

Local Government Fragmentation & the Local Public Sector: A Panel Data Analysis

Christopher B. Goodman, PhD

Assistant Professor

Rutgers, The State University of New Jersey

Faculty of Arts & Sciences

Department of Public Policy & Administration

401 Cooper Street, Camden, NJ 08102

Tel: (856) 225-6070 Fax: (856) 225-6559

`christopher.goodman@rutgers.edu`

Abstract

This study analyzes the influence of multiple fragmentation and concentration variables on per capita expenditures for all counties in the United States from 1982 to 2002. Fragmentation and concentration variables are grouped along total, horizontal and vertical lines as identified in the literature. The results of this analyses suggest that increases in overall fragmentation leads to higher per capita expenditures; however, supplemental analyses demonstrate this result is being driven by the proliferation of single purpose governments. The analyses also shows that concentration of spending in counties and school districts leads to lower per capita expenditures on average. Results are somewhat sensitive to specification. This analyses demonstrates that time is an important consideration and the relationship between fragmentation and the size of the local public sector is not straightforward.

Keywords: Local Government Expenditures; Federalism; Tiebout

JEL Classification: H72; H73; H77

Introduction

Until recently, a significant portion of the literature surrounding the relationship between local government structure and the size of the local public sector has been derived from the Tiebout (1956) model. Subject to numerous conditions about citizen mobility and knowledge of local governments, Tiebout posits that competition between a sufficient number of small municipal governments for mobile capital will lead municipal governments to provide local public services at or near lowest average cost. This competition between small municipal governments is akin to a market mechanism that forces citizen-voters to reveal their preferences for bundles of services and taxes. The Tiebout (1956) model has been tested and extended in various forms

suggesting that increased local government fragmentation can constrain the actions of local governments and slow the growth of the local public sector (Schneider, 1986, 1989a). In general, the empirical literature supports the assertion that greater levels of municipal fragmentation leads to lower per capita expenditure on average (Chicoine and Walzer, 1985; Schneider, 1986, 1989a; Sjoquist, 1982).

A principle assumption of the Tiebout model is the existence of only municipal or general purpose governments. Indeed, Tiebout reiterates this in collaborative work not long after the publishing on his 1956 article (Ostrom et al., 1961). However, Dowding and Mergoupis (2003) suggest that the testing of Tiebout's model is not appropriate in the U.S. context because the U.S. local public sector is simply too complex to accommodate the model. The Tiebout model suggests that all municipalities are general purpose and non-overlapping (Berry, 2008). However, the actual political landscape of local governments in the context of the United States suggests something very different from the assumptions of the Tiebout model. There are a large number of non-overlapping, municipal governments in the United States; however, there is an equally large number of overlapping, single purpose local governments. Rather than competing horizontally (as general purpose governments do), single purpose governments compete vertically (Berry, 2008). And rather than Tiebout working in the horizontal and vertical space, Berry (2008, 2009) suggests that there are different effects in each direction. In the horizontal space, Tiebout very well may dominate. However, in the vertical space, single purpose governments have little incentive to compete with each other in the manner of Tiebout. As noted by Berry (2009), to the resident, consumption of the various public goods provided by single purpose districts is bundled;¹ however, the provision of those goods is dispersed among numerous vertically stacked institutions. Instead of competition, the incentives for single purpose governments due a lack of migration for fiscal reasons is to enlarge their own budgets without regard for what other overlapping districts may be doing (Berry, 2008, 2009).

In addition to the governmental structure aspect of fragmentation, fiscal federalism suggests a different path for vertical fragmentation. Through the Decentralization Theorem, Oates (1972) suggests that to the extent that costs of service provision are similar between a central and a decentralized government, the decentralized government will be more efficient in service provision. Empirically, the literature on decentralization and its potential influence of the size of the public sector has proceeded with an examination of the relationship between fiscal arrangements (state-local responsibility) and the total size of the state-local sector (Oates, 1985; Nelson, 1986, 1987). General findings from this research would suggest that concentration of state-local spending in the local sector leads to a lower state-local public expenditures. However, this result is not supported by all research (Campbell, 2004).

¹The resident experiences service provision concurrently. That is, services from different single purpose districts are provided all at once and appears to the resident to be provided by one general purpose government.

This paper will proceed as follows. First, an overview of the literature pertaining to complicated nature of fragmentation and concentration is conducted. Next, a fully specified model of local expenditure is developed based on the median voter model and measures of fragmentation are incorporated. Since there is significant disagreement in the literature on the measurement of fragmentation of any kind, special attention is paid the measurement issues. Theoretical predictions of the influence of the two types of fragmentation are developed. Next, statistical analysis is conducted and results are reported. Finally, conclusions are discussed and practical implications of this research are explored.

Literature Review

As mentioned above, the general trend in research pertaining fragmentation and the size of the local public sector is toward more fragmented structures leading to a smaller public sector (Boyne, 1992; Chicoine and Walzer, 1985; Schneider, 1986, 1989a; Sjoquist, 1982). However, there are dissenting findings in this concern. As Hendrick et al. (2011) makes note of, this confusion over outcomes of analyses such as these are likely the result of inconsistencies in the methods of measuring local fragmentation. The concern of this literature review is to sort through the findings of the relevant literature and pay special attention to measurement differences.

Much of the confusion surrounding the influence of fragmentation/concentration on the size of the local public sector is from issues of measurement. Boyne (1992) provides much needed guidance in this realm. First, a distinction between *fragmentation* and *concentration* is drawn. *Fragmentation* is defined as the number of governmental units in a given area. It may be standardized by geographic area or population. A fragmented local government system is one in which there are a large number of local governments. Conversely, a consolidated local government system is one in which there are few (or in some cases, one) local governments. *Concentration* is related to the “distribution of responsibilities and revenues” (Boyne, 1992, pg. 334). A concentrated local government system is one in which service delivery responsibilities and revenue generation are held within a small number of local governments. Boyne (1992) notes that concentration is similar to the market share concept. A local government system can be highly fragmented (i.e. has a large number of local governments), but service delivery responsibilities can be concentrated in just a few of those local governments.

In addition to the fragmentation/concentration distinction, a distinction must be drawn between *vertical* or *horizontal* structure. The vertical component relates to the number of tiers in a local government system in the vertical fragmentation context or the distribution of responsibilities among the tiers in the case of vertical concentration. A vertically fragmented system is one in which there are multiple layers of local

government. Vertical concentration in a situation where one or two of the tiers of local government controls a large amount of the service delivery or revenue generation responsibility. The horizontal component relates to the number of local governments in each tier for horizontal fragmentation and the service delivery/revenue generation responsibility internal to each tier for horizontal concentration.

This framework allows the disparate lines of research in fragmentation and concentration to be more easily organized. However, many authors attempt to measure similar concepts using significantly different definitions. This framework also allows the sorting out of these issues as well since changes in definitions may also change the classification. By far, the most popular definition of fragmentation in the literature is a horizontal measure of fragmentation: the number of local governments within different tiers of local governments. In general, these measures are normalized by population or land area; however, this convention is not universal. Often, the measure is the number of general purpose and/or single purpose government per capita (Eberts and Gronberg, 1988; Hendrick et al., 2011; Stansel, 2006; Zax, 1989). However, municipalities (Craw, 2008; Eberts and Gronberg, 1990; Schneider, 1986), special districts (Chicoine and Walzer, 1985; Eberts and Gronberg, 1990; Stansel, 2006; Zax, 1989) and aggregates (Campbell, 2004; Chicoine and Walzer, 1985; Eberts and Gronberg, 1988; Oates, 1985) are also prominent. More specialized measures are also used such as overlapping taxing jurisdictions per municipality (Berry, 2008, 2009), average population size of jurisdiction (Nelson, 1986, 1987) and the number of bordering jurisdictions (Schneider, 1986, 1989a). It is important to note that few of these analyses expressly incorporate a vertical component to their analyses.

With so many definitions of fragmentation in the literature, distilling results from these studies is difficult. Theoretically, Tiebout (1956) and public choice advocates suggest that increased horizontal fragmentation leads to lower per capita expenditures. However, a more fragmented local government system may increase per capita expenditures. Hendrick et al. (2011) cites four potential reasons. A large number of small local government may be unable to realize economies of scale in production (Oakerson, 1999). A large number of small local governments may duplicate services and decrease the possibility of cost savings Boyne (1992); Foster (1997). Spillovers or externalities in production of local public goods can create costs and benefits for neighboring local governments leading to higher expenditures (Musso, 1998). Finally, citizen knowledge of costs in local government will be less in a more fragmented system leading less citizen oversight and higher expenditures than demanded (Buchanan and Wagner, 1977). In general, the literature indicates that increases in general purpose governments leads to lower local government expenditures (Campbell, 2004; Eberts and Gronberg, 1988; Stansel, 2006; Zax, 1989). Disaggregation of general purpose governments into municipalities is also considered in the literature. The results for these analysis is similar to the aggregated analyses (Eberts and Gronberg, 1990; Schneider, 1986). The results for single purpose and special districts are not the same as general purpose governments. The evidence from the literature indicates that increases

in single purpose or special purpose government is associated with an increase in the size of the local public sector (Berry, 2008, 2009; Eberts and Gronberg, 1988, 1990; Hendrick et al., 2011; Stansel, 2006; Zax, 1989). Finally, some analyses focused on metropolitan areas focus on the percentage of the MSA population in the central city as a measure of consolidation. Stansel (2006) analyses find that a larger central city leads to higher per capita expenditures overall; however, Eberts and Gronberg (1990) finds that a larger central city decreases expenditures in the suburbs.

The conceptualization of concentration variables in the literature is similarly disparate. However, unlike fragmentation, there is more emphasis on vertical influence. In the horizontal spectrum, measurement is not consistent. It varies from spending by municipalities (Campbell, 2004) to shares of spending made by a number of the largest governments in a MSA (DiLorenzo, 1983; Eberts and Gronberg, 1988) to a concentration index of local government size by employees or spending (Hendrick et al., 2011; Schneider, 1989a). Conceptualization of the vertical component of concentration is more uniform in the literature. In general, it is measured as the state (or local) share of total state-local spending or revenues (Hendrick et al., 2011; Nelson, 1986; Oates, 1985). The effects of concentration are as dissimilar as with fragmentation. Concentration of spending among different tiers of government have been shown to both increase (DiLorenzo, 1983) and decrease (Campbell, 2004; Eberts and Gronberg, 1988) per capita expenditures. Additionally, more dispersed government sized has been shown to decrease the growth of local government (Schneider, 1989a). On the state-local vertical component, the evidence is mixed. Hendrick et al. (2011) demonstrates that an increased local share of the state-local expenditure system leads to a larger local public sector. However, Oates (1985) finds nearly the opposite with concentration of spending at the state level leading to a larger state-local system. Additionally, Nelson (1986) finds that concentration of spending at the state level leads to lower state-local tax collections.

Certainly, there is significant disagreement in the extant literature about the influences of fragmentation and concentration on the size of the local public sector. It is possible this is due to the many disparate means by which these two concepts have been measured. The next section outlines the model specification of this analysis and the variables used to measure fragmentation and concentration.

Model Estimation

The theoretical and empirical literature on the expenditure patterns of local government provide an excellent starting point for the construction of a model to examine the influence of fragmentation and concentration on local public expenditures. The seminal work of Borcharding and Deacon (1972) and Bergstrom and Goodman (1973) provide the basis for a political economy model using the median voter model (Black, 1948;

Downs, 1957) to motivate their analyses. Fischel (2001) argues that, while not perfect, the median voter model does a good job of explaining government outcomes, especially at the local level. Further, Turnbull and Djoundourian (1994) finds that the median voter model is appropriate to explain the actions of general purpose local governments.

The objective of this analysis is to incorporate the measures of fragmentation and concentration into a fully specified model of per capita local government expenditures. Building upon Borcharding and Deacon (1972) and Bergstrom and Goodman (1973), a model is specified using the following functional form.

$$\text{exp} = f(\text{demand, fragmentation, concentration}) \quad (1)$$

Local public expenditure are the result of the average cost of service provision multiplied by the units of public services provided (Ladd and Yinger, 1989). In (1), the traditional demand variables, price and income among others, contribute to the number of units of public services provided. As identified in the literature, local government fragmentation and concentration influence the cost of service provision for local governments. Therefore, the functional form embodied in (1) incorporates both demand and costs variables to arrive at a fully specified model of local public expenditures.

Following the literature (Borcharding and Deacon, 1972; Bergstrom and Goodman, 1973; Ladd, 1992; Turnbull and Mitias, 1999), the application of a logarithmic transformation to this equation reveals the estimating equation for this analysis.

$$EXP_{it} = \beta_0 + D_{it}\beta_1 + FRAG_{it}\beta_2 + CON_{it}\beta_3 + \gamma_i + \delta_t + \varepsilon_{it} \quad (2)$$

Where EXP is per capita local government expenditures for county area i in time t , D is a vector of demand variables for county area i in time t , $FRAG$ is a vector of variables measuring the extent of local government fragmentation, total, horizontal, and vertical, in county area i in time t , CON is a vector of variables measuring concentration influences both at the local and state-local level in county area i in time t , and ε is the usual composite error term. Additionally, time (δ) and county are (γ) fixed effects are included.²

[Table 1 about here.]

The data for this analysis is derived five consecutive Census of Governments from 1982 to 2002. The full Census of Governments is conducted every five years so this results in data from 1982, 1987, 1992, 1997 and 2002. The nature of this research question necessitates a more aggregate analysis than usual examinations

²This is an assumption as to the appropriate estimation method for this equation. Formal testing confirms this assumption and is presented in the regression results section of this paper.

of local government expenditures. Rather than focus on one level of local government, this analysis focuses on the *county area* as the unit of analysis. The Census Bureau aggregates all financial, organizational, and employment data on all types of local governments (counties, municipalities, towns/townships, special districts and school districts) to the county or the equivalent level. As such, the *county area* is a regional level variable. There are benefits to using this type of data for this analysis. Aggregating the data in this manner allows for the overall size of the local public sector to be proxied. Since this analysis is concerned with influence of fragmentation and concentration on the size of the local public sector, this is a beneficial attribute. Also, aggregation up to the county level normalizes service delivery obligations across the different types of local governments. In this way, the size of the local public sector is comparable across space and time. The remaining data in the dataset is derived from various federal statistical agencies. To allow for comparability over time, the local governments in Alaska and the smaller independent cities in Virginia have been dropped from the dataset.³ This results in an unbalanced panel of 14,697 observations.

Fragmentation & Concentration

As mentioned in the literature review of this paper, there is significant disagreement in the extant literature as to the proper conceptualization and operationalization of fragmentation and concentration variables. Boyne (1992), Hamilton et al. (2004) and Hendrick et al. (2011) all suggest that there should be a distinction made between fragmentation and consolidation of local governments. Likewise, there should also be a distinction made between dispersion or concentration of service delivery responsibilities between state and local governments. As explained by Hendrick et al. (2011, pg. 478), the former is concerned with the “jurisdictional or institutional structure based on population or land area.” The latter is characterized by where the responsibility for service provision lays in the state-local public sector. This distinction is important because where a local area falls on one spectrum does not necessary mean the other dimension is similar. For instance, it is possible a local area to be highly fragmented but service delivery requirements are concentrated at the state level. Similarly, governments in a local area can be highly consolidated and deliver the vast majority of state-local services.

Further clarification between different types of fragmentation are necessary. Both Boyne (1992) and Hendrick et al. (2011) suggest that fragmentation is composed of three dimensions: total fragmentation, vertical fragmentation and horizontal fragmentation. For the purposes of this analysis, total fragmentation is the total number of local governments in a county area. This concept can be in aggregates or standardized by some factor such as population or land area. Vertical fragmentation refers to the number of overlapping governments or the number of overlapping kinds of governments. Finally, horizontal fragmentation refers to

³A list of the eliminated county areas or independent cities is available upon request.

the number local governments of a particular kind in a county area. For instance, the number of municipalities in a county area is indicative of a measure of horizontal fragmentation.

Further clarification between different types of dispersion or concentration is also warranted. Similar to fragmentation, there is a vertical component, a horizontal component and a total component to concentration. Vertical dispersion or concentration is identical to decentralization and centralization (Hendrick et al., 2011). Specifically, where does the taxing and service delivery authority lay in the state-local system of governments? In a decentralized system, most or all of the authority for raising revenues and delivering services lays with local governments. In a centralized system, all or most of the authority lays with the state. Concentration is a continuum with many different circumstances in between the two extremes mentioned above. In addition to the state-local level of concentration, there is a purely local vertical concentration. Primary responsibility to revenue raising and service delivery laying with counties would be indicative of local concentration where primary responsibility for raising revenues and providing service by less general purpose and more single purposes governments could be indicative of local decentralization. Hendrick et al. (2011) defined horizontal concentration as the concentration of revenue raising and/or service delivery responsibility among a few local governments of the same type (i.e. municipalities). Horizontal decentralization is the exact opposite with fiscal or service delivery responsibility spread among many of the same types of local governments. Finally, total concentration is concerned with how dispersed or concentrated an entire county area is with respect to local governments. For instance, revenue raising and service delivery responsibility concentrated with a few municipalities compared to all local governments in a county area would be a measure of total concentration.

The potential methods of measuring the three types of fragmentation and the three types of concentration are many. Hendrick et al. (2011, pg. 481) reports a list of the most popular methods in the literature. The methods chosen for this analysis are outlined in Table 1. As mentioned above, fragmentation can be measured in total, horizontally or vertically. Total local government fragmentation is measured as the total number of local governments per 10,000 residents. This is the most common way to measure fragmentation (of any type) in the literature (Campbell, 2004; Chicoine and Walzer, 1985; Craw, 2008; Dolan, 1990; Eberts and Gronberg, 1988; Forbes and Zampelli, 1989; Hendrick et al., 2011; Oates, 1985; Stansel, 2006; Zax, 1989). Horizontal fragmentation is measured using two variables relating to two types of local governments. General purpose governments and single purpose governments are measured as the number of these types of local governments per 10,000 residents. Special districts (a component of single purpose districts) per capita are prominent in the literature (Berry, 2009, 2008; Chicoine and Walzer, 1985; Eberts and Gronberg, 1988, 1990; Foster, 1997; Hendrick et al., 2011; Nelson, 1986, 1987; Schneider, 1986, 1989a,b; Stansel, 2006; Zax, 1989). Additionally, single-purpose districts are popular in the literature (Hendrick et al., 2011; Stansel, 2006; Zax, 1989). Finally, vertical fragmentation is measured using two variables: the percentage of independent/dependent school

districts and special districts of the total number of local governments.⁴ Though theoretically considered in Boyne (1992), vertical fragmentation has received little empirical examination in the literature except for Hendrick et al. (2011).

Hypotheses as to the influence of these variables on per capita expenditures depends on the theoretical perspective one takes. From the public choice perspective, increased fragmentation, particularly in the total and horizontal realms, should lead to lower per capita expenditures. From the local government reform perspective, increased fragmentation leads to higher per capita expenditures. Given the empirical disagreement over these predictions, this analysis takes no *a priori* stance on the influence of total or horizontal fragmentation. However, the theory and empirical evidence is clear regarding overlapping, single-purpose governments. Consistent with the literature, it is expected that increases in single purpose governments leads to higher per capita expenditures.

Concentration is measured, theoretically, on a total, horizontal and vertical basis. For this analysis, however, only the total and vertical aspects are analyzed. Total concentration is measured as a Hirshman-Herfindahl index of local government expenditures by local government type.⁵ Hendrick et al. (2011) suggests that operationalizing total concentration in this manner is a more comprehensive approach than others taken in the literature. Vertical concentration is broken into two parts. First, the local only vertical component is considered. This is operationalized by three variables measuring the percentage of county area spending by the county, independent/dependent school districts and special districts. Support for this operationalization in the literature is high (DiLorenzo, 1983; Forbes and Zampelli, 1989; Hendrick et al., 2011; Zax, 1989). The second vertical concentration component is state-local vertical concentration and is operationalized by two variables. Often operationalized from the state perspective (Forbes and Zampelli, 1989; Nelson, 1986; Oates, 1985; Wallis and Oates, 1988), the first variable is measured as the local share of total state-local expenditures. The second variable is the percentage of total local government revenues derived from the state sources (Hendrick et al., 2011). Theoretical predictions as to the relationship between concentration and expenditures is derived from the Leviathan model. Oates (1985) suggests that as service delivery responsibility is decentralized to local governments, the size of the public sector should be limited. Similarly, as service delivery responsibility is decentralized to local governments, Brennan and Buchanan (1980) suggest that the fragmentation present at the local level should restrict the growth of local government. Therefore, it is expected that an increase in the local portion of state-local expenditures will decrease expenditures.

⁴An aggregate of these two variables is also presented in Model II.

⁵Consistent with the recent literature, HHI is defined as $\left(\frac{1-\sum_{i=1}^n G_i^2}{1-100\%/n}\right)$ where G_i is the proportion of total expenditures derived from each local government type and n is the number of local government types. There are five types of local governments: counties, municipalities, towns and townships, independent school districts, and special districts.

Demand Variables

The demand variables included in this analysis are largely based on the analyses of Borcharding and Deacon (1972) and Bergstrom and Goodman (1973). Per capita personal income is included to control for the endowment of local residents. Consistent with the literature, it is expected that increases in per capita personal income lead to increases in expenditures. To approximate a tax price, the percentage of total revenues derived from the property tax is used. Unfortunately, this is a poor proxy for tax price but is necessitated by the data. There is no information on property assessments or rates included in the Census of Governments. However, the property tax base is dominated by residential properties (Brunori, 2007) and to the extent that property taxes are similar to other local taxes paid by residents, this variable approximates something similar to a tax price. As such, it is expected that this variable will be negative. Population density is included to control for effects related to urbanity and sprawl. This is measured as persons per square mile.

Results

Before running the various models in this analysis, several specification tests were conducted to determine the appropriate estimating technique. The nature of these data would suggest that a fixed effects model would be the most appropriate technique. This assumption is confirmed using the Hausman (1978) test. A joint F test on year fixed effects suggest that the inclusions of these variables are warranted. Therefore, estimation will proceed using a two-way fixed effects model. Testing for heteroskedasticity using the Modified Wald Test for Groupwise Heteroskedasticity using the method outlined in Greene (2008) suggests that heteroskedasticity is an issue. Additionally, testing for autocorrelation using the Wooldridge (2002) Test for Serial Correlation suggests there is an AR[1] disturbance in this data. Arellano (2003) indicates that standard errors clustered on the cross-sectional unit are robust to these two issues. Therefore, standard errors will be clustered on the county area. See Table 2 for summary statistics for all of the variables employed in this analysis.

[Table 2 about here.]

Table 3 presents four models incorporating different measures of fragmentation and consolidation. Model I represents the fully specified model including multiple measures of fragmentation and consolidation. Model II replaced school district and special district variables with an aggregate measure. Model III is a reduced form model of Model I and Model IV is a further reduced form model including a disaggregation of total local government fragmentation. Overall, the four models preform well; across the models within- R^2 s range from 0.536 to 0.590.

[Table 3 about here.]

Control Variables

Turning first to the control variables, price and income variables are of the correct sign and statistically significant. Across the four models, per capita personal income is 0.017 in three of the models and 0.020 in Model I. These results indicate that a one dollar per capita increase in personal income is associated with a 0.017 dollar increase in per capita total expenditures. In Table 4, elasticities for this analysis are presented. The income elasticity ranges from 0.13 to 0.16. This is somewhat smaller than that found in the literature (Bergstrom and Goodman, 1973; Borcharding and Deacon, 1972; Turnbull and Djoundourian, 1994). The approximation of a price variable in this analysis, property tax dependence, is uniformly negative across all four models. It ranges from -13.3 to -20.9. This indicates that a one percentage point increase in property tax dependence leads to a 13.3 dollar decrease in per capita total expenditures. In elasticity terms, a one percent increase in property tax dependence leads to a 0.23 percent decrease in per capita total expenditures. This result is similar to Bergstrom and Goodman (1973) but is smaller than the results found in Borcharding and Deacon (1972) and Turnbull and Djoundourian (1994). The final control variable, population density, is only significant in Model I. On average, a one person per square mile increase in population density leads to a 0.60 dollar increase in per capital total expenditures. In elasticity terms, a one percent increase in population density is associated with a 0.03 percent increase in per capita total expenditures.

[Table 4 about here.]

Fragmentation & Concentration

Table 3 provides results in levels and Table 4 provides results in elasticities. Turning first to Model III as the most reduced form, it includes only a total measure of fragmentation and three measures of concentration. Beginning with fragmentation, a one government per 10,000 individual increase is associated with a 9.23 dollar increase in per capita total expenditures at a statistically significant level. In elasticity terms, a one percent increase in total local governments per 10,000 residents is associated with a 0.06 percent increase in per capita total expenditures. Next, the concentration of local spending, a measure of total local concentration, is negative and statistically significant in Model III. Measured by a Hirshman-Herfindahl index varying from zero to one where one is equal spending by all types of governments, a 0.1 unit increase in the index is associated with approximately a \$109 decrease in per capita total expenditures. In elasticity terms, a one percent increase in concentration of local spending (a decrease in local concentration) is associated with a 0.30 percent decrease in per capita total expenditures.

There are two measures of vertical concentration in Model III. The first measure, the local share of combined state-local spending, is positive and statistically significant. A one percentage point increase in the local share is associated with a 12.85 dollar increase in per capita total expenditures. In elasticity terms, a one percent increase in the local share leads to a 0.30 percent increase in per capita total expenditures on average. The second measure, the percent of total revenues from state sources, is negative and statistically significant. A one percentage point increase leads to a 17.63 dollar decrease in per capita total expenditures. In elasticity terms, a one percent increase in the percent of state aid leads to a 0.27 percent decrease in per capita total expenditures. These two measures present opposing influences on per capita total expenditures.

Model IV is a slight generalization from Model III in that total local governments per 10,000 residents is replaced by a disaggregation into general purpose governments and single purpose governments per 10,000 residents. General purpose governments per 10,000 residents is positive; however, it is not statistically different than zero. Single purpose governments per 10,000 residents is positive and statistically significant. A one single purpose government per 10,000 increase leads to a 12.74 dollar increase in per capita total expenditures. In elasticity terms, a one percent increase in single purpose governments per capita leads to a 0.04 percent increase in per capita total expenditures on average. The influence of concentration of local spending is similar to that found in Model III. A 0.1 unit increase in the index is associated with approximately a \$109 decrease in per capita total expenditures. In elasticity terms, a one percent increase in concentration of local spending (a decrease in local concentration) is associated with a 0.30 percent decrease in per capita total expenditures. The same two measures of vertical concentration in Model III are present in Model IV. The results in Model IV are similar to those in Model III. Both variables are statistically significant and the signs are the same as Model III. A one percentage point increase in the local share is associated with a 12.79 dollar increase in per capita total expenditures. Additionally, a one percentage point increase leads to a 17.71 dollar decrease in per capita total expenditures.

Models I and II are more fully specified models incorporating a full set of fragmentation and concentration variables. Model II aggregates school and special districts into single purpose government variables. Otherwise, the two models are identical. In Model II, total local government fragmentation is positive and statistically significant. A one government per 10,000 resident increase leads to approximately a 9 dollar per capita increase in total expenditures. In elasticity terms, a one percent increase in total fragmentation leads to a 0.6 percent increase in per capita total expenditures on average. In addition to total fragmentation, vertical fragmentation is measured using the percent of all local governments that are single purpose. This variable exerts a positive and statistically significant influence on per capita total expenditures. A one percentage point increase in the percentage of all local governments that are single purpose results in a 1.49

dollar increase in per capita total expenditures on average. In elasticity terms, a one percent increase in the percentage of single purpose districts leads to a 0.03 percent increase in per capita total expenditures.

Concentration in Model II is measured in two parts: total and vertical. Total concentration is measured a Hirshman-Herfindahl index. Like previous models, this variable is negative and statistically significant. A 0.1 unit increase, signaling less concentration, leads to a 118 dollar decrease in per capita total expenditures. In elasticity terms, a one percent increase in concentration leads to a 0.32 percent decrease in per capita total expenditures. The vertical (local only) component of decentralization is measured using the percent of all local spending done by single purpose districts. This variable is negative but not statistically significant. Additionally, the percentage of total local spending made by counties is included. This variable is negative and not statistically significant. The state-local vertical concentration is measured using two variables from previous model. The local share of state-local spending and the percent of total revenues from state sources are both statistically significant. Similar to previous models, a one percentage point increase in the local share of the state-local expenditures leads to a 13.4 dollar increase in per capita total expenditures on average. Additionally, a one percentage point increase in the percent of total revenues from state sources leads to approximately a 17 dollar decrease in per capita total expenditures.

Finally, Model I presented the most disaggregated model. Beginning with fragmentation variables, per capita local governments is positive and statistically significant similar to previous models. A one government per 10,000 resident increase leads to a 5.6 dollar increase in per capita total expenditures. Two variables measure the vertical component of fragmentation: the percentage of all local governments that are special districts or school districts. Neither variable is statistically significant. Concentration variables are considered next. In the total context, the concentration of local spending is negative and statistically significant. A 0.1 unit increase in the concentration index leads to a 299 dollar decrease in per capita total expenditures on average. In elasticity terms, a one percent increase in the concentration index leads to a 0.82 percent decrease in per capita total expenditures.

The vertical (local only) measure of concentration in Model I is measured by the percentage of total expenditures made by counties, school districts and special districts. All three variables are statistically significant. A one percentage point increase in county spending leads to a 5 dollar decrease in per capita total expenditures. Also, a one percentage point increase in special district spending leads to a 16.5 percent increase in per capita total expenditures on average. Finally, a one percentage point increase in school district spending is associated with a 32.8 dollar decrease in per capita total expenditures. The state-local vertical concentration is measured using two variables from previous model. Both variables, the local share and percent state aid, are statistically significant. A one percentage point increase in the local share of state-local spending leads to a 10.35 dollar increase in per capita total expenditures on average. Also, a one

percentage point increase in the percent of total revenues from state sources leads to a 8.85 dollar decrease in per capita expenditures.

Discussion & Conclusion

Across the four models, trends emerge in the findings. Overall, increased total fragmentation leads to higher per capita total expenditures on average. The point estimates vary, but the findings are uniformly in the positive direction. This is in contrast to findings in the literature (Campbell, 2004; Craw, 2008; Hendrick et al., 2011; Stansel, 2006). However, Model IV suggests that this finding is being driven by the single purpose government component of total fragmentation. This proposition has support in the literature (Berry, 2008, 2009; Foster, 1997). Additionally, the percent single purpose government variable in Model II also suggests that single purpose governments are driving the increase in per capita total expenditures. This analysis is unable to say much about the influence of general purpose local governments on the size of the local public sector. However, this analysis does provide further evidence about the influence single purpose governments on local government finance.

Concentration variables demonstrate a variety of influences. The concentration of local spending variable suggests that a less concentrated system of local government expenditure is associated with lower per capita total expenditures. This result is in contrast to the results of Hendrick et al. (2011) who finds no relationship between concentration of local spending and per capita expenditures. The three variables measuring the percentage of total local government expenditures makes by certain types of local government sheds more light on concentration influences. The percent of local spending made by counties is associated with a decrease in per capita total expenditures. More concentrated spending at the county level where jurisdictions are typically larger is indicative of reductions in per capita total expenditures.⁶ The influence of special district spending and school district spending is opposing. Concentration of spending in special districts which tend to be smaller, overlapping, and have limited service delivery obligations increases per capita total expenditure in a statistically significant manner. This is supportive of the arguments made by Berry (2008, 2009) and Campbell (2004) that overlapping jurisdictions drive up the total cost of local government. However, the influence of school districts, both independent and dependent, is opposite of this finding. An increase in the percentage of total local spending from school districts decreases per capita total expenditures on average. This result is supportive of that found in Hendrick et al. (2011). Additionally, when these two variables are combined as in Model II, the influence of school districts dominates though the result is not statistically significant. The two variables measuring the state-local vertical concentration are considered next. An

⁶This result is sensitive to specification. See the differences in the percent of county spending between Model I and Model II.

increase in the local share of total state-local spending leads to an increase in per capita total expenditures on average. This result makes intuitive sense. More decentralization of state-local spending responsibilities leads to a larger local public sector. On the revenue side, an increase in total revenues from state source leads to a decrease in per capita total expenditures on average. This indicates that the decentralization of state-local service delivery leads to a larger local public sector; however, when funding for this arrangement is increasingly coming from state sources, the impact is moderated. Both of these findings are supportive of those found in Hendrick et al. (2011).

The results presented in the previous section provide a number of interesting outcomes. These outcomes are relevant to future research on fragmentation and concentration. Each will be carefully outlined and their influence ascertained. First, this analysis demonstrates that time matters. Many of the empirical analyses of fragmentation or concentration in the literature are cross-sectional (Berry, 2008; Campbell, 2004; Chicoine and Walzer, 1985; Craw, 2008; DiLorenzo, 1983; Eberts and Gronberg, 1988, 1990; Forbes and Zampelli, 1989; Foster, 1997; Hendrick et al., 2011; Nelson, 1986, 1987; Sjoquist, 1982; Zax, 1989) and of the analyses that do take time into consideration, few use more than two time periods. This analysis utilizes five time periods adding significantly more information to the problem. Additionally, this analysis takes advantage of more modern panel data methods than previous analyses of cross-sectional, time series studies.⁷ The Census of Governments provides a rich set of data from which to draw from for analyses such as this. Leaving a significant amount of data out of the analysis does not seem a prudent strategy. Certainly, cross-sectional analyses are not irrelevant. However, they only provide a snapshot in time of the local government situation. The usage of a richer set of cross-sectional, time series data provides a better understanding of how fragmentation/concentration interacts with the size of the local public sector.

An additional outcome made clear by the four models presented in Table 3 is the analysis presented here is sensitive to specification. The inclusion or exclusion of certain variables and the levels of aggregation of other variables substantially change the point estimations of this analysis. This sensitivity is on two fronts. First, the overall analysis is sensitive to the specification of individual variables. A log-linear transformation of the model, a common transformation in the literature, yields different point estimates than the models presented. Similarly, a log-log transformation on some or all of the variables in the four models yields different point estimates.⁸ Second, the models are sensitive to which variables are included in the analysis. While the demand variables are fairly consistent, the variables measuring fragmentation and concentration are more sensitive. The incorporation of the vertical fragmentation and concentration variables in Models I and II changes the point estimates of many of the other variables in the model relative to Models III and IV.

⁷A significant exception to this assertion is Berry (2009) who uses virtually identical data and methods to that presented in this analysis.

⁸These supplemental analyses are available from the author upon request.

This change is most obvious in the Model I with the full specification of fragmentation and concentration variables.

Dovetailing off the concerns about sensitivity, the results from Model I in Table 3 demonstrate that the vertical components of fragmentation and concentration are important to the overall model. The influence of many of the other variables in the model are decreased when the vertical fragmentation and concentration variables are added. Additionally, total concentration gains a more significant place in the model when the vertical components are added. These results suggest while the Tiebout (1956) model may be correct, it is in many ways incomplete by not considering the vertical components of fragmentation and concentration. Additionally, an analysis that ignores the vertical components of fragmentation and concentration will be incomplete. This will certainly be an important area of future research with regard to the size of the local public sector.

This analysis seeks to more fully understand the relationship between fragmentation/concentration and the size of the local public sector. There is significant disagreement in the literature as to how these variables should be measured and this has contributed to the confusion in the literature about the potential influences of these variables. This analysis builds on Hendrick et al.'s (2011) excellent contribution to the literature where they make a compelling argument for a more complete set of variables to be used in analyses such as this. Additionally, this research introduces the element of time to the analysis. The results from this analysis are somewhat opposed to those found in the previous literature; however, some propositions are supported. Overall, this analysis adds more evidence to the growing consensus that the vertical components of fragmentation and concentration are important in the calculus of the interaction between the spatial arrangement of local governments and service delivery obligations and the total size of the local public sector.

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Table 1: Variable Definitions

Variable	Description and Data Sources
<i>Dependent Variables</i>	
Per Capita Total Expenditures	Total direct expenditures divided by population; Source: U.S. Census Bureau, Census of Governments
<i>Fragmentation Variables</i>	
Per Capita Local Governments	The total of all local governments in a county area divided by population in 10,000s; Source: U.S. Census Bureau, Census of Governments
Per Capital General Purpose Governments	The total number of general purpose local governments (counties, municipalities, and towns/townships) divided by population in 10,000s; Source: U.S. Census Bureau, Census of Governments
Per Capital Single Purpose Governments	The total number of single purpose local governments (special districts and independent/dependent school districts) divided by population in 10,000s; Source: U.S. Census Bureau, Census of Governments
Percent Single Purpose Governments	The number of single purpose governments (special districts and independent/dependent school districts) divided by the total number of local governments; Source: U.S. Census Bureau, Census of Governments
Percent School Districts	The number of independent school districts divided by the total number of local governments; Source: U.S. Census Bureau, Census of Governments
Percent Special Districts	The number of special district governments divided by the total number of local governments; Source: U.S. Census Bureau, Census of Governments
<i>Concentration Variables</i>	
Concentration of Local Spending	Hirschman-Herfindahl index of local government expenditures by type; Source: U.S. Census Bureau, Census of Governments
Percent County Spending	County expenditures divided by total local government expenditures; Source: U.S. Census Bureau, Census of Governments
Percent Single Purpose Spending	Expenditures by special districts and school districts divided by total local government expenditures; Source: U.S. Census Bureau, Census of Governments
Percent School District Spending	Independent school district expenditures divided by total local government expenditures; Source: U.S. Census Bureau, Census of Governments
Percent Special District Spending	Special district expenditures divided by total local government expenditures; Source: U.S. Census Bureau, Census of Governments
Local Share	Total local government expenditures divided by total state-local government expenditures; Source: U.S. Census Bureau, Census of Governments
Percent State Aid	Intergovernmental aid from state sources divided by total revenues; Source: U.S. Census Bureau, Census of Governments
<i>Demand Variables</i>	
Per Capita Personal Income	Personal income divided by population; Source: Bureau of Economic Analysis
Property Tax Dependence	Property tax revenues divided by total revenues; Source: U.S. Census Bureau, Census of Governments
Proportion Age 19 or Younger	Proportion of the population age 19 or younger; Source: U.S. Census Bureau
Proportion Age 65 +	Proportion of the population age 65 and older; Source: U.S. Census Bureau
Population Density	Population divided by land area in square miles; Source: U.S. Census Bureau

Table 2: Descriptive Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
Per Capita Total Expenditures	\$2426.12	\$1251.09	\$100.71	\$34670.74
<i>Fragmentation Variables</i>				
Per Capita Local Governments	14.994	22.874	0.0284	440.165
Per Capita General Purpose Govs	6.507	13.498	0.000	330.124
Per Capita Single Purpose Govs	7.622	11.836	0.000	279.570
Percent Single Purpose Governments	54.090%	20.574%	0.000%	250.000%
Percent School Districts	18.913%	12.779%	0.000%	200.000%
Percent Special Districts	35.177%	19.508%	0.000%	95.206%
<i>Concentration Variables</i>				
Concentration of Local Spending	0.661	0.261	0	0.970
Percent County Spending	34.128%	28.619%	0.000%	100.000%
Percent Single Purpose Spending	45.621%	24.055%	0.000%	97.875%
Percent School District Spending	39.159%	21.944%	0.000%	97.524%
Percent Special District Spending	6.462%	10.032%	0.000%	95.393%
Local Share	55.699%	7.237%	22.079%	72.555%
Percent State Aid	37.442%	13.677%	0.000%	87.321%
<i>Demand Variables</i>				
Per Capita Personal Income	\$19407.44	\$5182.66	\$5774.29	\$73362.48
Property Tax Dependence	42.83%	17.51%	2.22%	96.06%
Population Density	129.700	431.465	0.098	12949.43

$n = 14,697$

Table 3: Regression Results

	I	II	III	IV
Per Capita Local Governments	6.545 (3.00)	9.040 (3.63)	9.233 (3.72)	- -
Per Capita General Purpose Govs	- -	- -	- -	1.775 (0.45)
Per Capital Single Purpose Govs	- -	- -	- -	12.739 (2.75)
Concentration of Local Spending	-2,989.792 (-5.43)	-1,177.399 (-2.95)	-1,094.755 (-2.87)	-1,094.793 (-2.87)
Percent Single Purpose Governments	- -	1.489 (2.01)	- -	- -
Percent Special Districts	1.261 (1.24)	- -	- -	- -
Percent School Districts	0.982 (0.95)	- -	- -	- -
Percent County Spending	-5.014 (-2.00)	-0.619 (-0.24)	- -	- -
Percent Single Purpose Spending	- -	-4.524 (-1.69)	- -	- -
Percent Special Purpose Spending	16.494 (5.12)	- -	- -	- -
Percent School District Spending	-32.843 (-7.93)	- -	- -	- -
Local Share	10.346 (3.13)	13.393 (3.67)	12.846 (3.50)	12.793 (3.48)
Percent State Aid	-8.847 (-7.91)	-17.044 (-10.24)	-17.627 (-10.79)	-17.709 (-10.80)
Per Capita Personal Income	0.020 (5.06)	0.017 (4.03)	0.017 (4.04)	0.017 (3.95)
Property Tax Dependence	-13.263 (-11.92)	-20.425 (-14.46)	-20.884 (-14.44)	-20.800 (-14.42)
Population Density	0.601 (2.18)	0.485 (1.66)	0.475 (1.69)	0.465 (1.65)
Constant	4,872.775 (10.01)	3,013.022 (7.74)	2,887.502 (9.89)	2,923.227 (9.97)
R^2	0.590	0.537	0.536	0.536
n	14,697	14,697	14,697	14,697

Robust t-statistics in parentheses. Year fixed effects excluded.

Table 4: Elasticities

	I	II	III	IV
Per Capita Local Governments	0.0405	0.0559	0.0571	-
Per Capita General Purpose Govs	-	-	-	0.0048
Per Capital Single Purpose Govs	-	-	-	0.0400
Concentration of Local Spending	-0.8146	-0.3208	-0.2983	-0.2983
Percent Single Purpose Governments	-	0.0332	-	-
Percent Special Districts	0.0183	-	-	-
Percent School Districts	0.0077	-	-	-
Percent County Spending	-0.0705	-0.0087	-	-
Percent Single Purpose Spending	-	-0.0851	-	-
Percent Special Purpose Spending	0.0439	-	-	-
Percent School District Spending	-0.5301	-	-	-
Local Share	0.2375	0.3075	0.2950	0.2937
Percent State Aid	-0.1365	-0.2630	-0.2720	-0.2733
Per Capita Personal Income	0.1629	0.1363	0.1361	0.1343
Property Tax Dependence	-0.2342	-0.3606	-0.3687	-0.3672
Population Density	0.0322	0.0259	0.0254	0.0249