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The Impact of Industrial Diversification and Clustering on the Volatility of City Budgets

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Abstract

Budget volatility—the difference between expected and actual revenues and expenditures—is a critical component to sustaining a local government's fiscal health. While scholars have examined many determinants of budget volatility, less understood is the effect of a local government's economy—the composition of its economic base—on budget volatility. To fill this gap, panel data methods are used to test the impact of a city's economic base on budget volatility.

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Introduction

Local governments rely on tax and nontax revenues to provide the recurring funds needed for their operating and capital budgets. Any disconnect between the flow of revenues into local coffers and the outflow of expenditures is the origin of most budget debates. The greater the disconnect between the two streams, the greater the complexity of and disharmony in the budget process. This study examines how the composition of a local government's economic base affects the volatility of the revenue side of the budget and ultimately the volatility of expenditures.

Budget volatility is the difference between expected and actual revenues and expenditures (Carroll and Goodman 2013; Hendrick and Crawford 2014). Excessive volatility leads to disruptions in service delivery (Yan 2011), cyclical expenditure increases or cutbacks (Hendrick and Crawford 2014), and lower municipal bond ratings (Grizzle 2010). A more stable pattern of revenues and expenditures enables leaders in local governments to formulate long-term strategies for improved governance and service delivery (Gamage 2012; Jordan 2003) making stable and predictable budgets a critical component to the long-term fiscal health of municipal governments.

While several studies have examined budget volatility (Afonso 2013; Carroll 2009; Carroll and Goodman 2012; Carroll and Stater 2009; Hendrick and Crawford 2014; Yan 2011), they have not analyzed the link between a city's economic base and budget volatility. Public finance scholars and local policy leaders do not fully understand the impact that the mix of private sector firms in a city has on budget volatility. Without theoretical and empirical work connecting these topics, both scholars and local leaders lack the policy guidance to move their economies and the budgets they finance to long-term fiscal health.

To fill this gap, this study uses panel data methods to assess the impact of a city's economic base on budget volatility. Using data from the Lincoln Institute's Fiscally Standardized Cities [FiSC] database[1] and industry data from the County Business Pattern database, we explore the differential impact of economic base diversification and clustering on the volatility of operating budgets. This study provides scholars and practitioners with policy recommendations on the critical linkage between a city's economic base and its fiscal health.

Conventional wisdom holds that an economic base with high-tech, globally competitive industries offers greater revenue growth potential for a city. Research in urban economics and economic development suggests otherwise. The diversification of industries and industrial clusters in a city's economic base are the key factors in local and regional economic resilience (Brown and Greenbaum 2016; Jackson 2016).

[1] Data were obtained from the Lincoln Institute of Land Policy. Fiscally Standardized Cities database. http://www.lincolninst.edu/subcenters/fiscally-standardized-cities/

Diversified and clustered economic bases offer distinct economic and political advantages over industrial targeting that positively affect budget stability. Industrial diversity is the number of different industries and the intensity of each industry's utilization in the local economy. Diversified local economies have more stable growth in the long-run because their success is not dependent on any single industry, mitigating the overall risk (Chinitz 1961). In addition, diversified economies can create robust knowledge spillover networks (Chinitiz 1961; Jacobs 1969; Jackson 2016), enhance local capital investment (Chinitz 1961), and improve firm survival rates (Renski 2011).

Clustering occurs when similar firms and firms that support the output of a central industry locate geographically in proximity to each other (Porter 2000). Clustering, also called agglomeration, gives firms a competitive advantage through lower production costs, increased innovation among related businesses, and increased colocation of similar and supporting businesses (Porter 2000). Clustering likely increases the productive efficiency of co-located firms, thereby enabling a city's economic base to compete more effectively in a global market and to better weather economic downturns compared to non-clustered competitors.

How do industrial diversity or clustering in a local economic base affect budget volatility? Does the clustering that arises from agglomeration economies create budget volatility? Do cities that have more diversified economic bases benefit from greater budget stability?

The paper begins with a review of the literature on budget volatility, diversification of revenue sources, and fiscal policy space. A discussion then follows of the theories of industrial targeting, economic base diversification, and clustering. Next, the research design and the use of panel data methods is explained. A concluding section discusses the results as well as the policy implications of our findings.

Fiscal Health and Budget Volatility

Fiscal health is the ability of local governments to stay financially solvent (Carroll and Goodman 2013; Hendrick 2006). A fiscally healthy city (1) has budgetary (ability to balance budgets), cash (ability to maintain 30–60 day cash supply), service (ability to provide adequate services), and long-term (ability to meet future obligations despite uncertainty) solvency (Clark 2015; Hendrick 2011), (2) maintains that solvency in the present and over the long term (Hendrick 2011), and (3) adapts its policies and practices to the changes in external factors. In short, fiscal health is a local government's ability to meet current and long-term service and capital demands while adapting to external political and economic forces (Hendrick 2011).

Budget volatility—the difference between expected and actual revenues and expenditures—impacts all aspects of a local government's fiscal health (Carroll and Goodman 2013; Hendrick and Crawford 2014). A volatile budget is harder to balance (i.e., weakens budget solvency), increases the difficulty to predict cash flow needs (i.e., weakens cash solvency), and increases the use of quick fixes to resolve cyclical reductions or expansions in service provision (i.e., weakens service solvency) (Hendrick and Crawford 2014). In addition, long-range planning becomes far less effective as revenue and expenditure patterns become more erratic (i.e.,

weakens long-term solvency) (Gamage 2012; Jordan 2003). Chronic budget volatility complicates all aspects of planning for and managing the financial resources of a city.

As part of a municipal government's budgeting process, budget volatility represents the interaction of two independent but connected streams of resources—the revenue stream, which comes from the taxes and charges collected from local economic activity and wealth, and the expenditure stream, which arises from the annual (or biennial) operating and capital decisions of the city's policy leaders. State law or local statute requires that most cities must balance these two streams when approving their budget (Bland 2013). As part of the budget process, analysts prepare a forecast of expected revenues that must ultimately be reconciled with the cumulative requests for expenditures. Highly volatile revenues will differ significantly from forecasted revenues, resulting in unexpected changes in expenditures.

Budget volatility is a function of fiscal structure (Afonso 2013; Carroll 2009; Hendrick and Crawford 2014) and fiscal policy space (FPS) (Hendrick and Crawford 2014; Pagano and Hoene 2010). A city's fiscal structure is the cumulative product of decisions by city officials, the types of revenue instruments used to fund its budget, the diversification of revenue sources, the fiscal capacity of the revenue base, and revenue complexity (Carroll 2009; Hendrick and Crawford 2014). Previous research on fiscal structure has focused on those fiscal instruments that increase budget stability, particularly the role of slack resources and diversification of revenue sources.

Slack resources refer to a local government's fund balance—the net difference between assets and liabilities—and its fiscal slack—excess revenue available for a broad range of purposes. In practice, slack resources exist in a variety of places in a city budget such as unrestricted fund balances, rainy day funds, and budget stabilization funds. As a countercyclical measure, slack resources accumulate when revenues are increasing and are spent during recessions to stabilize expenditures (Bland 2013), which helps smooth out expenditure volatility (Hendrick and Crawford 2014). As a matter of policy, the federal government, and to a limited extent state governments, use their slack resources as countercyclical measures (Douglas and Gaddie 2002; Hou 2003, 2005; Hou and Moynihan 2008), while local governments do not use slack resources in a countercyclical fashion (Wang and Hou 2010). However, recent research shows that slack resources improve a local government's fiscal health (Hendrick 2006; Marlow 2005) and promote budget stability (Carroll 2009; Hendrick and Crawford 2014).

Another fiscal tool that has been the subject of research is the diversification of revenue sources used to support a local budget. After the property tax revolt in California, which began in 1978 with passage of Proposition 13, city governments across the nation intensified their efforts to identify additional sources of revenue. By diversifying their revenue structures, local governments (1) minimize the impact of a fiscal shock on one revenue source (Carroll 2009) and (2) capture revenue from taxpayers who otherwise avoid paying local property taxes (Ulbrich 1991). Carroll (2009) finds that revenue diversification decreases revenue volatility in local governments. But how a municipality diversifies its revenue sources has a direct effect on budget volatility (Afonso 2014; Carroll 2009; Hendrick and Crawford 2014; Yan 2011). Local governments that substitute revenue from the more income inelastic property tax with revenue from more income elastic sources such as taxes on income, sales, property transfers, and service charges likely experience greater budget volatility (Afonso 2014; Yan 2011). Afonso (2014)

finds that counties relying on more income elastic revenue sources have increased budget volatility. Yan (2011) finds that revenue diversification does lead to increased revenue stability when the employment of that local government is volatile, and that revenue diversification leads to decreased budget stability when the local government's unemployment rate is stable.

In addition to a city's fiscal structure, its FPS affects both revenue and expenditure volatility (Michael Pagano, etc.). FPS refers to the exogenous parameters that affect the range of policy decisions available to city officials: 1) the intergovernmental context, 2) locally imposed laws, 3) the political culture, 4) demand for public goods and services, and 5) a city's economic base. Hendrick and Crawford (2014) test for the effect of FPS on spending volatility and find evidence that population and distance from a central city decrease spending volatility. But being a home-rule city has no effect on spending volatility. While these studies provide a first step toward understanding the effect a city's FPS has on budget volatility, we lack an understanding of the impact a city's economic base (i.e., the fifth FPS attribute) has on budget volatility (Hendrick and Crawford 2014; Pagano and Hoene 2010). This study extends the Pagano and Hoene (2010) and Hendrick and Crawford (2014) research by focusing on empirical and theoretical explanations for the link between a city's economic base and its fiscal health.

Theory

Fundamentally, a city's economic base is its set of economic resources that produce wealth for residents and businesses and ultimately generates the revenue to support local government expenditures (Hendrick and Crawford 2014; Overton 2016; Peterson 1981). A local government's economic base is defined as the aggregate of all public and private firms located in a city's borders from which taxable revenue is directly and indirectly generated (Overton 2016). Through employment, capital accumulation, and the production of goods and services, private firms and public organizations improve a community's quality of life while enhancing its economic profile. These activities also improve the financial condition of municipal governments directly through their revenue base, or indirectly by stimulating economic behavior that is directly taxed.

The fiscal health of a city, particularly its revenue yield, depends on the strength of a city's economic base. Increased economic activity leads to more jobs, higher personal income, and greater consumption, all of which are capitalized into property value.

A municipality's economic base has important political implications. Politicians fear capital flight—businesses moving away due to dissatisfaction with public services and tax rates (Oates 2005)—and, consequently, may be overly accommodating to business interests (Buss 2001; Peterson 1981; Splinder and Forrester 1993). Local government officials may grant overly generous concessions to prevent capital flight because the consequences of poor economic development can destroy political careers (Anderson and Wassmer 1995; Fieschmann et al. 1992; Goetz and Keyser 1993; Johnson and Neiman 2004; Minkoff 2012; Rubin and Rubin 1987; Stokan 2013).

Industrial Targeting

A generally held assumption of local leaders is that a city with an economic base comprised of large firms from high-tech industries has a stronger and more stable economy as opposed to one composed of mostly smaller businesses. This assumption has its origins in the economic development theory of industrial targeting, an economic development policy that strategically targets firms with the greatest potential for generating wealth (Woodward and Guimaraes 2009). Industrial targeting uses government intervention through tax subsidies to decrease supply costs and increase a firm's profits (Porter 2000). This activity distorts economic behavior resulting in less efficient decisions in firm location (Porter 2000).

In the short-run, firms benefit from a local government's subsidization of the sub-optimal behavior. In the long-run, however, these firms have a greater risk of becoming less competitive and less resilient to economic shocks from their inefficient location decisions. Municipalities are then faced with the decision of continuing to subsidize important businesses in their economic base indefinitely or risk the health of their local economy by eliminating subsidizes. Industrial targeting weakens the economic resilience of local governments, and increases the political power of the subsidized industries in local politics.

We propose that two alternative factors—economic diversification and industrial clustering—have a central role in reducing budget volatility in a local government.

Diversification

A generally held assumption in studies on budget volatility is that diversification of revenue sources increases budget stability. However, several studies have questioned the validity of such an assumption particularly when the diversification involves adding more income elastic revenues to the mix (Yan 2011; Afonso 2013). In the case of a city's economic base, however, the greater diversity of industries that make up its base, particularly if those industries follow distinctly different business cycles, may increase revenue stability and with it reduce budget volatility.

Economic base diversification refers to the proportion of different industries that constitute a city's economic base. Diversification has two-dimensions: the number of different industries that make up the economic base, and the relative amount of wealth each industry represents in the economy (Goodman 2016). Cities that rely on one or a few industries incur an increased risk of their economies being tied to the fortunes of those industries. As a city's economy broadens, it becomes less and less influenced by the economic cycles of one or a few industries, producing higher budget stability.

Revenue diversification theories originate from modern portfolio theory—diversification of stocks and bonds minimizes risk because fluctuations in the value of stocks and bonds are not correlated (Brealey and Myers 1991). The assumptions of modern portfolio theory do not hold when applied to local and regional economies because the economic prosperity of different industries and businesses are interdependent. Firms within a single industry compete to increase their firm's market share. However, these firms are not isolated from other industries. Competing

industries provide specialized support services improving quality and lowering supply costs. Other industries benefit from increased local consumption driven by the larger local employers.

Research has shown that industrial diversification improves local and regional economic stability for three reasons (Chinitz 1961; Kort 1981; Simon 1988; Wagner and Deller 1998; Renski 2011; Brown and Greenbaum 2016). First, economic base diversification mitigates the risk of relying too heavily on one or a few industries (Chinitz 1961). Second, diversified economic bases improve knowledge spillover and employee-employer matching (Chinitz 1961; Jacobs 1969; Jackson 2016; Brown and Greenbaum 2016). Third, Industrial diversification improves firm survival rates, which lowers regional costs associated with firm turnover (Renski 2011). Overall, diversification has been shown to lower economic volatility, and mitigate the impact of a fiscal shock.

Furthermore, economic base diversification minimizes the impact any single firm has on local elections or political decisions because, from an economic standpoint, they provide as much to the local economy as every other firm. Diversification lowers the political power gained as economic monopolies increase (Overton 2016). Overall, economic base diversification is likely to lower budget volatility for the economic reasons presented above, but also because a diversified economy means no single business will have much more of an influence on local politics than the others.

Clustering

Clustering occurs when firms that support the output of a central industry locate geographically in proximity to each other. Clustering, or agglomeration, gives firms a competitive advantage through lower production costs (Porter 2000). Whereas industrial targeting focuses on *what* is produced, clustering focuses on *how efficiently* it is produced (Woodward and Guimaraes 2009). Because clusters improve the productive efficiency of an industry, clustered industries are more likely to survive economic shocks than similar industries outside of clusters resulting in greater economic base resilience. Clustered industries are not the same as *undiversified* economies. A cluster is a *relative* geographic concentration of certain industries compared to a larger geographic unit. Clusters can and do exist within diversified economies (Brown and Greenbaum 2016).

Clustering 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). Firms within a cluster are shown to decrease supply costs and increase innovation. Clustered firms gain competitive advantages by sharing infrastructure (Burchfield et al. 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). Also, clustering creates externalities in the city's economic base by attracting suppliers and specialized service providers that otherwise would be less likely to locate in that city.

Clustered firms are also less likely to have disproportionate political influence in local affairs because of their higher opportunity cost of relocating. Businesses gain their economic advantage by locating close to similar businesses and would only hurt themselves by relocating out of their cluster. Overall, clustering improves the ability of businesses to survive an economic shock and lowers the political power of businesses in that cluster resulting in increased budget stability.

Research Design

This study extends previous research on budget volatility by examining the broader question of the impact of the economic base on local budgets. The following models are used to test our hypotheses:

$$RV_{it} = \propto + EBS_{it} + EBD_{it} + EBC_{it} + FS_{it} + FC_{it} + C_{it} + RV_{it-1}$$

$$EV_{it} = \propto + EBS_{it} + EBD_{it} + EBC_{it} + FS_{it} + FC_{it} + C_{it} + RV_{it} + EV_{it-1}$$

Revenue volatility (RV_{it}) is a function of economic base stability (EBS_{it}), economic base diversity (EBD_{it}), economic base clustering (EBC_{it}), a city's fiscal structure (FS_{it}), a city's fiscal capacity (FC_{it}), a vector of control variables (C_{it}), and the 1-year lag of revenue volatility (RV_{it-1}). Expenditure volatility (EV_{it}) is a function of economic base stability (EBS_{it}), economic base diversity (EBD_{it}), economic base clustering (EBC_{it}), a city's fiscal structure (FS_{it}), a city's fiscal capacity (FC_{it}), a vector of control variables (C_{it}), revenue volatility (RV_{it}) and the 1-year lag of expenditure volatility (EV_{it-1}).

Annual data from 2005 to 2012 were obtained for 149 fiscally standardized cities[2] from the Lincoln Institute of Land Policy'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.

One problem with using cities as the unit of analysis is that there is no standardized package of services. Cities vary in the package of public services they fund through their operating budgets and thus the dependence on local revenues. 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 direct comparison of a citizen's total revenue burden and services received. Currently, FiSCs provides annual data through 2012, but the industry data

[2] 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 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.

used to test the economic base hypotheses are only available in their current form starting in 2005.[3]

Dependent Variables

Our interest is in the association between the local economic base and budget volatility. Since budget volatility refers to both revenue and expenditure volatility we proceed by assessing these effects separately. Revenue (expenditure) volatility is defined as the difference between expected revenues (expenditures) and actual revenues (expenditure) (Carroll 2009).

We employ a two-step procedure adapted from previous revenue volatility studies (Carroll 2009; Carroll and Goodman 2013; Hendrick and Crawford 2014; Hou 2003; Marlowe 2005; Wang and Hou 2009). The first step estimates the following revenue (expenditure) growth trend regression model (Carroll 2009).

$$\mathrm{R}_{it}(\mathrm{E}_{it}) = \exp(\propto + \beta_1 i + \beta_2 t)$$

where R is the total own source revenue for the i^{th} city in t^{th} year and E_{it} is a vector of direct expenditures for the i i^{th} city in t^{th} year. R_{it} is modeled as a series of dichotomous variables, which indicate the year and each municipality in the dataset.[4] After estimating revenue and expenditure trends, the next step is to determine the deviation of actual revenues and expenditures from the values derived from the first step. The predicted values generated in step one are subtracted from the actual values. The absolute value of the difference between predicted and actual values is a measure of budget volatility, our dependent variable. As this value approaches zero, revenue volatility decreases.

On the expenditure side of the ledger, city budgets have two major components—operating expenditures and capital expenditures. Because of their distinctive methods of financing and distinctive decision processes, many cities separate the two categories into two distinctive budget processes each with its own budget. The research in cutback management shows that capital spending typically is reduced ahead of operating expenditures when operating revenues are constrained (Levine 1978). For this analysis, we evaluate the (1) aggregate of all non-intergovernmental expenditures, which is direct expenditure, (2) two direct expenditure subcategories separately to assess how the diversity of the local economy may affect them, and (3) we also evaluate salaries and wages separately because of their dominance in determining operating expenditures.

The same two-step procedure is applied to various expenditure categories: total expenditures, direct expenditures, current operation expenditures, capital outlay expenditures, and salaries and

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

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

wages. This breadth of expenditure categories allows for a closer examination of overall expenditure volatility while simultaneously allowing narrow types of expenditure categories, such as direct expenditures, salaries and wages, etc., to be investigated.

Independent Variables

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 only allow estimation of our data during 3 time periods (i.e., 2002, 2007, and 2012). Second, the Economic Census of 2002 and 2007 provides 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 FiSC's 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 substituted. 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 varying levels of classification detail. Two-digit NAICS codes (21 different classifications) are the broadest classification and group businesses by sector[5] (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 use the two-digit NAICS codes. Although greater levels of industrial classification are available, predictive power is lost with the narrower industrial classifications, which would require geographical area aggregation to overcome (Billings and Johnson 2012).

Empirically, we test economic base diversification using two versions of the Hirschman Herfinadahl index (HHI): one employee based and the other firm based. The employee based measure tests for the impact of industrial diversification as weighted by the number of employees in each industry on a city's budget stability. While this employee based measures accounts for mix of industries, it does not account for the market power of firms in those industries. If a town has a relatively even industrial mix, but each industry is dominated by one or a few firms, then the city's economy may be more vulnerable than indicated by the industrial diversity measure. To account for this potential influence, a firm-based HHI is included that weights each industry by the number of firms in that industry.

This study uses two measures to capture clustering: industrial agglomeration and industry productivity. A location quotient (LQ) 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

[5]Though sector and industry have different technical meanings in the NAICS, they are used synonymously throughout the manuscript.

specific industry compared to the MSA's share of an industry's employment relative to total MSA employment.

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

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

where X_{ij} is the total number of full time employees in industry *i* in geographic area *j*, X_{*j}, is the total number of full time employees in *all* industries * in geographic region *j;* X_{it}, is the total number of full time employees in industry *i* in state *t;* X_{*t}, is the total number of full time employees in *all* industries * in state *t*. When a city's LQ is greater than 1, then industry *i* is geographically clustered in area *j*.

While the LQ can determine the relative clustering of businesses, 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 productivity proxy [PP].

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

P_{it} is the productivity of industry *i* in county *j*. State-level data are available for the GDP of each industry. However, a proxy is used to estimate each industry's productivity at the county level. The county-level 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 industries GDP to a county, this is divided by employment in industry *i* in county *j*.

Control Variables

Previous research has shown that fiscal structure and fiscal capacity are important determinants of budget volatility (Carroll 2009; Hendrick and Crawford 2014). Revenue diversification is calculated as the HHI for the four primary categories of own-source revenue: property taxes, sales tax, other taxes, and nontax revenue. The amount of revenue from income elastic sources is expected to have a significant impact on budget volatility because of increased sensitivity of these revenue sources to the business cycle. The percentage of revenue from income and sales taxes captures the primary income elastic revenue sources.

As mentioned previously, slack resources play an important role in mitigating budget volatility. Slack resources are calculated as the difference between annual total revenues and total expenditures. A revenue surplus enables cities to reduce budget volatility by drawing down on slack resources. In practice, slack resources in municipal governments often come in the form of unrestricted fund balances, rainy day funds, and stabilization funds. However, given the unique construction of the FISC database, including more specific measures of "slack resources" is not possible. Intergovernmental revenue (IGR) is likely to result in increased budget volatility

(Hendrick and Crawford 2014). To account for its impact, per capita IGR is added as a control variable. A local government more reliant on grant funding likely has more erratic budgets.

The fiscal capacity of a local government likely affects its ability to adapt to exogenous shocks. We use spending on operations as a percent of total revenue to meet its ongoing obligations given an unexpected shortfall in revenues. The higher a local government's taxes are leveraged, the lower the ability of a local government to meet current expenditures given a revenue shortfall (Finkler 2005).[6]

Population, county level unemployment, and unemployment volatility are included as general controls. Unemployment volatility is operationalized like revenue volatility except, in lieu of own-source revenue, a county's unemployment rate is used to create an unemployment volatility measure. This variable captures local economic shocks that are too small to be captured in the time fixed effects utilized in our panel data model.

Methods

These models are empirically tested through the two-way[7] FE panel methods. For all five models, Hausman tests indicated that FE models are the appropriate estimation technique. Specification tests also suggest the presence of heteroscedasticity[8] and serial correlation.[9] Robust standard errors with Andrews weights are used to address heteroscedasticity and serial correlation (Andrews 1991; Andrews and Monahan 1992). All independent variables that vary annually are lagged by one year to overcome possible endogeneity (Wooldridge 2010).

[6] While long-term liabilities impact a local government's fiscal capacity, they were not included in the model because the long-time horizons of these liabilities make them predictable and thus they do not contribute to budget volatility. Alternative models were run with the variables to test "long-term debt" and "long-term debt interest." Both variables were statistically insignificant across all models. Results are available on request.

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

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

[9] 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
Own Source Revenue (Vol)	1043	0.0000	0.0348	0.0348	0.0067	0.0084	0.0066
Direct Expenditures (Vol)	1043	0.0000	0.0352	0.0352	0.0054	0.0070	0.0061
Current Operations Expenditures (Vol)	1043	0.0000	0.0333	0.0333	0.0056	0.0071	0.0060
Capital Outlays Expenditures (Vol)	1043	0.0000	0.1078	0.1078	0.0133	0.0170	0.0145
Salary and Wage Expenditures (Vol)	1043	0.0000	0.0515	0.0515	0.0062	0.0089	0.0082
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
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

Table 1: Descriptive Statistics Continued

	N	Min	Max	Range	Median	Mean	Std.Dev
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
Fiscal Slack (Per Capita)	1043	-6622.79	2623.91	9246.70	-79.21	-171.33	739.63
Intergovernmental Revenue (Per Capita)	1043	587.57	6004.41	5416.84	1766.13	2011.20	903.01
Elastic Revenue (%)	1043	0.0000	0.5053	0.5053	0.1389	0.1579	0.1134
Revenue Diversification	1043	0.1600	0.7100	0.5500	0.2900	0.3217	0.1014
Operational Spending (%)	1043	0.5600	2.7700	2.2100	0.7900	0.7942	0.1342
Population (Ln)	1043	10.3300	15.9184	5.5885	12.3352	12.4503	0.9265

Table 2: Volatility Regression Results

	Own Source Revenue	Direct Expenditures	Current Operation Expenditures	Capital Outlay Expenditures	Salary and Wage Expenditures
Intercept	56.244	-8.294	-58.432 *	47.451	25.675
Fiscal Slack (Per Capita)	0.000 *	0.000	0.000	0.001	0.000
Intergovernmental Revenue (Per Capita)	0.0007	-0.0004	-0.0002	-0.0001	-0.0007
Elastic Revenue Sources (%)	-11.483 **	-2.774	-0.233	-11.517	7.116
Revenue Diversification	1.112	-5.377	-7.449 **	27.215	-3.008
Operational Spending (%)	2.142 .	1.643	1.526	7.979	1.068
Population (Ln)	-0.994	1.014	5.897 **	-6.678	0.779
Unemployment Rate	-9.434	-30.643 **	-5.715	-141.410 *	-32.689 .
Unemployment Volatility	-0.954	1.163	0.497	-10.351 .	2.300
Employment HHI	-28.000	84.090	-38.132	483.710	74.723
Establishment HHI	-39.760	-25.629	-12.718	30.181	30.677
LQ Agriculture, Forestry, Fishing and Hunting	-0.262	-0.320 .	-0.247 .	-1.316	0.103
PP Agriculture, Forestry, Fishing and Hunting	-0.008 *	-0.008 *	-0.004	-0.031 .	-0.004
LQ Mining, Quarrying, and Oil and Gas Extraction	-0.052	-0.230	0.023	-0.833	0.255
PP Mining, Quarrying, and Oil and Gas Extraction	0.008	0.006	0.001	-0.018	-0.001
LQ Utilities	3.646 **	2.339 .	3.126 **	-4.907	-2.094
PP Utilities	0.002	0.011 *	0.014 ***	-0.006	-0.002
LQ Construction	-4.545 ***	-2.863 **	-3.034 ***	-1.607	-2.988 .
PP Construction	0.769	0.298	0.088	3.520	0.366
LQ Wholesale Trade	-2.075	1.332	0.616	6.572	1.876
PP Wholesale Trade	-0.378	-0.161	-0.232	-0.511	0.391
LQ Information	-2.594	-3.055	-1.396	-9.273	-4.222
PP Information	0.051	-0.251 *	-0.014	-0.477	-0.168
LQ Finance and Insurance	2.326	-1.547	-0.554	-3.022	-5.708 **
PP Finance and Insurance	-0.187	-0.254	-0.096	-0.388	-0.075
LQ Real Estate and Rental and Leasing	-1.089	0.204	-0.034	-1.923	0.112
PP Real Estate and Rental and Leasing	0.048	0.315 **	0.089	0.670	0.030
LQ Professional, Scientific and Technical Services	-1.145	0.474	-0.270	0.580	-1.070
PP Professional, Scientific and Technical Services	0.854	1.138	0.798	5.765	-1.394
LQ Management of Companies and Enterprises	-2.627 *	0.159	-0.230	2.313	2.697
PP Management of Companies and Enterprises	-0.113 .	-0.110 .	-0.076	-0.815 **	-0.087

Table 2: Volatility Regression Results Continued

	Own Source Revenue	Direct Expenditures	Current Operation Expenditures	Capital Outlay Expenditures	Salary and Wage Expenditures
LQ Administrative and Support and Waste Management and Remediation Services	-3.596 *	-0.482	1.101	-4.926	-3.863
PP Administrative and Support and Waste Management and Remediation Services	0.111	-0.093	-0.174	-1.183	-3.010 ***
LQ Educational Services	-2.567	0.667	0.303	-0.097	-0.945
PP Educational Services	-0.750 *	-0.296	-0.288	0.324	-0.276
LQ Health Care and Social Assistance	-10.709 *	-0.602	-0.347	12.072	4.602
PP Health Care and Social Assistance	-0.065	1.106	0.447	8.267 .	1.798
LQ Arts, Entertainment, and Recreation	0.120	0.607	0.031	11.268	-4.789 *
PP Arts, Entertainment, and Recreation	0.217	0.254	-0.220	3.674 *	-0.037
LQ Accommodation and Food Services	-3.865	-0.330	4.032	-14.542	-10.764 .
PP Accommodation and Food Services	0.295	-2.305 *	-0.408	-8.973	1.189
LQ Other Services, except Public Administration	-1.595	2.972 *	0.013	4.548	-3.602
PP Other Services, except Public Administration	0.869	-1.093	1.108	1.821	-0.530
LQ Manufacturing	4.423	0.596	0.643	-11.370	-2.096
PP Manufacturing	-0.202 *	0.070	-0.051	0.531	0.147
LQ Retail Trade	-1.334	2.625	1.768	-13.422	4.268
PP Retail Trade	-1.051	-0.492	-1.002	-12.901	3.951
LQ Transportation and Warehousing	-2.362	-1.154	-2.782 .	11.069	2.268
PP Transportation and Warehousing	-0.325	-0.594 **	-0.389 *	-0.298	-0.580 .
Own Source Revenue Volatility		165.680 ***	132.280 ***	-121.960	188.630 ***
Yt-1	483.520 ***	332.770 ***	475.460 ***	165.290 ***	313.330 ***
F	33.43 ***	31.32 ***	50.09 ***	4.04 ***	23.00 ***
Adj-R^2	0.8634	0.8558	0.9058	0.3727	0.8116
N	1043	1043	1043	1043	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.

Results

Table 1 presents the descriptive statistics for the variables used in this study. Table 2 presents the five models of interest: own source revenue volatility, direct expenditure volatility, current operation expenditure volatility, capital outlay expenditure volatility, and salary and wage expenditure volatility. The goodness of fit statistics are reported in Table 3. Overall, all the five models have statistically significant F-statistics at a 99.9% confidence level suggesting that each model's vector of independent variables are jointly statistically significant. The adjusted R-squared values for own source revenue volatility (.8634), direct expenditure volatility (.8558), current operation expenditure volatility (.9058), and salary and wage expenditure volatility (.8116) are all above .8 indicating that these models have excellent explanatory power. However, the adjusted R-squared value for capital outlay expenditure volatility is only .3727, which is also good, but low compared to the other models. Capital outlay expenditures behave differently than operational expenditures because they are generally costly one-time purchases paid out of the proceeds of a bond sale.

The variables of interest in this study are the diversification and clustering variables. Across all five models both employment and establishment diversification are statistically insignificant at a 90% confidence level. This finding suggests that diversification does little to mitigate expenditure volatility. Clustering is operationalized using LQ and PP measures for 19 different 2-digit NAICS industry codes. Detailed results are reported in table 3, but for the purposes of discussion general trends and patterns will be discussed rather than addressing each industry in each model.

In general, the industrial clusters that are statistically significant at a 90% confidence level are *negatively* associated with the volatility in all models as predicted. However, four industrial clusters are positively associated with volatility in at least one model: (1) utilities; (2) real estate, rental, and leasing; (3) health care and social assistance; and (4) arts, entertainment and recreation. Only utility clustering is consistently associated with increased revenue and expenditure volatility. The other industrial categories are associated with decreases in volatility.

Many municipal governments own and operate utilities. Utility clustering might reflect increased municipal ownership and the volatility increases are a result of volatile utility revenue markets. 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 show that a statistically significant and *negative* correlation exists between utility LQ and utility revenue. 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.

All statistically significant industrial clusters are negatively associated with own-source revenue volatility (except utility clustering, which behaves consistently in a counter intuitive fashion across three of the five models). In other words, an increase in the clustering of certain industries results in a decrease in own-source revenue volatility. In the second model, direct expenditure volatility, the statistically significant industrial clusters are generally negatively associated with direct expenditure volatility. Agriculture (forestry, fishing, and hunting), construction,

information, management of companies and enterprises, accommodation and food services, and transportation and warehousing clusters are negatively associated with direct expenditure volatility. Yet, utility, real estate, rental and leasing, and other services are positively related to volatility. Although these industrial clusters do not align with the general coefficient patterns, the coefficient sign can be explained.

The next three models—current operation expenditure volatility, capital outlay expenditure volatility, and salary and wage expenditure volatility—are component parts of direct expenditure volatility. Current operation expenditures pay for ongoing operational expenses like supplies, materials, and other program costs. Capital outlay expenditures are for the purchase large one-time capital purchases like equipment, land and existing structures, and construction. Salary and wage expenditures are for the compensation of personnel. Each of these expenditure categories is managed differently and is associated with distinct political concerns.

Agriculture, forestry, fishing and hunting clusters are statistically significant and negatively associated with both current operation volatility and capital outlay volatility, but does not have a statistical relationship with salary and wage volatility. This industrial cluster is the only cluster that is statistically significant for both current operations and capital outlay volatility. Given that businesses in this cluster require extensive swaths of preserved land, it is not surprising that this industrial cluster is associated with increased expenditure stability.

Except for utility clustering, all statistically significant industrial clusters for both current operation volatility and salary and wage volatility have negative coefficients as predicted. Yet, most of the statistically significant clusters differ between current operation volatility and salary and wage volatility. There are two exceptions: construction and transportation and warehousing clusters are statistically significant and negatively associated with both current operation volatility and salary and wage volatility, but not capital outlay volatility.

The results from the control variables warrants a brief discussion. First, the measures for fiscal slack, percent operational spending, and percent elastic revenue sources are statistically significant for own-source revenue volatility model, but do not have a statistically significant relationship with any of the expenditure variables. This indicates that local managers strategically mitigate revenue volatility from these sources to prevent expenditure volatility. Fiscal slack is positively related to revenue volatility because fiscal slack is used to smooth out expenditures when revenue volatility is high. Local managers strategically accumulate more slack resources when their revenue sources are volatile.

IGR is statistically insignificant across all five models implying that local governments make expenditure decisions on the assumption that they will have limited IGR. Revenue diversification is statistically significant and negatively related to current operations volatility. As a local government's tax structure becomes more diversified, current operation volatility increases. In modern portfolio theory, diversification increases stability. But local government revenue diversification actual increases volatility because local governments are moving diversify away from the property tax and toward more income elastic revenue sources (Alfonso 2013; Yan 2011). Population is statistically significant and positively related to current operation

expenditures implying that larger local governments have more volatile operations because of the broader and more dynamic demands of larger populations.

Unemployment rate is statistically significant and negatively related to direct expenditure volatility, capital outlay volatility and salary and wage volatility. In other words, an increase in unemployment lowers expenditure volatility. This finding is likely a purposeful policy response by public managers to mitigate risk when the economy takes a down turn. Cutback budgeting recommends, freezing positions and suspending capital outlays during times of fiscal stress and only as a last resort cutting current services. This idea is reflected in the statistically significance of capital outlay volatility and salary and wage volatility. Unemployment volatility also reflects this idea. Unemployment volatility is negatively associated with capital expenditures at a 90% confidence level. Overall, these findings imply that local governments are sensitive to the general economic conditions when making expenditure decisions.

Diversification and Clustering Discussion

Table 3: Summary of Effect of Business Clustering on Large City Revenues and Expenditures

	Own-Source Revenue	Direct Expenditures	Current Operating Expenditures	Capital Expenditures	Salary and Wages Expenditures
Employment HHI					
Establishment HHI					
Goods-Producing Industries	-	-	-	-	-
Utilities	+	+	+		
Trade and Transportation		-	-		-
Information and Financial Services		-			-
Professional and Business Services	-	-		-	-
Education and Health	-			+	
Leisure and Hospitality		-		+	-
Other Services		+			

The employment Hirschman Herfinadahl index (HHI) is a measure of industrial diversity in a FiSC using employment and establishment. HHI measures the diversity of industries in a FiSC by the number of firms in each industry. The higher the index value, the lower the diversity of

industries that make up the county's economy, and presumably the greater the budget stability. Both measures are insignificant in all models suggesting that diversity of industrial employment and firms that make up the local economy have no relationship to a city's revenue or expenditures stability.

When we examined the impact of clustered businesses of a similar type on the stability of own-source revenues and direct expenditures (current operating plus capital spending), several interesting conclusions emerge. First, clustering of goods-producing industries (agriculture, mining, construction and manufacturing) have a consistently inverse relationship with budget volatility. That is, the greater the clustering of goods-producing industries at the local level, the less actual own-source revenue deviated from predicted levels. Similarly, actual direct expenditures showed less volatility from predicted as did current and capital expenditures. Not surprisingly, salaries and wages were also less volatile in communities where goods-producing industries cluster.

Clustered professional and business services (professional, management, and business support services) show a similar pattern to that of goods-producing industries with the notable exception of the greater instability in current operating expenditures. Increased clustering of professional and business support services reduces revenue volatility and the volatility of direct expenditures, particularly capital spending.

The clustering of education and health services also reduces revenue volatility, but leads to greater volatility in capital spending. Otherwise this cluster of services has no effect on city operating or total direct expenditures. All other industry clusters—trade and transportation, information and financial services, leisure and hospitality, and the residual all other services—have no effect on revenue volatility. By contrast, all clustering of industry groups, except education/health services and utilities, reduces the volatility of direct expenditures. We speculate that education and health tend to be countercyclical. The volatility of direct expenditures by cities where these services cluster are unrelated to the clustered services.

Utilities, however, have a distinctly positive impact on the volatility of city own-source revenues, direct and current operating expenditures. This counter effect to all other industrial clusters (except the residual "other services" category) suggests that the budgets of cities with clustered utility services are more vulnerable to the cycles that drive the utility industry. We speculate that among this sample of large cities, the utility clusters crowd out municipal utility revenue and that competition between municipal and privately-owned utilities is the cause of the increases in budget volatility.

Conclusion

The purpose of this study is to understand the role economic base diversification and economic base clustering have on revenue volatility. Further, the findings presented in this study serve as an important first step in understanding how local economies are intertwined with a local government's fiscal health. Specifically, this study found no evidence that economic base diversity impacts budget volatility, suggesting that a broad and balanced business sector will

have little impact on a local government's budget stability. The results indicate that, in general, industrial clustering is going to lower budget volatility. Municipalities wishing to increase budget stability can achieve some success through clustering strategies. However, utility clustering was shown to actually *increase* budget volatility consistently.

Aside from the economic base findings, two broad conclusions can be made. First, capital outlay volatility is *less* predictable than operational and salary outlays given our model. While the other four models all had high goodness of fit statistics, capital outlay volatility had mediocre goodness of fit statistics. Capital outlays are fundamentally budgeted different than operational and salary expenditures. Capital outlays are expensive, one-time purchases whereas operational and salary expenditures are ongoing expenses. Therefore, current operations expenditures reflect the long-run trends of a city where capital outlay expenditures reflect the short-term political demands. The second broad conclusion is that revenue volatility was statistically significant and positively related to all expenditure volatility models except capital outlay volatility. Revenue drives operational expenditures, but does not impact infrastructure volatility.

Overall, this study is an important contribution to the public finance literature. Little is known about the role a city's economic base plays in its fiscal health, particularly how its economic base impacts budget volatility. While this study fills an important gap, it does not answer all the questions. More research is needed using different samples, and different measures of economic base. Overall, this manuscript will improve our understanding of municipal fiscal health while providing guidance for public managers to improve the financial capacity of their local government.

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