.0198**	0.0234**	0.0537**	0.0579**
	(6.37)	(2.69)	(6.79)	(7.43)	(6.44)	(6.95)
L2.state aid	-0.133**	-0.126**	-0.0738**	-0.162**	0.740**	0.633**
	(-8.98)	(-6.24)	(-5.97)	(-9.00)	(20.94)	(13.29)
L2.fed aid	0.222**	0.450**	0.493**	0.600**	2.533**	2.860**
	(4.99)	(8.69)	(13.29)	(12.94)	(23.91)	(23.36)
levy increase	-14.97**	13.30*	1.712	16.61**	-12.93	97.37**
	(-4.71)	(2.19)	(0.65)	(3.06)	(-1.71)	(6.79)
assess lim res	-21.95	-7.281	-96.59**	-41.88	122.0	418.8**
	(-0.55)	(-0.14)	(-2.91)	(-0.87)	(1.29)	(3.30)
assess increase	29.19**	22.30**	-7.508	-28.83**	29.01*	-53.61**
	(5.53)	(3.13)	(-1.71)	(-4.52)	(2.31)	(-3.18)
levy lim overr~e	77.35**	40.87	-64.36**	-200.3**	-223.6**	-450.6**
	(3.58)	(1.41)	(-3.58)	(-7.72)	(-4.35)	(-6.57)
new construction	43.00	32.93	-55.36*	59.84	178.9*	694.2**
	(1.41)	(0.80)	(-2.18)	(1.62)	(2.47)	(7.13)
L3.res pr index		0.878*		-0.574		-1.201
		(2.34)		(-1.71)		(-1.35)
median income		0.0122**		-0.000568		0.0127**
		(11.01)		(-0.58)		(4.87)
Constant	1430.8**	660.3**	-43.80	275.1**	2421.7**	1599.8**
	(29.33)	(6.52)	(-1.08)	(3.04)	(20.85)	(6.69)
Observations	2080	1256	2080	1256	2080	1256
Adjusted R-squ~d	0.290	0.376	0.479	0.555	0.628	0.690

t statistics in parentheses
All $ values inflation adjusted. All equations include census division and year indicator variables.
Variable definitions: pop chg: two year percentage change in city population. Levy increase: limit on annual increas
> e in levy. assess lim res: limit on residential assessments. assess increase: limit on annual allowable increase i
> n assessments. levy lim override: levy limit override allowed. new construction: net new construction considered.
> res pr index: residential housing price index.
* p<.05, ** p<.01

Table 4: Summary Statistics for Variables in Table 3

Property tax	1227	460	258	3354
Non-property taxes	719	450	14	3509
Charges	920	489	235	3064
State Aid	1768	787	336	4471
Federal Aid	348	229	44	1956
General Revenue	5078	1744	2023	18947
Housing Price Index	144	42	58	307
Foreclosure rate	.02	.02	.0005	.19
Allowed Assess Increase	2.8	3.76	0	10
Allowed Levy increase	2.27	3.22	0	15
Residential assess Limit	.45	.49	0	1
Levy limit Increase	.53	.50	0	1
Net new construction considered	.125	.33	0	1
Levy limit no assess limit	.36	.48	0	1
Assess limit no levy limit	.30	.46	0	1
Levy limit and assess limit, residential property	.27		0	1
Levy limit override allowed	.55		0	1

Sources: FiSC data set, supplemented by housing data from CoreLogic. Lincoln Institute of Land Policy. "Significant Features of the Property Tax."

In table 3, separate revenue equations are estimated for the property tax (Columns 1 and 2), other taxes (3 and 4), and general revenue (5 and 6). Each revenue source is estimated first for the larger sample of 150 cities, then the subsample of 90 cities. All models include census division and year indicator variables. Table 3 shows that the effect of density on per capita revenues is similar to its effect on spending, with a significant positive effect on property taxes, other local taxes, and general revenues. Population has a positive and significant effect on revenues, while the effect of population change is negative but not significant. The population effect is larger for non-property taxes than for property taxes, and larger for general revenue than for spending. Recall that population change had a negative effect on spending, which we argued was a

reflection of built-in lags in the adjustment of spending levels to changes in the population served. The results from table 3 suggest that revenue is more responsive than spending to population changes. This result is not surprising, given that adjustment lags are likely to be less important in revenue collection than in spending levels.

In table 3, the various property tax limitation variables show inconsistent and overall relatively weak effects on the level of property tax collections. The inclusion of property tax limitation variables in the other-tax models (3 and 4) is designed to show whether there are significant cross-tax substitution effects in the presence of various constraints on the property tax. The results provide some support for the cross-tax substitution argument. Levy-limit overrides are associated with higher property taxes and lower non-property taxes. The greater the allowed increase in assessment, the lower the level of other taxes. The general revenue models (Columns 5 and 6) provide estimates of the overall revenue effect of property limitations. Again, the results are mixed, depending on the type of limitation, and whether income is included as a covariate.

The residential housing price index, lagged three periods, is significantly related to property tax revenues. However, the effect of housing prices on other taxes and general revenue is statistically insignificant. This suggests that over the entire sample period, changes in the value of the residential property tax base, while having a direct effect on property tax revenues, are typically not great enough to affect the levels of general revenues. However, during the period of the housing boom and bust, in a number of cities, particularly in Florida, California, and Nevada, sharp increases in residential home values, followed by sharp decreases and a wave of housing foreclosures, had a strong effect on the time path of city revenues (Chernick, Newman, and Reschovsky 2017).

As shown in columns (5) and (6) of table 3, the relationships between general revenue and population, population change, and population density are similar to the relationships between these variables and spending. This is not surprising, given that for any given city revenues and expenditures must approximately balance over time. The state and federal aid variables also have very similar effects for general revenue. We noted above the strong spending effects of federal aid. Notably, higher federal aid is associated with higher property taxes, higher other taxes, and higher general revenues. These results help to reinforce the argument that, even though most of the federal aid programs do not have open-ended matching provisions, the distribution of federal aid, whether matching aid, project grants, or block grants, is partially endogenous to local revenue levels, with higher revenue cities able to pull in more aid than lower spending cities (Chernick 1979).

Alternative Measures of Fiscal Stress

In this section, we examine two alternative measure of fiscal stress, and investigate whether more diversified revenue structures can affect the measure.

Median Spending Change Compared to Actual Revenue Change

A rudimentary measure of the change in expenditure need can be calculated by the year to year change in expenditures, as measured by the median (percentage) change in spending for all cities in the sample. The median change emphasizes the common factors affecting expenditure change in all cities, while assigning lower weight to unusually sharp changes in state or federal aid, or to reassignments of spending responsibility that could have strong effects on measured spending in a particular city. The median spending change is compared to the annual change in revenue. The latter serves as a proxy for the change in fiscal capacity. The underlying assumption is that from year to year nominal tax rates are likely to be quite stable. Hence, the change in revenue reflects changes in the various tax bases, plus any changes in state or federal aid. With these assumptions, a second measure of fiscal stress is defined as:

$$\text{FISCAL STRESS (II)} = \text{Pct Chg in Median Spending}_t - \text{Pct Chg in Revenue}_{it} \quad (2)$$

To examine the effect of revenue structure on fiscal stress, the measure in (2) is regressed on revenue composition, as measured by the shares of revenue from the property tax, other taxes, state charges, state aid, and federal aid. To reduce potential simultaneity, the revenue shares are lagged two or three periods. Descriptive statistics are given in table 5, and estimation results are presented in table 6. The mean property tax share is 25 percent, with a range from seven percent to 69 percent. In model (1) the dependent variable is the percentage change in general revenue. In models (2)–(6), the dependent variable is FISCAL STRESS (II). The first column of table 6 indicates that in the period 2000–2013, there is no statistically significant relationship between lagged revenue structure and revenue growth. The same result carries over to the fiscal stress models. The results show no statistically significant relationship between fiscal stress and the lagged share of revenues from any of the major revenue sources of cities.

Table 5: Share of Revenue from Various Sources. 150 FiSCs, 2000–2013

	Mean	Std dev.	Min	Max
Property tax	.25	.09	.07	.69
State aid	.32	.11	–	.62
Other taxes	.02	.02	0	.22
Charges	.17	.08	.03	.59
Federal Aid	.07	.04	.001	.35

Source: Lincoln Institute of Land Policy, FiSC data set.

Table 6: Fiscal Stress and the Composition of Revenues

	(1) gen rev	(2) fisc stress	(3) fisc stress	(4) fisc stress	(5) fisc stress	(6) fisc stress
L3.shr prop tax	0.0103	-0.00372	-0.00372	-0.0147	-0.00289	-0.0173
	(0.58)	(-0.22)	(-0.22)	(-0.83)	(-0.16)	(-0.96)
L2.shr state aid	-0.00461	0.0161	0.0161	-0.000845	0.0174	
	(-0.26)	(1.01)	(1.01)	(-0.05)	(1.00)	
L3.shr state aid						-0.00448
						(-0.26)
L2.shr other tax	0.0117	0.0793	0.0793	0.0916	0.0781	0.0871
	(0.18)	(1.20)	(1.20)	(1.38)	(1.17)	(1.31)
L2.shr charges	0.00619					
	(0.27)					
L.shr charges						-0.0266
						(-1.20)
shr charges		-0.00581	-0.00581	-0.0214	-0.00455	
		(-0.28)	(-0.28)	(-0.98)	(-0.21)	
L2.shr federal aid	-0.0516					
	(-1.24)					
L3.shr federal aid					0.00736	
					(0.18)	
shr federal aid				-0.0987**		-0.102**
				(-2.59)		(-2.68)
Constant	0.00972	-0.00888	-0.00888	0.00817	-0.0101	0.0111
	(0.73)	(-0.78)	(-0.78)	(0.62)	(-0.76)	(0.84)
Observations	2100	2128	2128	2114	2114	2114
Adjusted R-squared	-0.001	-0.000	-0.000	0.002	-0.001	0.003

t statistics in parentheses
Notes. Estimated for 150 Fiscally Standardized Cities, 2000-2013.
Model 1: Dep. vble is the percentage change in general revenue.
In models 2-6, Fisc stress defined as: annual median percent change in spending revenue minus actual percent change > in revenue for each city.
Independent variables are the shares of various revenue sources in general revenue.
* p<0.05, ** p<0.01, *** p<0.001

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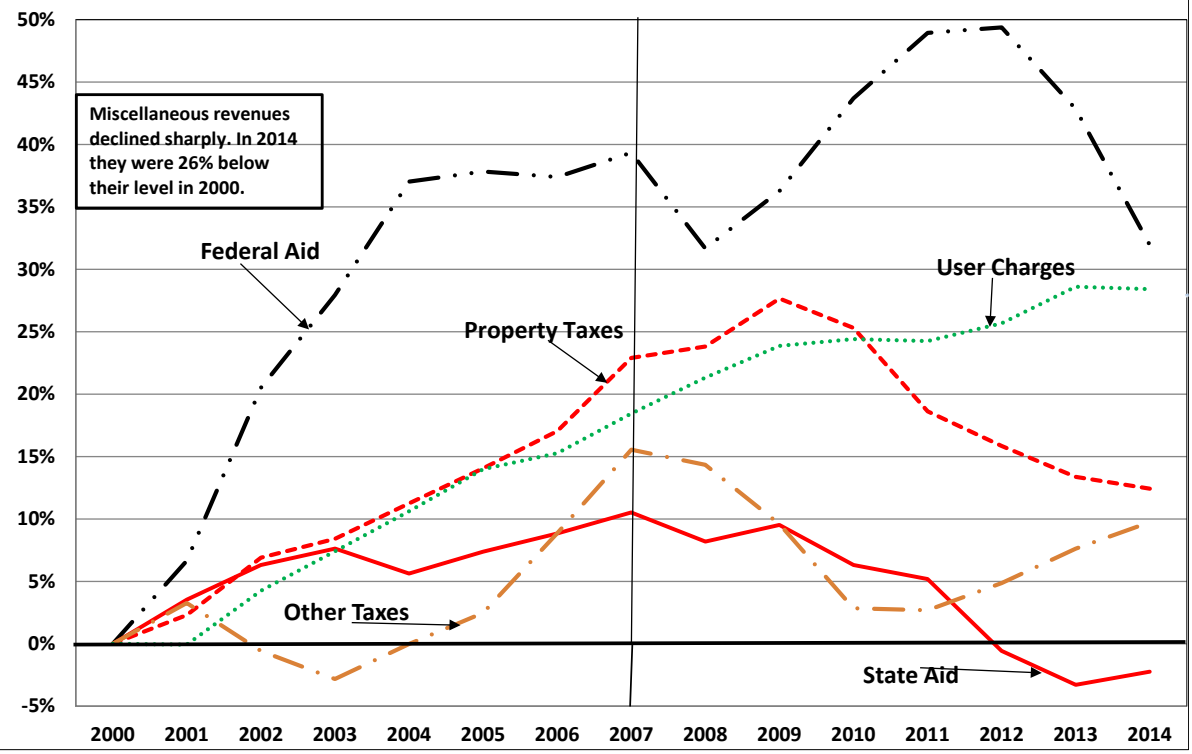
This lack of effect of revenue mix is consistent with the spider chart in figure 7, which shows that for most of the period 2000–2014, the major revenue sources of cities—property taxes, charges, and state aid—tend to move together. Hence, relatively greater reliance on one source as opposed to another does not have much effect on the overall path of revenue growth. However, as the figure also shows, other taxes dropped faster than the property tax at the outset of the Great Recession, but recovered more rapidly in the aftermath of the Great Recession, other taxes recovered more rapidly than the property tax. Hence, when we re-estimate the regressions in

Table 6 using the shorter time window that brackets the Great Recession, the greater the share of other taxes in local revenues, the more rapid the rate of revenue recovery.[27]

Figure 7

Real Per Capita Revenue by Source, Percentage Change Relative to 2000
91 Fiscally Standardized Cities



As shown in models (3) and (5), contemporaneous levels of federal aid are the only revenue source that has an effect on the fiscal stress measure. Evaluated at the mean, a one standard deviation increase in the federal aid share reduces fiscal stress measure by 0.4 percent. This suggests that an increase in federal aid may help to provide some temporary budgetary relief to cities. However, the transient nature of this relief is revealed in model (4). When I introduce the same three period lag in the federal aid share as for the other revenue sources, the statistically significant effect is no longer present.[28]

The Representative Tax System Approach to Measuring Fiscal Capacity

In the previous section, we use the change in actual revenue levels as a proxy for the change in fiscal capacity of each city. By contrast, the usual approach to the measure of fiscal capacity starts from the economic base of each local government. As emphasized by Ladd and Yinger (1989), the capacity to raise revenue depends on the access of local governments to tax and revenue *instruments*. The most frequently used approach for measuring the fiscal or revenue-

[27] The regression analysis is available on request from the author.
[28] As noted in section III B, some cities may have difficulty accessing federal aid, limiting its role as a fiscal buffer.

raising capacity of local governments is to calculate the maximum amount of revenue each local government could raise if it imposed a set of "standard" tax rates on a "standard" set of tax bases.

In order to have a valid measure of revenue capacity, each tax base should be defined by a higher level of government. In other words, local governments should not be able to influence the size of their own tax bases. This approach to measuring revenue-raising capacity is known as the *representative tax system* (RTS). The standard tax bases include all of the taxes or other revenue sources used by any local government within a province or a country, i.e., the reference group. The "standard" tax rates are often set equal to the average rates used by the local governments in the reference group.

In general terms, revenue-raising capacity in local government *i* is defined as the weighted sum of *N* potential tax bases, where the weight for each base *j* is the standard tax rate t^*_j for tax *j*.[29]

$$\text{Revenue Raising Capacity}_i = \sum_j^N t^*_j \, Base_{ij} \qquad (3)$$

In equation (4), the actual revenue collected by city *i* could be above or below *i*'s revenue-raising capacity, if the tax rates used by local government *i* are on average greater than or less than *t**.

Local fiscal capacity is calculated as the sum of property tax capacity, capacity from other taxes, plus the actual amount of charges.

$$FC\ Local_{i,t} = (\bar{t}\ property_t * Avg\ Home\ Value_{i,t}) + (\bar{t}\ other\ tax_t\ * Income_{i,t}) + Charges_{i,t} \qquad (4)$$

Property tax capacity in any year is measured by multiplying a standardized rate times the average sale amount of residential property in a city. The standardized rate by year is calculated as

$$\bar{t}_{property,t} = mean_t\left(\frac{p.c.\ tax_{property,i,t}}{Average\ Sale\ Price_{i,t}}\right) \qquad (5)$$

As shown in (5), the effective property tax rate for a given city in a given year is calculated by dividing per capita property tax revenue for the FiSC by the average sale price for all residential properties sold in that year in that city. The standardized annual property tax rate is calculated as the average of property tax rates across all cities, for each year.

The estimate in (5) excludes the non-residential component of the property tax base. Moreover, the price data for properties sold may over estimate (or under estimate) the average value of all residential property. We do not have data on the equalized value of the property tax base, or the share of the base which is non-residential in the FiSC sample. However, as a partial check on

[29] For a detailed discussion of the measurement of revenue-raising capacity see Chernick (1998).

effective property tax rates calculated in this report, we compare our estimates to those from the Lincoln Institute report on property tax rates by state (2016).[30]

From table 5 in the Lincoln Institute study, in 2013, the average effective tax rate on a median value home in the 50 highest property tax cities was 1.44 percent. Using my method, the average rate for the 91 FiSC cities in 2013 is 0.84 percent. Referring to note 29, if we assume that the average household size (β) is 2.66, and the average non-residential share (α) is 50 percent, then the implied tax rate would be 0.84*(2.66/1.5) = 1.49, an estimate which is very close to the Lincoln Institute estimate.[31]

I apply a similar approach for non-property taxes. The most commonly used of such taxes are local option sales and excise taxes. A small number of cities have local income or wage taxes. For non-property taxes the base is assumed to be household median income. For each year, the standardized tax rate is calculated as the average of the ratios by city of non-property taxes to median income. The calculated average property tax and non-property tax rates for a given year are shown in table 7.

[30] Table V in the Lincoln Institute report gives the effective property tax rate on the median value residential property in 2013, for the top 50 cities in terms of property tax on the median value. The effective tax rate measure used in this study is not strictly comparable to the Lincoln Institute estimate because our measure is a rate per capita, while Lincoln Institute's is a rate per property. If the share non-residential, and the average household size were the same in all cities, then the estimate in this report would be a constant fraction of the Lincoln Institute estimate. To show more clearly those role of these assumptions, the relationship between my measure and the Lincoln Institute measure can be expressed as follows.

Per capita property taxes care are equal to:

$$\frac{ptax}{pop} = \frac{t_{res}\, B_{res}}{pop} * (1 + Shr_{NR}) = t_{res}\, \bar{B}_{res} \left(\frac{1}{avg\ hh\ size}\right)(1 + Shr_{NR})$$

The property tax rate used in my fiscal capacity calculation is measured by

$$t_{prop} = \frac{ptax\ per\ capita}{\bar{B}}$$

Where B bar is the average value of residential properties sold. If Shr_{NR} = α, and average hh size = β, then

$$t_{res,Lincoln} \cong t_{prop}(\beta/(1 + \alpha)$$

[31] As a more precise check for one particular city, the revenue department of Milwaukee estimates an effective property tax rate of 3.1. The non-residential share of property was 44.6%. Census data indicate an average household size of 2.43 in 2005. In 2013, The FiSC estimate of the per person property tax rate is 1.37% (= $1,375/100,066). From the formula in Note 27, this implies that the equivalent estimate from the FiSC data is 2.31%, which is about 75 percent of the actual estimate from the city.

Table 7: Summary statistics for 2013 for Variables Used in Calculation of Fiscal Capacity (91 FiSCs)

Variable	Mean	Std. Dev.	Min	Max
Property tax				
Avg sale price	219306	152461	9970	885644
Calculated Property tax rate	.008	.009	.002	.08
Actual property tax	1265	450	541	3102
Calculated property tax	1837	1277	84	7419
Non-property Taxes				
median income	45442	12392	24609	99488
Calculated Tax rate	.018	.016	.0005	.1006
Actual non-property taxes	801	785	23	6635
Calculated non-property taxes	834	228	452	1827

Sources: FiSC data set, augmented by housing values from CoreLogic. See "Alternative Measures of Fiscal Stress" section for details.

Over time, charges have grown in importance in city finance. In 2013 charges on average comprised $977 per capita, or almost 19 percent of total FiSC revenues, versus 16 percent in 2000. The variation in reliance on charges across cities is substantial, with a standard deviation of 748, and a range from $233 to $5,337. Conceptually, it is difficult to estimate a city's fiscal capacity to levy charges. For many categories of charges, it is not clear what would be the appropriate base. Moreover, even if we could identify the base, uniform and consistent data is not available. The most important categories of charges in the FiSC database are for hospitals (23 percent), one component of which are Medicare reimbursements, sewerage and waste management (19 percent), and an all-other category (19 percent). In this initial attempt to measure fiscal capacity, I simply take the actual level of charges as reflecting the capacity to levy charges.[32] In future work, I will refine these estimates to take account of a variety of factors other than income which are likely to affect the ability to collect revenues from charges, including population density, poverty rates, and percentage elderly.

Intergovernmental aid is treated as additive to local fiscal capacity. We compute two additional measures of fiscal capacity by adding state aid to local fiscal capacity, as shown in (6), and state plus federal aid, as shown in (7).

[32] A similar strategy is followed by Chernick and Piazza (2016), in the calculation of fiscal capacity in Italian cities.

$$FC\ Local + State_{it} = FC\ Local_{i,t} + State\ Aid_{i,t} \quad (6)$$

$$FC\ IGR_{i,t} = FC\ Local + State_{i,t} + Federal\ Aid_{i,t} \quad (7)$$

This approach assumes that both sources of aid are exogenous to local fiscal decisions. As I have argued above, this assumption is likely to be more appropriate for state aid than for federal aid, given the high revenue and spending coefficient for federal aid.

Initial results using this approach to estimating revenue capacity and fiscal health are presented in table 9. The measure of fiscal health, called the fiscal gap, is the difference between predicted expenditures and calculated fiscal capacity, as defined in equations (5), (6), and (7).

FISCAL GAP = PREDICTED SPENDING – FISCAL CAPACITY (8)

Predicted spending is a proxy for expenditure need, and varies by year. The first panel shows estimates of fiscal capacity and fiscal health in 2007. The second panel shows the same information for 2013. The third panel shows fiscal health in 2013 if expenditure needs were maintained at the 2007 level.

The results from table 8 indicate that there is a very large variation in the fiscal capacity of cities. Excluding intergovernmental aid, the mean local fiscal capacity (excluding intergovernmental aid) was $3,731 in 2007, with a range is from $1,451 (Gary Indiana) to $9,538 (San Francisco). When we include state aid, the variation in fiscal capacity is reduced, with the coefficient of variation going from .46 to .36. By contrast, the inclusion of federal aid leaves the coefficient of variation unchanged. This latter result reflects the fact that federal aid makes up only a small share of FiSC revenues, and is also consistent with the finding that federal aid is channeled to cities with higher expenditures and own-source revenue. It suggests that this 'pull-in' effect is strong enough to offset the equalizing effect of poverty criteria in the formulae for the distribution of federal aid, particularly Title I of the Elementary and Secondary Education Act and the Community Development Block Grant Program. Comparing 2007 and 2013, average local fiscal capacity goes down by about 2.5 percent, reflecting a drop in average housing values and a decline in income. Taking account of state aid, average fiscal capacity is reduced by 5.6 percent in this period. This result indicates that the effect of reduced state aid reinforced and even outweighed the reduction in the local fiscal base in terms of effect on city fiscal health.

Comparing fiscal health, in 2007 the five cities with the highest fiscal gaps were New Orleans, Philadelphia, Baltimore, Pittsburgh, and St. Louis. The five cities with the lowest gaps were all in California (San Jose, Long Beach, Fremont, Huntington Beach, San Francisco). In 2013, the cities that were weak in fiscal health (high fiscal gaps) in 2007 were all still among the 10 weakest cities. Similarly, the fiscally healthy cities in 2007 typically preserved their relatively favorable fiscal health. Given the severity of the drop in housing values in California when the bubble burst, the persistence in relative fiscal health is notable. It reflects the fact that, despite the magnitude of the housing bust in California, in 2013 the average value of homes remained substantially higher than in most other parts of the country.

As shown in the lower panel of Table 8, if we use predicted spending in 2007 as the standard of need, the average fiscal gap increased by $423 from 2007 to 2013. The weakest city's fiscal gap increased from $2,498 to $2,572, while the strongest city's gap fell from –$4,627 to –$6,363. These calculations suggest that between 2007 and 2013, in the typical U.S. big city, fiscal hardship and the ability to maintain service levels declined substantially from their prior peaks.

Table 8: Fiscal Capacity and Fiscal Health (various years)

	Mean	Std.Dev.	Min	Max
		Fiscal Capacity (2007)		
Local	3731	1702	1451	9538
Including State Aid	5583	2012	3079	12295
Including State and Federal Aid	5951	2054	3442	12840
		Fiscal Gap* (2007)		
Including State Aid	–7	+1630	+4184	–4627
Including State and Federal Aid	–372	+1580	+2498	–5173
		Fiscal Capacity (2013)		
Local	3639	1730	1326	11300
Including State Aid	5267	1946	3022	14030
Including State and federal aid	5711	2031	3418	14658
		Fiscal Gap		
Including State Aid	–110	1570	+2894	–7014
Including State and federal aid	–483	1531	+2076	–7014
		Fiscal Gap (2007 Predicted Spending – 2013 Calculated Fiscal Capacity)		
Including State Aid	+313	1591	+3329	–6363
Including State and Federal Aid	+61	1583	+2572	–6990

* [Predicted Spending – Calculated Fiscal Capacity]. (Positive value indicates fiscal gap)

Source: See "Alternative Measures of Fiscal Stress" section for details.

To better understand the sources of changes in fiscal health, table 9 examines disparities in the fiscal capacity component of fiscal health for selected years between 2000 to 2013. The table shows the coefficient of variation for the three measures of fiscal capacity described above—local, local plus state aid, and local plus state and federal aid. The first row of table 9 shows a sharp increase in the dispersion of local fiscal capacity, from 0.39 in 2000 to 0.48 in 2013. This increase reflects the increasing differential in the cost of housing across U.S. cities. Comparing the second to the first row shows the equalizing effect of state aid, state aid reduces the variation in fiscal capacity in each year. However, the reduction is not enough to offset the increase over

time in the variation in local fiscal capacity. The third row, which shows the percentage reduction in variation due to state aid, goes from 23 percent in 2000 to 28 percent in 2005, then falls back to 23 percent by 2013. Thus, state aid was not able to offset the sharp increase in variation in local fiscal capacity in the aftermath of the Great Recession. [33] As shown in the fourth row of table 9, federal aid had no effect on the dispersion of fiscal capacity. This lack of effect reflects both the relatively small share of federal aid in FiSC revenues, as compared to state aid, and the fact that, as discussed in the third section, federal aid is positively correlated with local spending.

Table 9: Disparities in Fiscal Capacity (various years, 90 FiSCs)

Table 9						
Disparities* in Fiscal Capacity (FC), Various Years, 90 Fiscally Standardized Cities						
Year			2000	2005	2010	2013
Local FC**			0.39	0.45	0.48	0.48
Local FC** + State Aid			0.3	0.36	0.36	0.37
Reduction in Fiscal Disparities (%)***			23%	20%	25%	23%
Local** + State & Federal Aid			0.3	0.35	0.36	0.37
Notes						
* Disparities Measured by the coefficient of variation (CV).						
**Local Fiscal Capacity = Local tax capacity + charges. (See text for details)						
*** Calculated as $1.0 - [(CV_{\text{local FC + state aid}})/CV_{\text{local FC}}] \times 100$						

Conclusion

This paper uses the Lincoln Institute of Land Policy's Fiscally Standardized Cities database to examine various aspects of the fiscal health of U.S. cities. The FiSC dataset includes revenue and spending data for 150 cities and their constituent governments. The time period for analysis is 2000–2013.

Fiscal health as analyzed in this paper differs in concept and in data sources from the default risk approach used by budget analysts and bond-rating agencies. While the fiscal gap approach is based on Census of Governments' data aggregated in FiSCs, and is only available with a lag of at least two years, default risk analysis relies on current financial and accounting information from Comptroller's Annual Financial Reports, intra-year fund balance information, and changes in short-term debt levels. In the appendix, we use the FiSC data to compare spending, revenues, and

[33] Since housing values are the primary determinant of local fiscal capacity, the results suggest that an increase over time in the dispersion of housing prices was an important contributor to increased fiscal disparities. I also computed the relative fiscal capacity of fiscally weak and fiscally strong cities in 2000 and 2013. Relative fiscal capacity is calculated as the ratio of each city's fiscal capacity (including both state and federal aid) to fiscal capacity in a hypothetical city with median values for each of the components of fiscal capacity. In both years, the cities weakest in fiscal capacity were at least 15 percent lower than the median, while the highest capacity cities were at least 50 percent above the median. In 2013 New York and San Francisco were at 2 and ½ and 3.2 times the median.

debt in Detroit and Stockton, two cities that experienced recent fiscal crises and were forced to file for bankruptcy. While Detroit shows a longer run pattern of spending exceeding revenues, and sharply rising long-term debt, the FiSC data suggest that in Stockton the crisis arrived more suddenly, precipitated by a sharp decline in revenue due to the bursting of the housing bubble.

The FiSC data show consistently strong rates of increase in revenue and spending between 2000 and 2009, followed by sharp decreases during the Great Recession. Spending was somewhat more volatile than revenue, particularly during the housing boom and bust period. Spending declined by 12.7 percent from 2009 to 2012, with declines in capital spending of at least 18 percent. However, fiscal performance varied considerably across cities. Those with large spending decreases did not share in the sustained run-up in the earlier part of the thirteen-year window of observation, but declined at a similar rate to the median during the Recession.

We estimate a set of spending and revenue regressions, and use the predicted values to calculate various measures of fiscal health. Per capita spending is somewhat higher in denser cities, particularly for public safety and education, and in cities whose population is declining. Intergovernmental aid plays a key role in FiSC spending. An additional dollar of state aid displaces a relatively small amount of own revenues (between 13 percent and 32 percent), while federal aid is associated with higher local spending, particularly in social services, welfare, and public safety. This result suggests that cities with greater needs in these functional areas are able to leverage more federal aid. Resident income has a positive, but relatively small spending effect, a reflection of the offsetting effects of positive income-related demand for public goods, and a negative income-state aid relationship. State aid's implicit tax on local fiscal capacity is substantial, with almost half of the additional spending that would be associated with higher resident income offset by reduced state aid.

The various types of property tax limitations fail to show strong or consistent effects on levels or changes in property tax revenues. This may be due in part to the endogeneity of limitations—higher property tax cities may be more likely to have limitations imposed by their states—and in part to measurement issues in characterizing the many state-specific provisions of the various limitations. However, the result should not be taken to imply that property tax limitations have not had an effect on revenues. The imprecision of measurement means we are unable to statistically discriminate between cities facing different types of limitations. However, given that almost all cities in the sample have faced at least one type of limitation since the beginning of our analysis period, their effect on revenue is likely to be incorporated into the estimates of the average effect of housing values and income on property tax revenues.

The major findings on fiscal stress are as follow:

1. **There is substantial cyclical sensitivity in city fiscal position**. Using predicted spending and actual revenue, the mean fiscal surplus goes from close to zero in 2000 to a negative four percent of revenue by 2003, rises to a positive two percent surplus in 2007, then again turns negative, only reaching a balanced fiscal position by 2013. There is wide variation across cities, with the average 2000–2013 deficit for the (10) most fiscally stressed cities equal to 25 percent of revenues, as compared to an average surplus for the least fiscally stressed of over 14 percent.

2. **Revenue composition**—differences in the shares of revenue that come from the property tax, other taxes, or state aid—**does not have a statistically significant effect on revenue growth or fiscal stress**. The irrelevance of the structure of revenues reflects the fact that over most of the sample period, the major revenue sources for cities tend to move together, with only temporary divergences during periods of recession. While a more diversified revenue structure appears to have some effect in reducing the volatility of revenues during economic downturns, these effects disappear over a longer sample period. The only source that does reduce fiscal stress is contemporaneous federal aid, which may imply a short-run role for federal aid as a budget balancing device.

3. **Local fiscal capacity**, estimated based on housing values, median income, and the actual value of charges, **varies enormously across cities**. Estimates for 2007 range from $1,451 (Gary, Indiana) to $9,538 (San Francisco), with a mean value of $3,731. Disparities have increased by almost 25 percent between 2000 and 2013. State aid plays an important equalizing role, lowering fiscal disparities by about 23 percent. However, recession related reductions have reduced the effectiveness of state aid as an equalizing factor. Federal aid, which is more likely to go to higher spending cities, has no effect on fiscal disparities.

4. In the aftermath of the Great Recession, the typical large city experienced a substantial decline in its ability to maintain prior service levels. The average fiscal gap (predicted spending minus estimated fiscal capacity) increased by 15 percent between 2007 and 2013.

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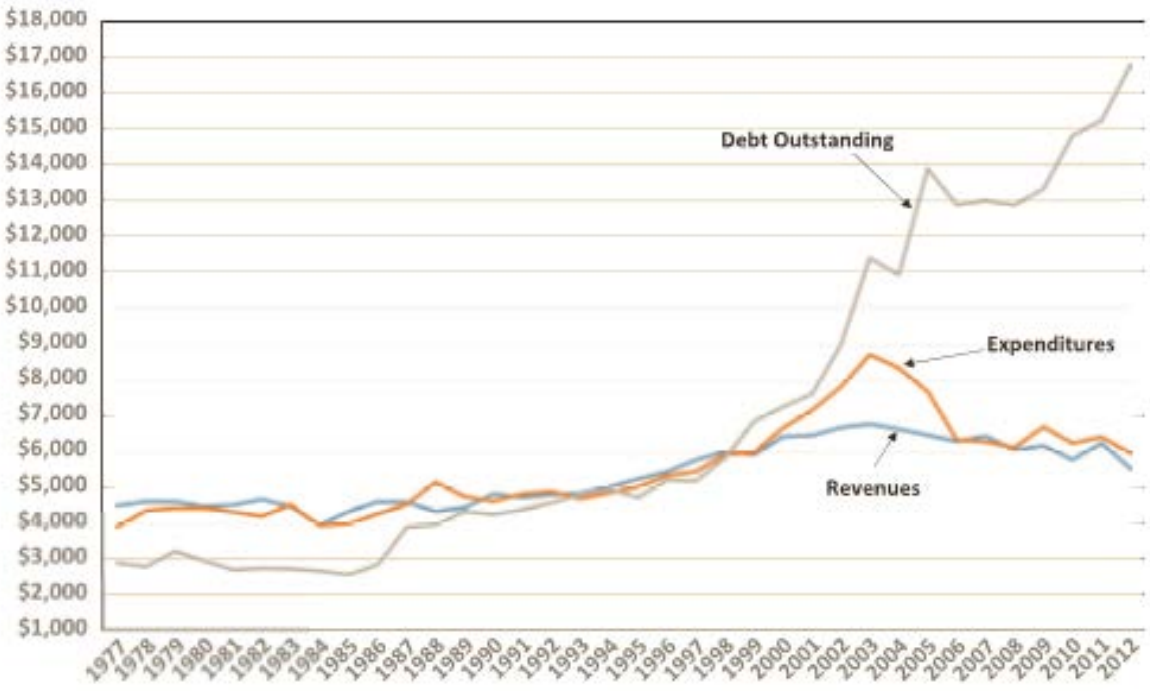
Appendix

Using the FiSC Data to Study Fiscal crises

While the FiSC data provide insight into the long run fiscal condition of cities, they may also be used to provide insight about cities which have actually experienced fiscal crises. As an illustration of the uses and limitations of the FiSC data in explaining fiscal crises, figure 1 below shows revenues, expenditures, and debt for the city of Detroit, from 1977 to 2012. Detroit filed for municipal bankruptcy in 2013.[34] The data indicate quite clearly the fiscal difficulties that preceded the bankruptcy filing. The graph shows a sharp increase in debt levels beginning in 2000. Most of this increase was in the form of long-term debt. The gap between general revenues and general expenditures that opened up between 2000 and 2006 suggests, but does not prove, that long-term debt may have been used to finance current operating deficits in that city.

Figure A1: Per Capita Revenues, Expenditures, and Debt Outstanding, City of Detroit, 1977–2012 (in 2012 dollars)



Per capita revenues, expenditures, and debt outstanding, City of Detroit, 1977 to 2012 (2012 dollars).

Comparing Detroit to other rust belt cities, as shown in figure 2 below, indicates that many older cities also experienced a rapid increase in debt.[35] Indeed, when one examines average debt for the entire FiSC sample, a similar pattern emerges. However, Detroit was the only city in the group of rust belt cities which filed for bankruptcy.

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[34] This graph comes from Howard Chernick and Andrew Reschovsky, "The Fiscal Condition of U.S. Cities: Revenues, Expenditures, and the 'Great Recession,'" *Journal of Urban Affairs*, 39, Issue 4, 2017: 483–505.
[35] The report from which this and the second graph come from is available at http://www.roosevelthouse.hunter.cuny.edu/?forum-post=detroits-bankruptcy.

Figure A2: Spending, Revenue, and Debt for Six Rust Belt Cities

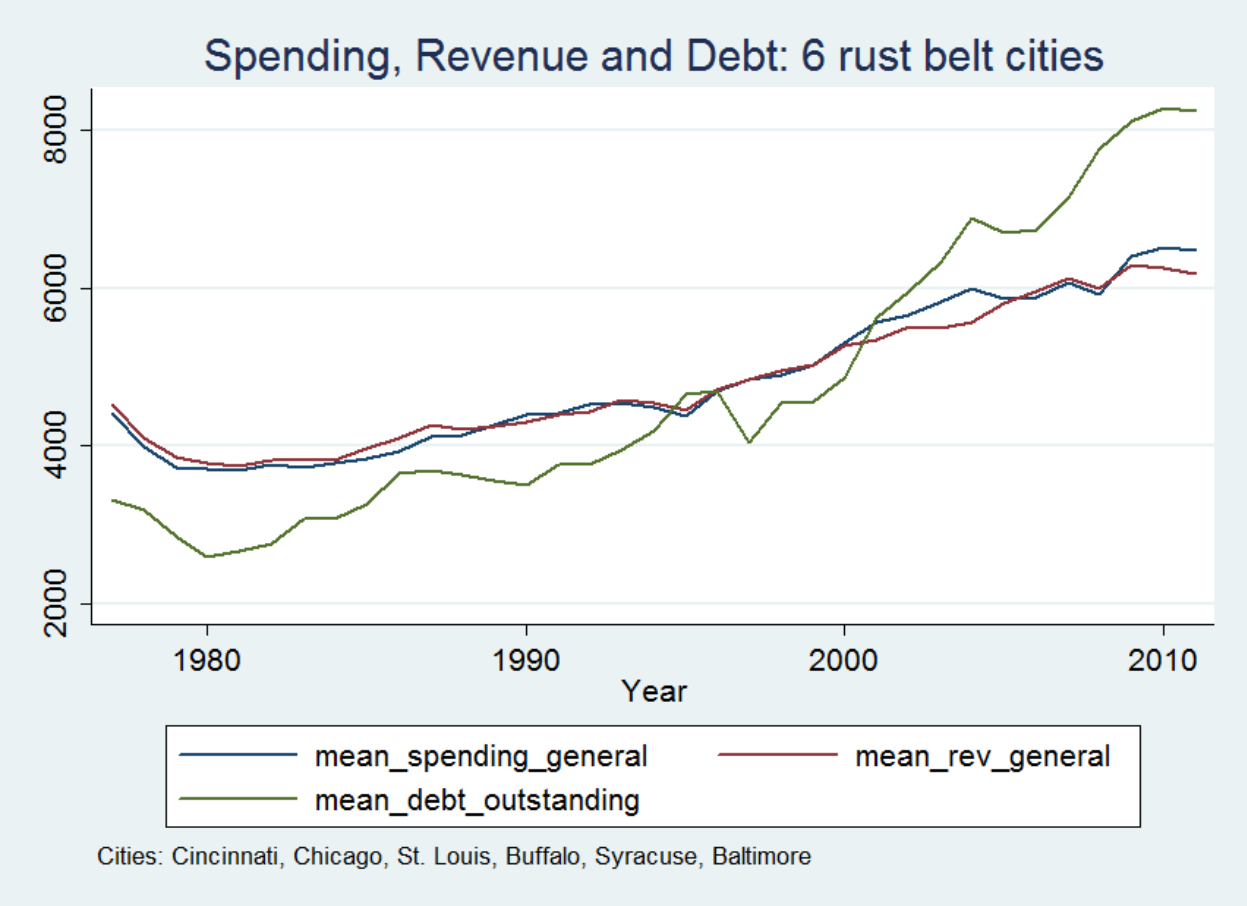

Figure 3 shows revenues and expenditures for Stockton, California. Stockton, which filed for bankruptcy in 2012, was the largest municipal bankruptcy in the U.S., until surpassed by Detroit. The graph shows the divergence between expenditures and revenues in the Great Recession. Though Stockton was hard hit by the housing crash in California and a high level of pension obligations, its fiscal condition does not appear to have been as dire as that of Detroit on the eve of its bankruptcy filing.

Figure A3: Revenues and Expenditures for Stockton, California