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Exploring the Linkage between Economic Base, Revenue Growth, and Revenue Stability in Large Municipal Governments

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Abstract

The Great Recession had far-reaching consequences for the fiscal health of municipal governments. The deeply weakened economy has undermined the capacity of local governments to meet their financial obligations. City leaders face a trifecta of shrinking tax bases and aid from federal and state governments, increasing demands for public services, and deteriorating infrastructure. Local governments increasingly find themselves as fiscal islands left to fend for themselves. Given this reality, it is essential that scholars study how local governments can build their local economies—their economic base—to more effectively guide public policy. Adding to the urgency for this inquiry is President Trump's call for investment in rehabilitating and expanding public infrastructure as a cornerstone in his goal to rebuild America. Using data from large U.S. cities, this study explores how a city's economic base affects its revenue growth and volatility.

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Table of Contents

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Introduction

The Great Recession of 2007 to 2009 had far-reaching consequences for the fiscal health of municipal governments. The resulting weakened national economy stretched the capacity of their tax bases to meet their financial obligations, forcing many to reevaluate their fiscal strategies. In balancing current needs with future aspirations, local government managers face a trade-off between balancing the immediate need for budget stability against investing in future economic growth (Felix 2008; White 1983).

On the one hand, the adoption of and reliance on stable revenue sources mitigates the negative consequences of economic downturns. Revenue stability has many benefits including fewer disruptions in service delivery (Yan 2011), less expenditure volatility driven by economic cycles (Hendricks and Crawford 2014), and a higher municipal bond rating (Grizzle 2010). On the other hand, reliance on stable revenues may result in slower long-term revenue growth from the income inelasticity of these revenue sources. Cities that rely more heavily on income elastic revenue sources capture more revenue from the growth in their local economy but may sacrifice the stability of their local revenue streams in return. Both revenue stability and revenue growth are essential to a city's long-term fiscal health.

While revenue stability and growth have been examined by many studies, most have explored how growth in income (Sobel and Holcombe 1996; White 1983) or the fiscal structure of a local government impacts the volatility or revenue growth (Carroll 2009; Yan 2011). Lacking is an analysis of the impact that a city's economic base—its mix of private and public sector enterprises—has on the growth and stability of its revenue. A city's economic base is the foundation from which its revenue is ultimately generated—it is the driver of local prosperity. This study provides policy leaders a clearer understanding of the link between a city's economic base and its long-term fiscal health. No prior study has linked a city's economic base to its revenue sources. How do the different types of business sectors that comprise a city's economic base impact the volatility of its property tax, sales tax, and own-source revenue in general?

Panel data are used to assess the relationship between a city's economic base and the growth and volatility of its revenues. Specifically, this study focuses on the impact of changes in a city's economic base on own-source revenue, and then separately on the two most important own-source revenue streams to local governments sales tax and property tax revenue. As such, proper attention is given to the impact that a municipality's economic base has on the fiscal health of a city through the analysis of own-source revenue and the two most ubiquitous taxing instruments available to local governments in the United States. Data between 2005 and 2012 for 149 fiscally standardized cities[1] from the Lincoln Institute of Land Policy (Lincoln Institute of Land Policy

[1] Data were obtained from the Lincoln Institute of Land Policy. Fiscally Standardized Cities database. (http://www.lincolninst.edu/subcenters/fiscally-standardized-cities/) Rutland, Vermont is included in the original 150-city FiSC database but was deleted from the sample for this study because it is located in a Micropolitan

2016) and industry data from the County Business Pattern Dataset are analyzed using two-way fixed effects models.

Income elasticity measures the sensitivity of a revenue source to changes in the economy (Carroll and Goodman 2011). Revenue volatility, on the other hand, measures the difference between actual revenue and that predicted from a trend. While inelastic revenue sources provide stable yields, they grow slower than the economy, creating a gap between actual and growth-adjusted trends. Income elastic sources grow faster than the economy providing a revenue surplus in good economic times. As the economy slows, so does the revenue growth of income elastic revenues. As a local government relies on more income elastic revenues, it is likely to see faster growth in its revenues but experience more revenue volatility over the long term due to the business cycle. Conversely, as local governments rely more on income inelastic sources of revenue, they grow slower but have more stable revenue yields over the business cycle.

The paper begins with a brief introduction to strategies for promoting fiscal health and provides the theoretical basis for connecting a municipality's economic base to its revenue structure. Next, drawing on the fiscal health literature, revenue elasticity and volatility are discussed followed by a discussion of the conceptual and theoretical foundation of a municipality's economic base. The last half of the study begins with an elucidation of the methods employed, followed by a discussion of the research findings and ends with a summary and the implications for public policy.

Fiscal Health

Fiscal health is the ability of a municipal government to meet current financial, service, and capital obligations (Carroll and Goodman 2011). Local governments must be able to pay operational expenses—the annual costs for continuing services—plus one-time capital outlays for infrastructure to satisfy the full range of citizen demands. Fiscal health ultimately depends on the capability of a local government to meet its *current* service and capital demands in addition to its ability to sustain prosperity in the *long term* while adapting to external influences (Hendrick 2011).

Fiscal health is a multidimensional concept that encompasses multiple periods while accounting for internal capacity and external constraints. In a practical sense, a fiscally healthy local government must (1) provide ongoing services at a socially acceptable level, (2) meet its capital needs for infrastructure, (3) meet long-term liabilities such as bond debt and accrued pensions while (4) simultaneously adjusting its fiscal strategies to changing political and economic environments.

In their pursuit of fiscal health, local government managers must balance competing forces such as the current service expectations of constituents with future capital needs of the community. Revenue growth and volatility are important factors of a local government's capacity to balance

Statistical Area while the other 149 cities are located in Metropolitan Statistical Areas. Micropolitan statistical areas are smaller, more rural, and less economically developed than metropolitan statistical areas, and thus not comparable to the other cities in the study sample.

countervailing pressures and maintain fiscal health. While fiscal health has been measured in a variety of ways, this study uses revenue volatility and growth because they are key determinants of a municipality's fiscal health broadly defined (Carroll and Goodman 2011).

Local government managers typically prefer a revenue structure that captures the benefits to revenue yield from economic growth while simultaneously minimizing revenue volatility. Unfortunately, these goals are often at odds (Carroll and Goodman 2011; Felix 2009) because revenue growth occurs with highly elastic revenue systems. However, elastic revenues are sensitive to shifts in the economy that drive revenue volatility. Gains in revenue through growth of the local economy leave municipal governments more susceptible to revenue volatility. Conversely, stable revenues are often associated with limited economic growth because inelastic revenue sources are less sensitive to shifts in the economy. Officials must strategically manage these two opposing outcomes to achieve a fiscally healthy revenue structure.

Both outcomes—growth and stability—can promote fiscal health depending on the budgetary requirements of a local government. If a local government needs to increase services or infrastructure, a strategy aimed at growing revenue by expanding the tax base gives its leaders the flexibility to meet those service expectations. Municipalities that are expanding will inevitably need to fund that expansion and will benefit from a growth-focused revenue strategy. Conversely, a local government that provides an appropriate level of services will desire more revenue stability to maintain service levels across business cycles. Bedroom communities and local governments that have reached buildout or otherwise have limited growth potential will benefit by pursuing strategies that promote more revenue stability.

Revenue Growth and Income Elasticity

Under normal circumstances, a city experiences revenue growth when its economy expands. However, the relationship between the two variables varies widely depending on the composition of the city's economy and the revenue sources that tap that economic base. The more closely linked a city's taxes and fees are to the composition of its economy, the more income elastic the revenue yield. Local government managers know that they can maximize revenue growth by relying heavily on income elastic revenue sources.

Analysts face two important decisions when measuring revenue elasticity: how to measure "revenue," and how to measure "the economy" (Carroll and Goodman 2011)? Measuring the income elasticity of taxes and fees is typically accomplished by regressing the natural log of annual yield from a revenue source on the natural log of the revenue base. Revenue yield is the amount of revenue levied by a local government, whereas the revenue base is the value of the objects or transactions to which a tax rate is applied (Bland 2013).

Measuring Revenue

Revenue yield rather than revenue base is used in this study to assess the impact of the components of the local economy on local budgets. Using revenue base to measure elasticity has the advantage of isolating the effects of wealth generation from confounding policy decisions

such as a change in the tax rate. Growth of a city's revenue base is also important when preparing budget forecasts. However, budget decisions are made using revenue yield, not revenue base. Revenue yield also captures the effect of rate changes in addition to growth or decline in the base. Finally, given our interest in the impact of economic growth on budgetary decisions, revenue yield provides a more appropriate measure of that linkage. Given the distinctive budgetary processes that municipalities typically pursue when making budget decisions for their tax-supported activities, we also examine two subsets of own-source revenue yields: the property and sales taxes.

Revenue yield is defined as the total amount of revenue from tax and nontax sources other than intergovernmental aid. In many cases, local governments adjust tax or service charges rates annually and occasionally more frequently in the case of some municipal-owned utilities. Many factors affect rate adjustment decisions that make using a city's revenue base a less than ideal way to capture revenue elasticity. First, tax rates are influenced by the tax rates of neighboring jurisdictions. Local governments look to minimize business relocation and citizen dissatisfaction by setting tax rates at a favorable level *compared to neighboring jurisdictions* (Besley and Case 1992; Brueckner 1998, 2003; Buettner 2001; Heyndels and Vuchelen 1998; Ladd 1992; Shleifer 1985). The revenue rates of neighboring municipalities act as an unintentional benchmark that both businesses and citizens use to evaluate their city's performance.

Second, revenue rates, particularly for the property tax, are often adjusted to offset changes in the revenue base (Alm et al. 2011; Doerner and Ihlanfeldt 2011; Ihlanfeldt 2011; Lutz 2008; Lutz et al. 2011; Vlaicu and Whalley 2011). When a revenue base decreases, local governments often increase rates upward to balance their budget and vice versa. Some scholars debate the frequency such offsetting practices occur (Ihlanfeldt 2011; Ihlanfeldt and Willardsen 2014; Ross and Yan 2013), although the budgetary motivations are apparent. Thus, rate adjustments made to balance a municipal budget are frequently used to offset changes in their respective base.

Third, when preparing budget forecasts, public managers use the expected yield from each revenue source plus the unassigned fund balance (i.e. that portion above the balance required by policy) to establish a beginning point for budget negotiations. The unassigned fund balance is particularly important because it allows local governments to maintain budgeted services and capital outlays if there is an unexpected fiscal shock resulting in a revenue shortfall. Furthermore, properly maintained slack resources, such as the unassigned fund balance, are crucial for maintaining short-term cash solvency (Hendrick 2011). Rate adjustments can occur in response to changes in a local government's fund balance or to provide a cushion when slack resources have been depleted or exceed policy requirements. Thus, using revenue yield rather than revenue base provides a more accurate connection between a city's economic base and the revenue available for budgetary purposes.

Measuring Economic Growth

The other key factor of interest to this study is economic growth. Typical measures include personal income, GDP (if the unit of analysis is county, state or nation), and unemployment. To better parse the distinctive effects of the local economic base on revenue yields, this study uses

three specifications that measure important dimensions of local economic development: aggregate local economic growth, industrial diversification, and industrial agglomeration.

To capture the impact of a local government's economic base on its revenue elasticity, this study examines not only own-source revenue yield—revenue generated through taxes, fees and services excluding all intergovernmental revenue—but also the yields from the property tax and sales tax. These two taxing instruments (1) are widely used by local governments, (2) typically comprise the largest non-intergovernmental portion of local government revenues, and (3) in the case of the property tax, are more revenue inelastic and, in the case of the sales tax, are more revenue elastic, thereby providing contrasting indicators to measure their impact on revenue volatility.

Property taxes are income inelastic in the short-term because the tax base is fixed at a point in time and in advance of setting the tax rate. Where local governments have control over the property tax, the rate is typically adjusted by city councils to bring total revenues into balance with total expenditures including capital spending, a process referred to as millage offsetting (Iflanfeldt 2011). While property values fluctuate with the economy, locally set tax rates smooth out year-to-year revenue yields from the tax. Sales taxes, however, are revenue elastic, and local governments have less discretion than with the property tax to alter rates prior to or during the fiscal year.

Revenue Volatility

Revenue volatility is a function of fiscal structure (Afonso 2014; Carroll 2009; Hendricks and Crawford 2014) and fiscal policy space (FPS) (Hendricks and Crawford 2014; Pagano and Hoene 2010). Fiscal structure refers to a city's tax burden, types of revenues used, diversification of revenue sources, fiscal capacity, and revenue complexity (Carroll 2009; Hendrick and Crawford 2014). Previous research has focused on fiscal instruments that increase revenue stability through slack resources and revenue diversification. FPS refers to exogenous determinants of revenue volatility such as state and local laws that restrict a city's tax options, its economic base, and its political culture.

Slack resources are a local government's "pool of resources in excess of the minimum necessary to produce a given level of output" (Hendrick 2006, p.15). As a countercyclical measure, slack resources accumulate when revenues increase and are spent during recessions as governments work to stabilize expenditures (Bland 2013). While state governments use their slack resources in this manner (Douglas and Gaddie 2002; Hou 2003, 2005; Hou and Moynihan 2008), local governments are less inclined to use slack resources purposefully as a countercyclical measure (Wang and Hou 2010). Yet, recent research indicates that slack resources improve a local government's fiscal health (Hendricks 2006; Marlow 2005) and promote revenue stability (Carroll 2009; Hendricks and Crawford 2014).

Another fiscal tool of interest to public finance scholars is revenue diversification. After the 1978 property tax revolt in California that culminated in passage of Proposition 13, local governments in other states pressured their legislatures for access to other revenues in addition to the property

tax. By diversifying their revenue structures, local governments minimize the impact of a fiscal shock on one revenue source (Carroll 2009) and capture revenue from individuals or businesses that otherwise avoid paying the property tax (Ulbrich 1991).

Carroll (2009) finds that revenue diversification decreases revenue volatility in local governments. But how a municipality diversifies its revenue is critical to achieving revenue stability (Afonso 2014; Carroll 2009; Hendricks and Crawford 2014; Yan 2011). When cities substitute revenue from the property tax with either a general sales or income tax, the income elasticity of their tax base increases and with it the volatility of their revenues (Afonso 2014; Yan 2011). Afonso (2014) finds that counties that rely on more income elastic revenues have increased revenue volatility. Yan (2011) finds that revenue diversification leads to increased revenue stability when the employment rate is volatile, and that revenue diversification leads to decreased revenue stability when the local economic base is stable.

In addition to fiscal structure, a city's FPS heavily influences revenue and expenditure volatility. FPS refers to the exogenous parameters that limit the policy options available to city officials (Hendrick and Crawford 2014; Pagano and Hoene 2010). Five attributes shape the FPS of a city: its intergovernmental context, locally imposed laws, its political culture, demand for public goods and services, and its economic base. Hendricks and Crawford (2014) test for the effect of fiscal policy space on spending volatility and find evidence that population and distance from a central city decrease spending volatility. But a city's status as a home rule city has no effect on spending volatility. While this is a good first step toward understanding the effect a city's FPS has on revenue volatility, a more complete understanding would account for the impact of a city's economic base on its revenue volatility. This research extends the work by Pagano and Hoene (2010) and Hendrick and Crawford (2014) to pursue a more detailed theoretical explanation of the link between a city's economic base and its fiscal health.

Economic Base

A city's economic base is the economic resources that produce wealth for residents and businesses, and ultimately generates revenue for the local government (Hendricks and Crawford 2014; Overton 2016; Peterson 1981). For this study, we define a local government's economic base as the aggregate of all public enterprises and private firms located in a city's borders from which revenue (property, sales, or other) is directly or indirectly generated (Overton 2016).

Private businesses and public organizations serve many functions that support the economic prosperity of a local government such as providing income through employment, improving capital accumulation by constructing buildings, and generating economic activity by producing and selling goods and services. Some of these activities form the municipality's revenue base, which is directly taxed. However, other economic activities are not subject to taxation or other local charges and fees—like many service industries—but indirectly these economic activities can improve a city's fiscal health by providing jobs, positive economic externalities, or supporting a key local industry as an intermediary. Growth in the economic base normally produces more jobs, higher personal income, greater consumption, and more property wealth.

This economic activity affects a municipality's revenue bases, revenue rate adjustments, and revenue yield.

Conceptually, a municipality's economic base is distinct from its revenue base. An economic base encompasses all economic activity, while a revenue base is a subset of activities and objects subject to taxation or other charges and fees. Ideally, the revenue structure of a city is designed so that increases or decreases in a city's economic base closely track as increases or decreases in its revenue base. But the reality of implementing an equitable and efficient tax system results in an imperfect association between the two (Pagano and Hoene 2010; Tannenwald 2004).

Recently, the use of NAICS data and the evolving economy have exacerbated the differences between a municipality's economic base and its revenue base. NAICS provides the most comprehensive and comparable industrial data available to local government professionals. It groups together similar businesses for the purposes of providing useful and comparable data. The NAICS was initially developed in 1997, replacing the previous Standard Industrial Classification (SIC) system. While the SIC system poorly organized new economic activity, the NAICS overcame this aggregation defect by adopting a unifying economic concept for grouping industries—referred to as a supply-side concept. The supply side concept defines and groups industries based on the similarity of their production processes. While the NAICS created a robust classification system, it was *not* created with the purpose of classifying industries by their contribution to local tax revenue or their conformance to tax codes. The NAICS measures many aspects of a local government's economic base well, but not its revenue base. Smaller datasets exist at the local and state level, but none of these datasets offer national coverage using a standardized format. The lack of a nationally standardized way to connect local economic and revenue bases has prevented analysts from studying their interaction.

In addition to data limitations, policy makers have been unable to create taxing instruments and update tax legislation at the same pace that the economy is evolving. The fiscal structures of local governments were designed for older economic institutions, and the fiscal structures that once worked have failed to keep pace with emerging economies (Tannenwald 2004). First, the US economy has been increasingly shifting toward a service economy. While the trend away from manufacturing started as far back as 1939 (Short 2011), the national economy continues shifting toward service-providing industries. In the 10-year period between 2004–2014, gross employment in the service sector grew by 9% and made up 80.1% of all employment, while goods-producing industries declined in gross employment by 12.1% making up only 12.7% of all employment in 2014 (Bureau of Labor Statistics 2015). The consumption of intangible services has increased as a percentage of total consumer consumption. Unfortunately, tax bases tend to rely on the consumption of tangible goods. Industries that provide services are difficult to tax, and often exempt from sales taxes, due to cross-border concerns.

Second, technology, the internet, and social media have created new industries while simultaneously reshaping the way commerce occurs. Local tax structures have not kept pace with the high-tech revolution and fail to distribute the tax burden fairly across newer versus older industries. The emergence of e-commerce, the internet of things, the "sharing" economy, big data, machine learning, and the subsequent loss in state and local sales tax revenue is evidence

that technological developments have out-grown state and local fiscal structures. Tax policies and instruments have failed to keep pace with the evolving economy.

The NAICS data and the changing economy have contributed to expanding the divide between a municipal government's economic base and its revenue bases. The purpose of this study is to determine how a local government's economic base impacts revenue elasticity and volatility. Previous studies into revenue volatility and growth either (1) do not include economic base variables or (2) use broad aggregate outcome measures—such as unemployment rate—that do little to differentiate between different components in a city's economic base. This study proposes measuring a local government's economic base using three conceptual measures: measures of aggregate economic base employment, diversification, and clustering.

Aggregate Employment

The overall strength of a local economy is frequently measured using the city's unemployment rate. Certainly, a low unemployment rate is an indication of a strong local economy where most residents have an income, are self-sufficient, and are likely to spend money, which promote economic growth. Unemployment is an important concept when determining the strength of a local government's economic base, yet it fails to explain why a city's economic base is strong or resilient to economic shocks.

Another aggregate employment measures is unemployment volatility—the difference between a long-run unemployment trend line and actual unemployment. As unemployment volatility increases, a city's economic base is more susceptible to noncyclical economic shocks indicating that the economic base as a whole lacks stability (Yan 2011). Unlike unemployment rate that signals the strength of a local economy, unemployment volatility is an indicator of an economic base's resilience to economic shocks.

This study contends that the strength of an economic base is partially dependent on the mix of industries comprising that base. Businesses interact with each other in a dynamic economic system where they are supported by intermediaries and threatened by competitors. The actual industry type is less important than how those industries are organized, giving rise to the concepts of economic diversification and clustering.

Diversification

Diversification is a two-dimensional concept concerned with (1) the breadth of different component parts and (2) the balance between these options (Goodman 2016). Industrial diversity is the number of different industries and the intensity of each industry's utilization in the local economy. Diversified local economies, those economies with a broad and balanced mix of industries, show more stable growth in the long-run because their growth is not dependent on any single industry (Chinitz 1961). In addition, diversified economies create robust knowledge spillover networks (Chinitiz 1961; Jackson 2016; Jacobs 1969), enhance local capital investment (Chinitz 1961), and improve firm survival rates (Renski 2011).

Modern portfolio theory provides insight into the effect of diversification on fiscal health. It argues that an investor owning a broad number of stocks and bonds will have far more stable returns in the long-run than a portfolio containing one stock. Because the growth of stocks and bonds is not perfectly associated, stocks dropping in value will not result in total loss of the stockholder's investment (Brealey and Myers 1991). From the viewpoint of modern portfolio theory, diversification mitigates risk and stabilizes growth.

However, modern portfolio theory assumes that there is an available and accessible mix of stocks and bonds whose prices and risk do not perfectly correlate. This assumption is relatively safe given the global supply of investment opportunities. Yet, this assumption does not universally apply to local or regional economies because the different industries in a diversified economic base are interdependent. Some industries provide supporting services for other industries similar to the relationship between mining and manufacturing and manufacturing and transportation/warehousing. Some industries do not compete for a global market at the local level—industries like retail trade and food services rely on local foot traffic and the synergistic gains from their location. Despite the industrial interdependence in a local economy, research shows that a more diversified economy has more stable long-run growth, but not necessarily higher long-run economic stability (Chinitz 1961).

Clustering

Clustering occurs when firms that support the output of a central industry locate geographically in proximity to each other. Clustering, also called agglomeration, gives firms a competitive advantage through lower production costs (Porter 2000). It creates competitive advantages from the increased productivity of complementary firms, increased innovation among businesses in that industry, and new business formation beyond what occurs outside the cluster (Porter 2000). The clustering of similar primary and intermediary industries is likely to improve the economic condition of a local government because it improves productive efficiency of the economic base. Efficient production matters because it enables a city's economic base to compete in a global market and is more likely to weather economic downturns than non-clustered competitors.

Research shows that clustered industries have lower supply costs and increased innovation. Clustered firms gain competitive advantages by sharing infrastructure (Burchfield, Overman, Puga, and Turner 2006), sharing a labor market pool (Overman and Puga 2010), improving proximity to suppliers (Amiti and Cameron 2007), increasing the likelihood of employee-employer matching (Costa and Khan 2000), and encouraging knowledge spillovers (Audretsch and Feldman 1996).

Research Design

Two measures are used to gage the impact of economic base on revenue yield: revenue elasticity and revenue volatility. Revenue elasticity and revenue volatility represent a vector of dependent variables. To understand the connection between economic base and revenue yield this study uses the revenue elasticity and volatility for own-source revenue, property tax revenue, and sales

tax revenue. By exploring these individual revenue streams, a more accurate measure of the linkages between various industries and individual revenue streams can be provided.

Revenue elasticity (RE_{it}), and revenue volatility (RV_{it}) are modeled using the following specifications:

$$RE_{it} = \propto + EBEMP_{it} + EBD_{it} + EBC_{it} + RE_{it-1}$$
$$RV_{it} = \propto + EBEMP_{it} + EBD_{it} + EBC_{it} + RV_{it-1} + \mathrm{RE}_{it}$$

Revenue elasticity (RE_{it}) and revenue volatility (RV_{it}) are functions of aggregate economic base employment ($EBEMP_{it}$), economic base diversification (EBD_{it}), economic base clustering (EBC_{it}), and the revenue elasticity (RE_{it-1}) and volatility (RV_{it-1}) of the previous year. Economic base employment, diversification, and clustering are all used to understand not only the impact certain industries have on revenue elasticity and revenue volatility but also the impact that diversification and clustering within those industries has on a local government's fiscal health.

Annual data from 2005 to 2012 were obtained for 149 fiscally standardized cities from the Lincoln Institute's FiSC database, from the U.S. Census Bureau's County Business Pattern database, and from the Bureau of Economic Analysis. The final set of observations constitutes a balanced dataset of 1043 observations.

The unit of analysis for this study is a fiscally standardized city [FiSC]. A FiSC is a fictitious city created to facilitate fiscal comparisons among local government service areas. One problem with using cities as the unit of analysis is that there is no standard package of services. While some cities provide most, if not all, public services, others provide only a small portion while the overlapping counties and special districts pick up the balance. FiSCs are constructed by taking the financial data of 149 large cities and adding that to the financial data of overlapping governments. The key benefit of using FiSCs is that it allows for cross-city comparison of total revenue burden and services received. Currently, FiSCs provides annual data through 2012, but the industry data used to test the economic base hypotheses are only available in their current form starting in 2005. Thus, our sample is limited to the years 2005–2012.[2]

Dependent Variables

To fully explore the impact of a city's economic base on revenue elasticity and revenue volatility, three different revenue sources are used as dependent variables: own-source revenue, property tax revenue, and sales tax revenue. Own-source revenue is the aggregate of all revenue generated by the local government excluding state and federal aid. Property and sales tax revenue are subsets of a local government's own-source revenue. Revenue elasticity is operationalized as the natural log of these various revenue streams divided by the natural log of economic base.

[2] The first year of the North American Industrial Classification Systems (NAICS) was 1998. Previously, the Standard Industrial Classification (SIC) system was used. While there is some comparability between the two, it is limited—especially at the level of detail of this study.

Revenue volatility is operationalized as the absolute value of the predicted revenue minus the actual revenue divided by the predicted revenue to standardize the variable. We employ a two-step procedure adapted from previous studies to create our revenue volatility measures (Hou 2003; Marlowe 2005; Carroll 2009; Wang and Hou 2009; Carroll and Goodman 2013; Hendricks and Crawford 2014). The first step estimates a long-run revenue growth trend regression (Carroll 2009).

$$R_{it} = \exp(\propto + \beta_1 i + \beta_2 t)$$

Revenue for city *i* in year *t*, R_{it}, is modeled as a series of dichotomous variables, which indicate the year and each municipality in the dataset.[3] After estimating revenue or expenditure volatility, the next step is to determine the deviation of actual revenues and expenditures from the values derived from the first step. The absolute value of the difference between predicted and actual values is a measure of budget volatility, our dependent variable. This value is then divided by the predicted revenue. As this value approaches zero, revenue volatility decreases. Volatility measures are calculated for all revenue sources: own-source revenue, property tax revenue, and sales tax revenue.

Operationalizing a Municipality's Economic Base

Economic base variables are divided into three categories: aggregate employment measures, diversification, and clustering. The primary independent variable of interest in this study is the city's economic base. While the Economic Census provides the data needed for this study at the city level, it has two limitations. First, the Economic Census only comes out every 5 years, which would allow estimating the model using data from only three time periods (i.e., 2002, 2007, and 2012). Second, the Economic Census of 2002 and 2007 only provide data for cities with a population over 5000, and the 2012 economic census provides data for cities with populations over 2500. While this sampling procedure has no direct effect on the FiSCs used in the dataset, it does limit inference of various spatial factors.

To overcome these limitations, county-level data from the County Business Patterns dataset are used. This dataset provides data for every county for every year between 2005 and 2012. We conduct an analysis of the connection between a city's economic base and its budget volatility. The County Business Patterns dataset uses the North American Industry Classification System (NAICS), which groups businesses with similar products and services into the same category. The classification is divided into NAICS codes with various levels of classification detail. Two digit NAICS codes (21 different classifications) are the broadest classification and groups businesses by sector (i.e. manufacturing, retail, entertainment, etc.) while three digit NAICS codes (82–87 different classifications depending on the year) classify businesses by subsectors. The economic base measures present detail based on the two digit NAICS codes. Although there are significantly greater levels of industrial classification, predictive power is lost using these narrower industrial classifications (Billings and Johnson 2012).

[3] Although the primary sample only uses data from 2005-2012, this budget growth trend regression model uses all financial data available; 1977-2012. By using a greater range of data, a more accurate growth trend regression model can be estimated.

In order to capture the overall economic climate in a municipality, unemployment rate and unemployment volatility are included in the analysis. Unemployment rate is the percent of the population in the labor force that is actively seeking employment but not currently employed. This measure captures overall productive efficiency, utilization of the labor force, and individual employee economic distress. Unemployment volatility is calculated using the same two-step procedure to calculate revenue volatility and is used to capture overall volatility in the local economy. This variable captures local economic shocks that are difficult to operationalize in addition to accounting for the overall economic stability of the local economy. Unemployment data are collected at the county level.

Economic base diversification is measured in two ways using the Hirschman Herfinadahl index (HHI): one employment-based and one firm-based. The employment based measure tests for the impact of industrial diversification on a city's revenue elasticity and volatility. While this employment-based measure accounts for the mix of industries, it does not account for the market power of firms in those industries. If a town has an equally proportional industrial mix, but each of those industries is dominated by one or a few firms, then the city might be more vulnerable than the industrial diversity measure indicates. To account for this potential influence, a firm based HHI is included that measures how concentrated employment is among firms across industries. The HHI is calculated using the following formula

$$\sum_{ij} S_{ij}^2$$

The HHI is the sum of each 2-digit industry's share of either the number of employees or the number of firms in county j.

This study uses two measures to capture clustering: industrial agglomeration and industry productivity. A location quotient measures the agglomeration of an industry in a city relative to the regional sorting of that industry. Specifically, a location quotient uses industry employment data to calculate the ratio of the share of the focal city's employment comprised of a specific industry compared to the state's share of an industry's employment relative to total state employment.

The LQ of industry *i* in city *j* is calculated using the following formula:

$$LQ_{ij} = \frac{(X_{ij}/X_{*j})}{(X_{i*}/X_{**})}$$

where X_{ij} is the total number of full time employees in industry *i* in city *j*, X_{*j}, is the total number of full time employees in *all* industries * in city *j;* X_{i*}, is the total number of full time employees in industry *i* in state *; X_{**}, is the total number of full time employees in *all* industries * in state *. When a city's LQ is greater than 1, then industry *i* is considered geographically clustered in that city compared to other cities in the state.

While the LQ can determine the relative density of businesses in a region, an important component of industrial clusters. However, it does not account for the actual economic strength

of that industry. An industrial productivity proxy is used to help indemnify industries that drive the overall regional economy (Hill and Brennan 2000). Productivity can be thought of as the value added to an economy through every hour of work. Since no direct measures exist, a proxy is created [PP].

$$\mathrm{PP}_{it} = \left[GDP_{it} * \frac{Payroll_{ij}}{Payroll_{it}}\right] / Emp_{ij}$$

P_{it} is the productivity of industry *i* in county *j*. We know the GDP of an industry at the state level. However, we want to know its productivity at the county level, which requires a proxy measure. The PP is calculated by multiplying the GDP of industry *i* in state *t* by the payroll of industry *i* in county *j* by payroll for industry *i* in state *t*. After assigning a portion of an industry's GDP to a county, this is divided by employment in industry *i* in county *j*.

Methods

To empirically examine the research questions, six two-way[4] fixed-effects panel data models are estimated. For all models, Hausman tests indicated that FE models are the appropriate estimation technique. Specification tests also showed the presence of heteroscedasticity[5] and serial correlation.[6] Robust standard errors with Andrews weights are used to address heteroscedasticity and serial correlation (Andrews, 1991; Andrews and Monahan, 1992). Furthermore, all independent variables that vary annually are lagged by one year in order to overcome possible endogeneity (Wooldridge, 2010). The sample for regressions where sales tax revenue was the dependent variable required that we drop 63 observations because sales taxes were not collected in nine cities in the FiSC dataset.

[4] F-tests for time and individuals effects were statistically significant (P<0.01) for all three models.

[5] Breusch-Pagan test for heteroskedasticity was statistically significant at a 95 percent confidence level for all models, which suggests the presence of heteroscedasticity.

[6] The Breusch-Godfrey test for panel models was statistically significant at a 99 percent confidence level for all models indicating the presence of serial correlation (Wooldridge 2012).

Table 1: Descriptive Statistics

	N	Min	Max	Range	Median	Mean	Std.Dev
Dependent Variables							
Own Source Revenue (Ln)	1043	17.8904	24.7330	6.8427	20.4026	20.4573	1.0891
Own Source Revenue (Vol)	1043	0.0000	0.0348	0.0348	0.0067	0.0084	0.0066
Sales Tax (Ln)	979	8.5313	22.7590	14.2277	18.4523	18.1823	1.7556
Sales Tax (Vol)	979	0.0001	3.6064	3.6064	0.0313	0.0997	0.3393
Property Tax (Ln)	1043	16.7566	23.6249	6.8683	19.5147	19.5364	1.0753
Property Tax (Vol)	1043	0.0001	0.0607	0.0606	0.0085	0.0104	0.0085
All Other Taxes (Ln)	1043	11.9370	23.1963	11.2592	16.8204	16.8494	1.4679
All Other Taxes (Vol)	1043	0.0000	0.1651	0.1651	0.0153	0.0203	0.0179
Current Charges (Ln)	1043	15.8793	23.0239	7.1447	19.1087	19.0977	1.1671
Current Charges (Vol)	1043	0.0000	0.0912	0.0912	0.0107	0.0139	0.0125
Miscellaneous (Ln)	1043	15.0901	22.2243	7.1343	18.2019	18.1958	1.2099
Miscellaneous (Vol)	1043	0.0000	0.1041	0.1041	0.0123	0.0157	0.0136
Economic Base Variables							
Unemployment Rate	1043	0.0240	0.1690	0.1450	0.0600	0.0663	0.0271
Unemployment Volatility	1043	0.0000	0.8929	0.8929	0.0940	0.1175	0.1016
Employment HHI	1043	0.0812	0.1285	0.0472	0.0898	0.0906	0.0057
Establishment HHI	1043	0.0715	0.1589	0.0875	0.0923	0.0947	0.0134
LQ Agriculture, Forestry, Fishing and Hunting	1043	0.0000	13.0108	13.0108	0.6986	1.1547	1.4387
PP Agriculture, Forestry, Fishing and Hunting	1043	0.1778	1052.1520	1051.9750	7.5246	23.1769	64.2505
LQ Mining, Quarrying, and Oil and Gas Extraction	1043	0.0000	13.7674	13.7674	0.3323	0.6145	1.1561
PP Mining, Quarrying, and Oil and Gas Extraction	1043	0.0000	355.9269	355.9269	6.9896	17.1189	31.8865
LQ Utilities	1043	0.0000	1.0646	1.0646	0.2491	0.2867	0.1874
PP Utilities	1043	1.0505	324.7481	323.6976	24.6568	35.6144	39.4740
LQ Construction	1043	0.4257	3.3217	2.8960	1.5944	1.6455	0.5274
PP Construction	1043	0.3648	5.2898	4.9250	1.1834	1.2966	0.6066

Table 1 Continued: Descriptive Statistics

	N	Min	Max	Range	Median	Mean	Std.Dev
Economic Base Variables							
LQ Wholesale Trade	1043	0.6118	2.7878	2.1760	1.2114	1.2307	0.3176
PP Wholesale Trade	1043	0.5657	15.1931	14.6275	2.3318	2.4960	1.1494
LQ Information	1043	0.2195	1.6625	1.4431	0.7426	0.7478	0.2487
PP Information	1043	1.7239	32.4085	30.6846	4.9624	5.6103	3.3725
LQ Finance and Insurance	1043	0.4801	2.4137	1.9337	1.3458	1.3675	0.3388
PP Finance and Insurance	1043	0.3729	23.7455	23.3726	2.0254	2.6794	2.5128
LQ Real Estate and Rental and Leasing	1043	1.5593	5.6906	4.1313	2.8758	2.9647	0.5893
PP Real Estate and Rental and Leasing	1043	1.6295	22.7554	21.1259	5.8396	6.5001	2.9990
LQ Professional, Scientific and Technical Services	1043	0.6789	3.7961	3.1172	2.0066	1.9928	0.6034
PP Professional, Scientific and Technical Services	1043	0.3386	5.6681	5.3295	1.1590	1.3080	0.7488
LQ Management of Companies and Enterprises	1043	0.0860	2.7995	2.7135	0.3444	0.4119	0.2679
PP Management of Companies and Enterprises	1043	0.0998	40.1612	40.0614	4.0012	5.3798	4.7588
LQ Administrative and Support and Waste Management and Remediation Services	1043	0.2540	2.1095	1.8556	0.7202	0.7470	0.2475
PP Administrative and Support and Waste Management and Remediation Services	1043	0.2096	3.6702	3.4606	1.1609	1.1838	0.4928
LQ Educational Services	1043	0.1514	1.6236	1.4722	0.5610	0.5770	0.2093
PP Educational Services	1043	0.1173	15.8650	15.7476	1.4361	2.0555	2.0975
LQ Health Care and Social Assistance	1043	0.4046	1.2290	0.8243	0.7329	0.7431	0.1385
PP Health Care and Social Assistance	1043	0.8413	6.9586	6.1173	1.5979	1.6956	0.6114
LQ Arts, Entertainment, and Recreation	1043	0.4020	2.8824	2.4804	0.8568	0.8854	0.3262
PP Arts, Entertainment, and Recreation	1043	0.2701	12.4944	12.2243	1.1507	1.6193	1.3406
LQ Accommodation and Food Services	1043	0.2799	1.7692	1.4894	0.8509	0.8493	0.1793
PP Accommodation and Food Services	1043	0.3805	5.5725	5.1920	0.6952	0.7841	0.4258
LQ Other Services, except Public Administration	1043	1.1976	3.1220	1.9244	2.1414	2.1462	0.2873
PP Other Services, except Public Administration	1043	0.2963	1.7649	1.4686	0.5837	0.6142	0.1937
LQ Manufacturing	1043	0.1348	2.2146	2.0799	0.3852	0.4131	0.1897
PP Manufacturing	1043	1.0798	37.0471	35.9673	5.9582	6.7237	3.8330
LQ Retail Trade	1043	0.7430	2.0480	1.3050	1.0242	1.0501	0.1631
PP Retail Trade	1043	0.5324	1.9642	1.4318	0.9832	0.9989	0.1906
LQ Transportation and Warehousing	1043	0.2513	1.8346	1.5833	0.7114	0.7642	0.2749
PP Transportation and Warehousing	1043	0.5961	11.8729	11.2768	2.4547	2.8754	1.6923

Results

Table 1 presents the descriptive statistics for variables used in the analysis. Table 2 presents the results of the regressions with elasticity as the dependent variable. Table 3 presents the results of the regressions using revenue volatility as the dependent variables. Overall, all six models presented in table 2 and table 3 exhibit excellent goodness of fit statistics. Every F-statistic is statistically significant at a 99.9% confidence level indicating that each model is jointly significant. The adjusted R-squared values for each model are also excellent. All three elasticity models presented in table 2 have an adjusted R-squared at or above .9831. The three volatility models in Table 3 also have excellent adjusted R-squared values. Overall, the fixed effects specifications have strong model diagnostics.

Table 2: Elasticity Regression Results

	Own Source Revenue	Sales Tax Revenue	Property Tax Revenue
Intercept	9.6870 ***	15.2470 ***	8.8924 ***
Unemployment Rate	-0.8548 **	0.5440	-1.5291 ***
Unemployment Volatility	-0.0343	0.0896	-0.0187
Employment HHI	-0.4413	-8.0691	-4.9938 **
Establishment HHI	0.0276	-3.8596	0.1492
LQ Agriculture, Forestry, Fishing and Hunting	-0.0008	-0.0172	0.0001
PP Agriculture, Forestry, Fishing and Hunting	0.0001	-0.0002	0.0002 *
LQ Mining, Quarrying, and Oil and Gas Extraction	-0.0022	0.0493 **	0.0018
PP Mining, Quarrying, and Oil and Gas Extraction	-0.0001	0.0001	-0.0001
LQ Utilities	-0.0087	-0.0491	-0.0589
PP Utilities	-0.0001	-0.0010 .	-0.0002
LQ Construction	-0.0039	0.1355	-0.0331
PP Construction	-0.0034	0.1547 *	0.0013
LQ Wholesale Trade	0.0012	-0.0268	-0.0598
PP Wholesale Trade	0.0036	0.0453 .	0.0074
LQ Information	-0.0282	0.4364 *	-0.0402
PP Information	0.0016	0.0058	0.0062 .
LQ Finance and Insurance	0.0141	-0.1909	0.0274
PP Finance and Insurance	0.0000	0.0181	-0.0040
LQ Real Estate and Rental and Leasing	-0.0183	0.0271	-0.0217
PP Real Estate and Rental and Leasing	0.0036	0.0160	-0.0008
LQ Professional, Scientific and Technical Services	-0.0018	-0.1442	-0.0131
PP Professional, Scientific and Technical Services	0.0146	0.0233	-0.0059
LQ Management of Companies and Enterprises	0.0227	0.0853	-0.0265
PP Management of Companies and Enterprises	0.0013	-0.0004	0.0020
LQ Administrative and Support and Waste Management and Remediation Services	0.0466	0.1298	0.0296
PP Administrative and Support and Waste Management and Remediation Services	0.0020	0.0531	-0.0053
LQ Educational Services	0.0390	-0.0867	0.0582
PP Educational Services	0.0170 *	0.0661 *	0.0204 *
LQ Health Care and Social Assistance	0.0998	-0.1706	-0.1042
PP Health Care and Social Assistance	0.0334	0.1430	-0.0134
LQ Arts, Entertainment, and Recreation	0.0495	0.0414	0.0505
PP Arts, Entertainment, and Recreation	0.0051	0.0700 *	0.0030
LQ Accommodation and Food Services	0.1764 *	-0.1307	0.2821 **
PP Accommodation and Food Services	0.0071	-0.0593	-0.0247
LQ Other Services, except Public Administration	-0.0314	0.2043	-0.0230
PP Other Services, except Public Administration	0.1029 .	0.1739	0.0208
LQ Manufacturing	0.0711	0.2068	0.0264
PP Manufacturing	-0.0010	0.0218 **	0.0028
LQ Retail Trade	-0.0348	0.1826	0.0091
PP Retail Trade	0.1121 *	0.5253 *	0.0775
LQ Transportation and Warehousing	0.0148	-0.0671	-0.0048
PP Transportation and Warehousing	0.0006	0.0219	0.0022
Yt-1	0.5026 ***	0.0491 ***	0.5722 ***
F	2141 ***	301.9 ***	1433 ***
Adj-R^2	0.9975	0.9831	0.9963
N	1043	980	1043

1. Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
2. Time and Individual Fixed Effects were used in all regressions, but not included in the presentation of material.

Table 3: Volatility Regression Results

	Own Source Revenue	Sales Tax Revenue	Property Tax Revenue
Intercept	19.737	-518.240 **	60.377 *
Unemployment Rate	-8.943	256.110 .	-27.585 .
Unemployment Volatility	-1.123	4.272	-0.629
Employment HHI	-32.063	484.320	-331.490 ***
Establishment HHI	-40.873	-37.324	-12.386
LQ Agriculture, Forestry, Fishing and Hunting	-0.202	-0.114	-0.243
PP Agriculture, Forestry, Fishing and Hunting	-0.008 *	-0.018	-0.009 *
LQ Mining, Quarrying, and Oil and Gas Extraction	-0.059	7.575 ***	-0.150
PP Mining, Quarrying, and Oil and Gas Extraction	0.008	0.001	-0.008
LQ Utilities	3.607 *	11.755	7.351 ***
PP Utilities	0.003	0.065	-0.003
LQ Construction	-4.375 ***	30.102 *	-9.657 ***
PP Construction	0.661	-2.061	0.297
LQ Wholesale Trade	-2.248	-25.917	-3.271
PP Wholesale Trade	-0.453 .	4.971 .	-0.617 .
LQ Information	-2.830	61.822 **	-8.452 ***
PP Information	0.041	-0.178	0.127
LQ Finance and Insurance	2.113	-8.844	1.180
PP Finance and Insurance	-0.093	4.099 .	0.276
LQ Real Estate and Rental and Leasing	-1.301 .	7.177	-0.918
PP Real Estate and Rental and Leasing	0.055	2.925 *	0.013
LQ Professional, Scientific and Technical Services	-0.900	3.564	-4.020 **
PP Professional, Scientific and Technical Services	0.886	-0.133	1.342
LQ Management of Companies and Enterprises	-2.280 .	9.884	-3.616 *
PP Management of Companies and Enterprises	-0.101	-0.263	-0.120
LQ Administrative and Support and Waste Management and Remediation Services	-3.312 .	25.504	-5.978 **
PP Administrative and Support and Waste Management and Remediation Services	0.071	-0.442	1.458 .
LQ Educational Services	-2.509	-0.843	-4.687 .
PP Educational Services	-0.743 *	0.783	-1.004 *
LQ Health Care and Social Assistance	-9.465 *	24.006	-17.339 **
PP Health Care and Social Assistance	-0.011	6.718	-0.160
LQ Arts, Entertainment, and Recreation	-0.079	-11.840	-1.016
PP Arts, Entertainment, and Recreation	0.112	1.367	-0.281
LQ Accommodation and Food Services	-3.813	22.444	3.578
PP Accommodation and Food Services	0.730	-0.953	0.579
LQ Other Services, except Public Administration	-1.550	53.894 **	-1.140
PP Other Services, except Public Administration	0.819	-19.540	2.848
LQ Manufacturing	5.115 .	69.170 *	1.628
PP Manufacturing	-0.227 *	2.146 *	-0.432 ***
LQ Retail Trade	-1.592	26.638	-9.090 .
PP Retail Trade	-1.037	40.737 .	-0.947
LQ Transportation and Warehousing	-1.734	39.729 .	-3.332
PP Transportation and Warehousing	-0.250	2.406	-0.385
DV Elasticity	1.213	3.440 .	2.232 .
Yt-1	501.770 ***	26.526 .	476.940 ***
F	33.86 ***	886.2 ***	37.28
Adj-R^2	0.862	0.9942	0.8733
N	1043	980	1043

1. All coefficients multiplied by 1000 for readability.
2. Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
3. Time and Individual Fixed Effects were used in all regressions, but not included in the presentation of material.

The aggregate measure variables, unemployment rate and unemployment volatility, in table 2 and table 3 were included in the models to account for overall economic conditions. A municipality's unemployment rate is negatively associated with own-source revenue elasticity and property tax revenue elasticity, but no statistically significant relationship was found between unemployment and sales tax revenue elasticity. These findings suggest that as unemployment increases, own-source revenue and property tax revenue have lower elasticities. These findings are intuitive because higher unemployment indicates a less productive local economy, which leads to lower value being added to the community and consequently lower tax revenues. The lack of a statistically significant relationship between the unemployment rate and sales tax revenue elasticity is likely occurring because community wealth and consumption habits are being captured by the municipal fixed effects.

The results indicate that there is a complex relationship between unemployment rate and revenue volatility. First, the local unemployment rate has no statistically significant impact on own-source revenue volatility. Since own-source revenue includes sales and property tax revenue, perhaps the opposite coefficients negate each other when revenue is aggregated. Second, the unemployment rate has a statistically significant relationship with the volatility of both sales tax and property tax revenue. However, an increase in the local unemployment rate affects sales tax volatility and property tax volatility in opposite ways. As the local unemployment rate increases, the revenue volatility of sales tax yield increases and property tax yield decreases. An intuitive theoretical proposition is that higher unemployment destabilizes the local economy by providing less disposable income to consumers, and with it a loss of property value, particularly for retail, food, and entertainment establishments.

Third, the unemployment rate is negatively associated with property tax revenue volatility. This finding is less intuitive, but still logical. As the unemployment rate increases, property tax volatility decreases because prices in the real estate market stabilize or even decline as demand for property eases. Local government managers adjust millage rates to ensure that the property tax yield balances the budget (Alm et al. 2011; Doerner and Ihlanfeldt 2011; Ihlanfeldt 2011; Lutz 2008; Lutz et al. 2011; Vlaicu and Whalley 2011). However, millage rate adjustments are sensitive to the local political climate. When citizens are out of work, city officials are less inclined to risk the political backlash associated with increasing property tax rates. By holding millage rates constant or raising the rates only marginally, property tax stability increases during times of high unemployment.

Unemployment volatility is a measure of economic base stability used in previous studies (Yan 2011). However, in all six models, unemployment volatility, the difference between the expected and actual unemployment rate, is statistically insignificant at a 90 percent confidence level. Separate regressions were run (1) without the year fixed effects, (2) without municipal effects, (3) without the clustering and diversification measures, and (4) on a single year rather than across the whole panel to see if any of the variables were capturing economic instability.[7] In every iteration across all six dependent variables, unemployment volatility was statistically insignificant suggesting that aggregate economic base instability has no impact on revenue growth and volatility.

[7] These regressions will be provided upon request.

Economic base diversity was expected to increase elasticity and decrease stability across the three revenue sources. However, diversity based on the number of firms (i.e., establishment HHI) was statistically insignificant in all six models and diversity based on employment (i.e., employment HHI) was only statistically significant for property tax revenue elasticity and volatility. An increase in employment diversification[8] results in an increase in property tax elasticity and volatility. As predicted, diversification of a municipality's industrial base results in greater long-run elasticity in property tax revenue.

A diversified economic base has two distinct advantages for increasing property tax growth. First, local governments can better "pick and choose" which industries to attract to their jurisdiction to maximize property values (Fischel 2009). A diversified economic base implies that a local government has multiple businesses that wish to locate within the jurisdiction. An array of industries enables local officials to maximize revenue through zoning laws that prevent firms associated with negative externalities (i.e., sex shops and manufacturing firms that pollute) and enable relocation of firms with positive externalities (e.g., shopping centers, warehouse space in a manufacturing heavy municipality, etc.). Second, a diversified economic base allows industrial synergies to emerge in the city. These positive externalities are capitalized into higher property values (Bogart and Cromwell 1997; Clark and Herrin 2000; Fischel 2009; Geoghegan et al. 2003; Hilber and Mayer 2009; Oates 1969).

An increase in employment diversification also results in an increase in property tax volatility. While modern portfolio theory predicts that employment diversification creates greater revenue stability, local industries are intrinsically linked and therefore a decrease in volatility is unlikely to occur. While it is fairly clear why diversity did not decrease volatility, it is not entirely clear why employment diversity is positively associated with property tax revenue volatility. One possible explanation is that diversity lends itself to local networks, where the failure of one business ripples out and affects other businesses more than if the local economy was less diversified.

[8] Due to the way the HHI is calculated, an increase in diversification is a decrease in the HHI.

Table 4: Clustering Coefficient Result Summary

Goods-Producing Industries						
	Own Source		Sales Tax Revenue		Property Tax	
	Elasticity	Volatility	Elasticity	Volatility	Elasticity	Volatility
Agriculture, Forestry, Fishing and Hunting		-			+	-
Mining, Quarrying, and Oil and Gas Extraction			+	+		
Construction		-	+	+		-
Manufacturing		+/-	+	+		-
Service-Producing Industries						
	Own Source		Sales Tax Revenue		Property Tax	
	Elasticity	Volatility	Elasticity	Volatility	Elasticity	Volatility
Utilities		+	-			+
Wholesale Trade		-	+	+		-
Information			+	+	+	-
Finance and Insurance						
Real Estate and Rental and Leasing		-		+		
Professional, Scientific and Technical Services						-
Management of Companies and Enterprises		-				-
Administrative and Support and Waste Management and Remediation Services		-				-/+
Educational Services	+	-	+		+	-
Health Care and Social Assistance		-				-
Arts, Entertainment, and Recreation			+			
Accommodation and Food Services	+				+	
Other Services, except Public Administration	+			+		
Retail Trade	+		+	+		-
Transportation and Warehousing				+		

Clustering was measured using two specifications: LQ and PP. While the detailed results can be found in table 2 and table 3, table 4 summarizes the clustering variable results in the elasticity and volatility models. A "+" sign indicates that the LQ, PP, or both are statistically significant and positively related to the corresponding dependent variable. A "-" sign indicates a statistically significant and negative relationship with the corresponding dependent variable. A blank cell indicates that there was no statistically significant relationship at a 90 percent confidence level.[9]

[9] A "+/-" or "-/+" indicates that the LQ and PP had different coefficient signs.

Table 4 reveals several interesting patterns. First, utility industries behave counter intuitively because clustering is negatively associated with sales tax revenue elasticity, and positively related to both own-source and property tax revenue volatility. Clusters should (1) increase growth due to the economic advantages they bring, and (2) decrease volatility due to global supply advantages. However, the utility industry is structured differently than other industries. For example, utility firms are often accompanied by strict land-use regulations to ensure public safety. These regulations limit (to a degree) the number of retail firms or other industries with foot traffic. A shopping mall would not be wise to locate next to a water treatment plant where chlorine gas is a byproduct of the treatment process. Increases in property tax revenue volatility (and subsequently own-source revenue volatility) probably occur by offsetting changes in millage rates.

Often local governments own utilities, and some of the more entrepreneurial local governments sell their excess supply on the open market. Revenue from utilities is subject to volatile commodity costs, and thus, can be unpredictable. Therefore, offsetting this volatility with adjustments in the millage rate is more likely to occur when local governments rely on utility clusters for revenue.

To test the proposition that the uncharacteristic direction of the coefficients can be explained by municipal ownership of utilities, Pearson correlation tests were run between Utility LQ (LQ and not the PP was statistically significant for volatility), and a variable not included in the analysis: Municipal Revenue from Utilities. The results in table 5 indicate a statistically significant and *negative* correlation between Utility LQ and Utility Revenue. Increases in utility clustering are associated with more revenue volatility—the opposite of what was expected. However, this finding suggests a different explanation: that increases in utility clustering are the result of increased private/non-profit utilities, and subsequently, more utility competition for local governments.

Table 5: Pearson Correlations

	Utility Revenue	
Utility LQ	-0.19	***

1. Signif. codes: '***' 0.001

Unlike the utility clusters, the estimates for the 19 other industrial classifications show broad patterns of significance that have policy significance for local government officials and scholars alike. The first important pattern that emerges is that every statistically significant cluster in each of the elasticity models is positively associated with the respective model's dependent variable.[10] In other words, an increase in clustering is associated with an increase in own-source revenue, sales tax revenue, and property tax revenue elasticity. Of the 19 clusters, only education services is statistically significant across all three elasticity models. Information (sales tax and property tax models), accommodation and food services (own-source and property tax models), and retail trade (own-source and sales tax models) are statistically significant in two elasticity models.

[10] Excluding the utility industry, which as previously discussed is an oddity.

Only service-producing industrial clusters are consistently significant across two or more models. Another important pattern emerges with the goods-producing industries. First, none of the goods-producing industries affect own-source revenue elasticity. While industrial clusters from goods-producing sectors impact individual revenue streams like sales taxes or property taxes, they ultimately do not impact overall revenue elasticity. The shrinking importance of goods-producing sectors in the national economy extends to local government revenue elasticity.

Second, all goods-producing sectors, except agriculture, forestry, fishing, and hunting, have statistically significant (90% confidence interval) positive relationships with sales tax elasticity. Since, tangible goods produced by these sectors are easily subject to a sales tax, local governments have successfully captured the economic activity of these sectors into their sales tax base.

Third, the goods-producing sector, agriculture, forestry, fishing, and hunting, has a statistically significant and positive relationship with property tax elasticity. Since activities in this sector require designated swaths of land set aside for economic purposes, it is easier to apply land-value appraisals that reflect their economic value.

Another important pattern for public policy is the statistically significant cluster variables in each of the three volatility models that have the same direction of signs for their estimated coefficients, but not across all three models. Sales tax revenue volatility is positively associated with eight statistically significant cluster industries. This finding suggests that clusters actually make sales tax revenue *less stable*. Yet, property tax revenue volatility is negatively associated with ten statistically significant industrial clusters. Unlike sales tax revenue volatility, an increase in an industrial cluster is associated with a decrease in property tax volatility. Clusters stabilize property tax revenue and destabilize sales tax revenue. The consistency of the coefficient sign direction within each volatility model and across clusters suggests that this is not a data artifact but a robust pattern.

Why do clusters increase sales tax revenue volatility and destabilize property tax revenue volatility? The answer lies in the attributes of each tax base. The sales tax is levied on individual economic transactions. Conversely, a property tax is a tax on wealth levied annually. Unlike sales taxes, property tax rates are more easily adjusted (i.e., millage offsetting), and often used to balance budgets in response to changes in the property tax base or shortfalls in other revenue sources. But clusters interact differently with the sales tax base than with the property tax base. Clusters lower supply costs and give the clustered industry a competitive global advantage. This global advantage not only increases the industries revenue generation but also increases the ability of firms to survive economic shocks thus minimizing the chances of business bankruptcy. This ability to survive has a two-fold impact on property tax revenue stability. First, the lower chance of bankruptcy and competitive advantages of locating in an industrial cluster minimize the chances of firms relocating. On the margin, a business in a cluster will remain in their current location, thus keeping a steady property tax base. Second, the decreased chance of clustered firms relocating also decreases the chance of employees relocating. The productive advantages of industrial clusters create a natural economic incentive for businesses to remain in their current location.

However, clusters do not stabilize sales tax revenues. For businesses, the primary draw of participating in an industrial cluster is that, through the supply/demand advantages, their goods and services will be more competitive in a larger market. This larger market can result from increased centralization of foot traffic, similar to what occurs in shopping centers where consumers can walk and shop, or the larger market can, in fact, be a global rather than regional market. Clusters *expand* and *externalize* the market for goods and services produced in a municipality. An internalized market has less growth potential, but is predictable and stable. As the market for a region's products expands, the aggregate transactions (i.e., the sales tax base) become susceptible to a wider range of factors outside the control of the firm.

The third and final important pattern that emerges is one that is most important to local officials and managers attempting to integrate economic development and simultaneously promote greater municipal fiscal health. The literature on elasticity and volatility suggests a trade-off exits between the two—growth leads to greater volatility. The analysis suggests that clustering in fact improves own-source revenue/property tax revenue growth while simultaneously decreasing volatility. Conversely, clustering improves sales tax growth, while simultaneously increasing sales tax volatility.

Conclusion

This study investigated how different types of industries impact revenue elasticity and volatility in a municipality. A municipality's economic base is the foundation from which tax and fee revenue is ultimately generated. No previous studies have explored the connection between a municipality's economic base and its various revenue streams. While local governments have access to a wide variety of taxes, fees, service charges, and the income from enterprise activities, this study examined the elasticity and volatility of three revenue streams: own-source revenue, sales tax revenue, and property tax revenue. This study contributes to the current public finance literature by providing a conceptual and empirical framework that can be used to develop our understanding of a local government's economic base.

Specifically, this study found that economic base diversity had no impact on own-source revenue/sales tax revenue elasticity and volatility. However, the analysis indicated that employment diversity was associated with increased property tax revenue elasticity, and volatility suggesting that industrial diversity could be an effective strategy for local governments (1) looking to grow and (2) heavily reliant on the property tax.

In addition, economic base clustering was associated with increased revenue elasticity for own-source, sales, and property tax revenue. Economic base clustering was also associated with decreasing own-source and property tax revenue volatility, but increasing sales tax revenue volatility. These findings suggest that pursuing industrial clusters can be an effective way to increase own-source, sales tax, and property tax revenue, but those local governments heavily reliant on sales tax revenue will see decreases in stability. The analysis suggests that the development of industrial clusters can be a particularly good strategy for improving municipal fiscal health when (1) a local government relies mostly on property tax revenue, (2) limits utility

clustering, and (3) heavily recruits businesses in educational services, accommodation and food services, retail trade, and wholesale trade.

Our analysis suggests that clustering does the impossible for local governments concerned with fiscal health—certain clusters can simultaneously promote revenue growth and stability when the local government relies on the property tax. Of particular interest to development and public finance scholars are the findings that industrial clustering increases growth in both property and sales tax, but decreases volatility only for the property tax while increasing volatility in sales tax revenue. Clusters create robust production regions where businesses are likely to thrive resulting in great property tax stability. But clusters also connect the local economy to an increased number of distant markets that ultimately decrease sales tax stability.

This study fills an important gap in public finance, local governance, and economic development scholarship by presenting a multi-dimensional conceptualization of a municipalities economic base, providing local government officials a framework for developing a cohesive development/finance strategy to improve the fiscal health of the city, and illustrating the importance of industrial clusters in public finance studies. While the findings are important, more work needs to be conducted on the intersection of economic development and public finance. Particularly, studies are needed that use national samples, rural cities, different measures of diversification and clustering, and studies that explore longer time horizons. Researching this area has the potential to increase the capacity of our local government's ability to meet the challenges of the future, and create better communities.

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