DOES ONE SIZE FIT ALL? AN ANALYSIS OF TAX AND EXPENDITURE LIMITATIONS IN COLORADO

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ABSTRACT

This analysis evaluates three tax and expenditure limitation (TEL) policies in Colorado: the Taxpayers' Bill of Rights (TABOR), the Statewide Limitation on Property Tax Revenue (SLPTR), and the Gallagher Amendment (GA). It extends previous research in two novel ways. First, it enables analysis of overlapping policies while incorporating county-specific characteristics by abstracting away from specific policies. Rather, the focus rests on the impacts of these policies on property tax levies. Second, it incorporates spatial dependency to account for overlapping populations and economic activity. Within this framework, the revenue and expenditure implications of TEL policies are evaluated, and TELs are found to have material impacts in both cases. TELs are associated with depressed revenues and measurable changes in expenditure behavior. With this context, the final empirical section evaluates the drivers of successful "DeBrucing" efforts, in which localities are able to exempt themselves from components of TABOR and SLPTR. The analysis demonstrates that socioeconomic factors are the dominant determinant of voting outcomes.

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[1] For long-term price changes, this analysis uses the Chained Personal Consumer Expenditures Index. The primary reason is that the PCE, in contrast to the Consumer Price Index, accounts for changes in the basket of consumed goods over time and substitution for less expensive alternatives when the price of a particular good increases.[24]

[2] As used here, revenue yield signifies the actual, realized revenue collected by a given jurisdiction. Revenue capacity, by contrast, captures the economic potential of the tax base. We may think of this concept as the abstract revenue yield for a given county at some standard level of tax effort. If, for example, the property in county A is more expensive than the property in county B, county A can collect more revenue than county B with the same level of tax effort. In this example, county A has greater revenue capacity than county B.

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Chapter 1

Overview

1.0.1 The Taxpayers' Bill of Rights

> "Shall there be an amendment to the Colorado Constitution to require voter approval for certain state and local government tax revenue increases and debt; to restrict property, income and other taxes; to limit the rate of increase in state and local government spending; to allow additional initiative and referendum elections; and to provide for the mailing of information to registered voters?" Tax Limitations - Voting, Colorado Ballot #1, 1992

In 1992, by a vote of 812,308 to 700,906, Colorado voters chose to amend Section 20 of Article X of the Colorado State Constitution. The initiative is known as the Taxpayer Bill of Rights (TABOR), one of the most well-known tax and expenditure limitations (TELs) in the United States. A remarkable 43.3% of the total population[1] turned out to weigh in on the incorporation of an additional TEL into an increasing complicated scheme of subnational finance.

1.0.2 What is the Purpose of this Inquiry?

The purpose of this study writ large is to explore the endogenous role of fiscal institutions in emergent fiscal outcomes. The class of institutions studied here, tax and expenditure limitations, act directly on fiscal outcomes by restricting the set of feasible choices for revenue generation and the allocation of public funds. These institutions, however, are generally enacted as a response to dissatisfaction with realized fiscal outcomes. It would be reasonable to push this point further: the magnitude of the restriction bears some relationship to the extent of the dissatisfaction.

Such endogeneity is notoriously difficult to untangle, even when the scope of the phenomenon under study is restricted. In the case of tax and expenditure

[1] The population of Colorado was 3,489,832 in 1992.

Figure 1.1: Outcome of the TABOR Ballot Initiative

limitations, there are many moving parts. TELs typically have broad application, affecting jurisdictions with wide variation in socioeconomic circumstance and constituent preference. Each of these jurisdictions differs in its revenue portfolio, as well as the complexity and scope of its expenditure responsibilities. Furthermore, each of these subsystems is vulnerable to the whims of macro-level fluctuations in economic activity and legal structure. Analytic tractability requires a reduction in the data space, so that we may tie together a plausible model of the world. This reduction is necessary in any rigorous analysis, but endogeneity is not making the task any easier.

For this reason, we identify three broad objectives:

1. Evaluate the impact of TELs on revenue yield and capacity;
2. Evaluate the extent to which TELs impact expenditure choices; and,
3. Explore whether or not TELs help to align voter preferences with fiscal outcomes.

In general, it would be reasonable to classify this analysis as firmly in the political economic arena. As will be discussed, TELs are blunt instruments. Their popularity, given this lack of surgical precision, is curious to say the least. This study aims to shed light on why these policies are enacted. The upfront material and even the first two empirical sections (revenue and expenditure impacts, respectively) may be viewed as context for this motivating inquiry. The approach taken seeks to understand the drivers of votes that exempt counties from the strictures of TABOR, but these drivers cannot be comprehended without understanding the impacts of TELs on local public finance *and how those impacts vary across counties with differing socioeconomic circumstances.* The fiscal circumstances of a given county contain information not only about the material resources available to that county, but also information about the preferences

of county voters. These two informational inputs are difficult to separate from each other and voter outcomes. What follows does not speak to the separation of resources and preference, but it does attempt to address the endogeneity issue by using a predictive framework that incorporates the county-specific stress faced by the counties in the sample.

1.0.3 What is the Value Added?

This kind of analysis is not novel in a broad sense. As we will see, there exists a formidable literature on TELs. There are two major elements that differentiate this study from those that have preceded it. First, rather than focus on a single policy (e.g. TABOR), this analysis models the joint impact of overlapping policies. The most novel element of this approach is abstraction away from the explicit program elements. Previous studies have often modeled the existence of TELs with binary indicators, or built an index score based upon factors like method of passage (statutory vs. constitutional), ease of override, and the magnitude of the growth ceiling among other things. Unless we believe that the impacts of TELs are additive, binary approaches lack the informational resolution to model the joint impacts of overlapping policies.

Index methods, on the other hand, have a commensurability problem. Just because one TEL has a statutory authorization and another has a constitutional authorization, is the former fundamentally less restrictive than the latter in all cases? Even if we roll all elements of the index into the equation, does an override procedure have universal impact irrespective of the joint distribution of remaining TEL components? Both the binary and index approaches also suffer from lack of variation in the impact across jurisdictions. The restrictiveness of TELs, as we will see, is quite dependent upon the circumstances of the constrained jurisdiction.

For all of these reasons, this study attacks the issue from a novel perspective. To operationalize these policies, *the focus is shifted from program design to program impact.* Instead of asking how a TEL was passed, for example, we ask what is the feasible levy given the existence of the policy? This approach rests on a constraint function that carries arguments for revenue impact and jurisdiction-specific characteristics. In so doing, it avoids implicit assumptions about commensurability, facilitates modeling of joint impact for multiple policies, and provides continuous variation across jurisdictions. Ultimately, the aforementioned deficiencies are hard to overcome, and indeed, this study makes an imperfect attempt. We will still have to make some assumptions that are less than desirable. However, the philosophy followed here suggests that more is knowable about the impact of TELs on specific jurisdictions, and we should use that information to the extent possible.

The second major innovation in the world of TEL research is the explicit acknowledgement of spatial dependency. No jurisdiction operates in a vacuum. By virtue of the fact that this study evaluates the impact of state-enacted policies on local governments, the very design suggests that vertical relationships across governmental entities matter. Horizontal relationships are also important

components of the system. As it turns out, externalities are real. The impact of one jurisdiction influences, and is influenced by, the actions of jurisdictions in the local neighborhood.[2] In a manner quite similar to omission of temporal dependency, omitting spatial dependency can lead to false signals. Does a given jurisdiction respond to the TEL constraint as the spatially-static model suggests, or is the measured response a function of the actions of neighbors? The smaller the jurisdiction, the greater the influence of overlapping populations, commercial activity, and shared resources.

The flexibility afforded by policy abstraction and the reduction in error associated with county-specific stress indicators along with the modeling of spatial dependence clearly separate this analysis from those that have preceded it. Whether or not these innovations change the picture painted by previous literature, they seek to account for potentially confounding elements in the measurement space. In so doing, agreement would serve only to bolster the robustness of earlier findings. More importantly, however, these approaches (of which this study provides only a test drive) open the door for a wider scope of inquiry than was available with the binary and index approaches. In particular, the incorporation of jurisdictional variation in impact helps local policymakers to better understand policy implications for their own specific circumstance.

1.0.4 What is the Spatial Scope of Analysis?

The geographic scope of this study is the State of Colorado. It was chosen because it features what is widely regarded as one of the most restrictive TEL regimes in the United States. TABOR, specifically, is often mentioned in the same breath as California's Proposition 13 and Massachusetts' Proposition $2\frac{1}{2}$ when describing what a restrictive regime looks like. That being said, TABOR is just one piece of the puzzle. The TEL landscape also includes the Gallagher Amendment (GA) and the Statewide Limitation on Property Tax Revenue (SLPTR), two additional restrictions that act upon local governments.[3] All three of these policies have significant implications for the property tax, which is the dominant element of own-source revenue for local governments in the state. As a consequence of this intersection, the impact on property tax revenue is the dominant focus for operationalizing the impact of these policies.[4]

Counties serve as the unit of analysis for a number of reasons. First, general purpose jurisdictions are convenient insofar as they feature greater variety in

[2] The local neighborhood represents jurisdictions that are "close" to the jurisdiction in question. What it means to be "close" varies by analytic objective. For our purposes, we use local neighborhood to mean the jurisdictions that are spatially proximate. For a different purpose, one might alternatively define "close" to be similarity in industrial base, or demographic composition, or some other variable set of interest.

[3] Colorado features additional restrictions like Amendment 23 and policies acting on the state level. This analysis, thus, represents only a partial representation of the entire landscape.

[4] So enters an implicit assumption that is less than ideal. TABOR actually has broader revenue scope than SLPTR and GA, but the construction of the composite constraint used in the empirical modeling requires a common object upon which the policies can act. The property tax serves that role, and therefore acts as a proxy in the TABOR case for the dynamics associated with the broader revenue portfolio.

service responsibilities. To understand the impact of TELs on expenditure behavior (the second research objective), this variation will prove useful because it facilitates identification of differential impacts from TELs. Suppose an extreme case in which we have classified expenditure behavior into only high and low expenditure categories. We may be able to extract a good sense of the likelihood of a TEL pushing a jurisdiction into one category or the other, but determining the precise magnitude of the shift is less straightforward. Increasing the number of categories or switching to interval expenditure data[5] helps us answer that question. Splitting the expenditure into more functions refines our understanding even better.

Second, counties are favored over municipalities for reasons of spatial parsimony. There are 62 counties in Colorado, and two consolidated city-county governments (Denver and Broomfield). For the purposes of this study, Denver and Broomfield are also treated as counties. This choice reflects the fact that Denver and Broomfield[6] do not overlap, nor are they overlapped by, the conventional counties in the state. Moreover, this collection of 64 jurisdictions represents a spatially-exhaustive set of jurisdictional units. Municipalities do not feature these properties, nor do they consistently nest within counties. Thus, the use of municipalities would complicate the analysis substantially.

The third reason, and perhaps the most important, relates to the allocation of levy responsibility for the property tax. As we will see, property taxes are the dominant form of own-source revenue. Counties generally collect a greater share of property taxes relative to the other major general purpose jurisdictional form: municipalities.

Finally, counties are also analytically convenient from a data availability standpoint. Data are collected extensively at the county-level by both state and federal statistical authorities. At the state level, the information used in this study is collected by the Colorado State Division of Local Affairs. They provide excellent, standardized fiscal information and limited demographic information over the study window. The federal sources (predominately the US Census Bureau) do not feature the same reporting frequency in some cases, but the set of socioeconomic variables is much greater than that which is collected by the state.

1.0.5 What is the Significance of the Study Period?

This study examines the fiscal response of counties to TELs over the 1993-2009 time period. The start date reflects the first year in which all three TELs of interest (TABOR, GA, and SLPTR) acted upon the counties in Colorado. The end date, by contrast, reflects a less conceptually relevant rationale. At the start of the this inquiry, the latest available data in the Colorado County and

[5] Switching from categorical to interval data is effectively equivalent to increasing the number of categories, $n \to \infty$.

[6] According to the Bureau of Economic Analysis, Broomfield County was created from parts of Adams, Boulder, Jefferson, and Weld counties effective November 15, 2001. Estimates from BEA for Broomfield began in 2002.

Municipal Financial Compendium was for 2009.[7] The subsequent dataset build was then based upon this window.

1.0.6 A Word on TELs as an Instrument of Democracy

It will become apparent in what follows that TELs are much like sledgehammers. If binding, they can have large effects on the fiscal behavior of affected jurisdictions, producing foundational shifts in the trajectories of revenues and expenditures. Precision, however, is not the a major strength of the approach. They can just as easily create structural imbalances as combat waste, fraud and abuse perpetuated by local officials. And yet, by all accounts, they are quite popular. The student of fiscal affairs must consider why this is the case.

Canonical public finance is taught from a perspective of the state as an exogenous actor. The unfettered market, while a remarkably useful mechanism, is characterized by certain problematic defects that limit its ability to produce desirable outcomes. Public policy is typically proposed *to counteract these market failures.* The very idea that such a thing is possible requires a belief in our ability to objectively observe and diagnose a problem, and redirect activity. It requires a belief in the ability of the state to act on the economy from the outside. The orthodox question is *should the state act* given the existence of both market and government failures? It is not *can the state act* on the market?

Buchanan and Tullock, acting as critics of state action, begin to depart from this premise in the *Calculus of Consent.*[8]

> "The orthodox approach does not, however, lend itself well to a comparative evaluation of different methods of organizing activity. If we wish to compare collective organization with private organization, and especially if we want to analyze various collective decision-making rules, we need, even at the conceptual level, some means of comparing the *net* direct gains or the *net* direct costs of collective action with the *costs of organization* itself, that is, with *the costs of organizing decisions collectively [...].*"[17]

[7] In Colorado, all county fiscal years coincide with the calendar year.

[8] Their viewpoint could still be framed in a public versus private context. In reality, this is a gross oversimplification. It is convenient to frame the tradeoffs between private and public action as two forces acting against each other, but Buchanan did in fact view the state as solely a collection of rules and institutions, as is made clear in the appendix of the 2004 reprinting of the book (published by Liberty Fund, Inc). This conception was critical to his distinction between positive and normative theories of politics.

> "A positive science of politics should analyze the operation of an existing, or a postulated, set of rules for collective decision-making quite independent of the efficacy of this set in furthering or in promoting certain 'social goals'. A normative theory of politics should, by contrast, array the alternative sets of rules in accordance with their predicted efficiency in producing certain ends or goals which should be, if possible, made quite explicit."

One need not align with Buchanan's normative assessments to find value in this methodological split.

The analysis in this study is generally built on the orthodox view, but we should at least momentarily consider a reframing of public action that may make the proliferation of TELs somewhat easier to understand. Richard Wagner suggests that perhaps it is inappropriate to think of the market and state as actors.[114] Neither construct actually does anything at all. Rather, they are regulatory constructs the govern the allowable actions of people who operate within them. To borrow his terminology, they are not actors, but fora.

When viewed from this angle, *the state can only "act" on the market if the two fora are populated by different people.* The ability to separate these groups is a function of the governance structure that prevails in a society at a given time. Monarchy serves as the primary example of a governance structure that allows for separability. Indeed, Wagner suggests that our monarchal roots are the cause for the orthodox view. In a democratic society, however, separability does not hold. The same people operate in both the state and market fora. The only distinction is that each forum has its own set of operational rules that differentiate how each facilitates the extraction and processing of resources into services for the public.

Viewed from this angle, the task of the state does not exist. The task of the public is to design state rules that better align services rendered with its preferences, from within the existing, yet mutable, set of rules. Institutional rules are complex and, importantly, are not conducive to smooth adjustment as a function of societal welfare. That is, there is no straightforward way to change the rules in a way that maps exactly to the optimal welfare value for a collection of people. If a jurisdiction increases taxes on cigarettes, the measurement of the welfare impact must take into account consumers, producers, and all of the market participants' auxiliary activity related to the production and consumption of cigarettes. This view is complicated by knock on effects, as well as the existence and regulation of many other products and services. Furthermore, it turns out that welfare is difficult to measure to begin with.

Choice of rules must also contend with the issue of degradation. For its noble beginnings and the important benefits still conferred today, the American version of democracy is not without its challenges. To choose only one aspect, equal representation is more easily idealized than realized. In the modern political age, it has become clear that even the definition of equal representation is fairly unclear. At the base, we can all agree on a single vote for each voter. The ability, however, to influence the agenda confers great benefits on those who successfully leverage said influence. Attempts to limit that power, however, are hamstrung by the need to apply rules in a general way. Designing rules that do not also abridge basic rights is a significant challenge.

In this context, ballot initiatives like those that produce tax and expenditure limitations, blunt as though they may be, emerge as a method of circumventing the agenda setting power of established interest groups that have refined their ability to influence the policymaking process. They are seen as enhancing the role of the public in a democratic mechanism that must deal with some thorny issues. To be sure, interest groups have strong influence in promoting the passage or failure of these initiatives. From the perspective of the voter,

however, the at least apparent civic return may outweigh any lack of precision associated with the instruments. Furthermore, and this is important, even if the mix of outcomes is not quite right, the central tendency may be more in line with the voter's preference than the outcomes generated by conventional means. Whether or not all of the variables are appropriately weighed in decisions about these tradeoffs is an empirical question.

1.1 Layout of the Inquiry

Before any empirical testing, it is important to provide information about the operating context. Chapter 2 provides an overview of subnational finance in the US. In particular, the presented perspective seeks to provide broad justification for studying subnational fiscal institutions. Furthermore, the Appendix extends this discussion with an overview fiscal institutions in general. This study, of course, focuses on tax and expenditure limitations specifically. Chapter 3 explores the fiscal structure of Colorado, and the socioeconomic context for the study period. The chapter concludes with a detailed discussion of TELs in Colorado, and how this study attempts to operationalize them.

Given the context, the next three chapters address aspects of the research objectives detailed in Subsection 1.0.2. Chapter 5 explores the extent to which TELs in Colorado (COTELs) impact revenue yield and capacity at the county level. To the extent that COTELs modify the ability to collect revenue, these policies impact a county's capacity to deliver public services. Chapter 6 tests whether or not the intensity of COTEL constraints is associated with a deflection in the expenditure behavior of a given county. Such a deflection would affect the ability of a county to provide services that are consistent with constituent preferences. Both Chapter 5 and Chapter 6 are essentially explorations of the transactional nature of local public service consumption, the "duality" of public finance at the local level. With this context, Chapter 7 changes directions to partially explore TELs as an instrument of democracy. The big question, as identified in Subsection 1.0.2, is whether or not TELs can align fiscal outcomes with voter preferences. Before such a question can be answered, we must know what voter preferences are. This last empirical chapter tests local overrides (i.e. "deBrucing")[9] as an instrument of revealed voter preference.

Chapter 8 contains the conclusion. It presents final thoughts on what has been learned in the empricial testing and seeks to weave the findings together to see what may be said of TELs in Colorado. It will also include discussion of the extent of the study's external validity, as well as thoughts on what may be explored with future research.

[9]Douglas Bruce is a former lawmaker in Colorado, and the principal author of the Taxpayers' Bill of Rights (TABOR). Having been remarkably persistent in pushing the policy through, he has largely been seen as the public face of TABOR. Consequently, votes conducted by localities to exempt themselves from the strictures of TABOR for at least a limited amount of time have come to be known as "DeBrucing" efforts.

Table 1.1: Analytic Model Summary

Chapter	**Research Questions**	**Estimator**	**Dependent**
Chapter 5	Do COTELs increase fiscal convergence?	Pooled OLS	LISAs
	Do COTELs depress revenue yield or economic capacity?	Pooled OLS	PC Revenue PC Annual Payroll
		Repeated Spatial Lag	PC Revenue PC Annual Payroll
		Fixed Effect**	PC Revenue PC Annual Payroll
Chapter 6	Do COTELs change expenditure behavior?	Repeated Spatial Lag	Cluster Distance
		LASSO	Cluster Distance
		Fixed Effect**	Cluster Distance
Chapter 7	What is the baseline propensity to deBruce?	Support Vector Machine	Vote Pass/Fail
	Which ballot components drive vote outcomes?	Logit	Vote Pass/Fail
		Probit	Vote Pass/Fail
		OLS	Vote % Yes

**Note: Both fixed effect and random effect models were evaluated. Fixed effect models were chosen given the result of Hausman tests.

Chapter 2

Subnational Finance in the United States

The federal system of government in the United States is arguably among the most complex social coordinating mechanisms in the world. It is comprised of over 90,000 individual governmental entitites[1] characterized by hierarchical, overlapping, and irregular spatial arrangements. The national and state governments account for only 51 of these entities. Aside from a handful of territories, the remaining entities constitute the remarkably diverse local government sector. In broad terms, to borrow the Census classification, these governmental units are split into five classes: counties, municipalities, townships, school districts and special districts. These local governments vary in population size and composition, resource endowment, geographic scope, corporate purpose, and the nature by which they interact with vertical and horizontal counterparts.

2.1 Why are the Fiscal Affairs of States and Localities Important?

In his treatise, *The Theory of Public Finaince* [77], Professor Musgrave constructed a framework for conceptualizing public finance in a federal system that has proven robust to a remarkably varied set of research inquiries. This framework once again proves useful in explaining the significance of subnational finance in the US. Musgrave's approach defines three primary tasks for the public sector in an economy, and allocates those functions to the appropriate level of government. For the purposes of this analysis, the front end of the framework (function definition) proves directly applicable while some modification of the back end (allocation of functions) may be needed.

According to Musgrave, there are three primary roles for the public sector:

[1] According to the US Census Bureau, as of 2012, there were 90,106 state and local governments.[56]

- Direct service delivery (i.e. allocation);
- Redistribution of resources; and,
- Macroeconomic stabilization.

The first (allocation) is the direct product of government operation, the most direct link to taxes paid. The second (redistribution) seeks to adjust resource allocations to accord with societal preferences for distributional equity. An additional motivation for this function can be the mitigation of damages that have occured due to trade. Insofar as the cost-benefit calculation from a trade is typically considered beneficial whether or not the gains help to offset the losses experienced by ill-placed parties[55, 64], losses are free to occur by construction. The third function (stabilization) seeks to maintain an environment conducive to achieving the full potential of economic output.

As it turns out, these three functions cannot be cleanly assigned to the three levels of government (federal, state, and local). Indeed, comparatively recent literature[6, 49] suggests that the discord is even greater than Musgrave had originally believed. In any event, there is broad agreement that the preponderance of direct service provision occurs at the level closest to the recipients of services: local. Indeed, this de facto postulate is the supporting force behind Oates' Decentralization Theorem[80][2]:

> "For a public good - the consumption of which is defined over geographical subsets of the total population, and for which the costs of providing each level of the good are the same for the central or for the respective local government - it will always be more efficient (or at least as efficient) for local governments to provide Pareto-efficient levels of output for their respective jurisdictions than for the central government to provide any specified and uniform level of output across all jurisdictions."

Perusal of budgets across the three levels of government will affirm that direct service provision constitutes larger portions of the budget the closer one gets to the citizens. This is a good thing because the capacity to choose among local menus is welfare enhancing.

Direct service provision serves as the nexus at which the taxpayer realizes the connection between tax price and the return from that investment. Indeeed, this intuitive dictum accords with an argument that substantially predates Musgraves' revelation. The nascent stages of our republic were characterized by fierce deliberation over the capacity to govern such a geographically expansive jurisdiction. The concern raised by so-called "Anti-Federalists" was the idea

[2]It should be noted that Professor Oates would argue, and has argued ([83]), that Tiebout sorting is not a prerequisite for the Decentralization Theorem. Mobility is not required for the latter to have an effect. I would argue, however, that even if unnecessary, Tiebout sorting improves the efficacy of the Decentralization Theorem in the sense that mobility increases the systemic capacity to match supply and demand in the local taxation-expenditure bundle market.

that it was simply not possible to govern a space of this size because representatives could not feasibly identify with the populations they were elected to represent.[107] Again, the issue was contact. Supporting direct service delivery (a role that is critical not only to public finance, but also democracy) requires a vehicle by which said activities can propagate. That is, the resources to deliver these services must be reliably generated from a viable and stable revenue source.

2.1.1 What Normative Objectives Should be Pursued in a System of Subnational Finance?

2.1.1.1 The Importance of Local Autonomy

While it is true that the proliferation of idiosyncratic elements across local governments creates challenges in coordination, the variety is actually an asset.[108] It is this variety that provides a vehicle for demand articulation within the public sphere. Insofar as taxpayers are free to choose among a set of taxation-expenditure bundles, the system intrinsically seeks to minimize the deadweight loss associated with coerced conformity. Tiebout sorting requires some unrealistic assumptions in perfect information and costless mobility, but there does appear to be empirical support for the occurrence of sorting. The following draws upon the review of voting and sorting literature performed by Stephen Ross and John Yinger[88]:

- Individual jurisdictions are far more homogenous than the urban area in which they are contained[84];
- Within-jurisdiction homogeneity increases with the number of jurisdictions[50, 37];
- Census tracts of similar types are likely to be found within the same jurisdictions[53]; and,
- Surveyed households within jurisdictions show statistically relevant alignment in preferences about the appropriate level of public services.[48]

While this does look promising, Ross and Yinger note that homogeneity as an observable phenomenon is insufficient to prove sorting because the observed results are also consistent with the consensus bidding framework. Schmidt, however, does find evidence that increased income heterogeneity increases the desired number of school provider types.[92] This result is consistent with the predictions of the Henderson model[54], which is a derivative of Tiebout's. The implication here (albeit weak) is that public service preferences, rather than home values, drive sorting.

An extensive review of the sorting literature is beyond the scope of this inquiry. However, if we believe the sorting narrative that has provided the basis for much of the literature over the last half century, then the capacity to finance

a tax-expenditure bundle consistent with the preferences of the residents in a particular jurisdiction is essential.

If the means of finance is not available, with what resources can policymakers respond to the demands of their constituents? Fiscal autonomy requires the freedom to set expenditures *and* raise revenues to finance said expenditures.[13] Furthermore, autonomy is driven less by the overall adequacy of revenue as the control over *marginal* sources of revenue.[62] If total yield was all that mattered, local differentiation would be far less relevant. The capacity to deviate is what enables accommodation of local preference.

2.1.1.2 Local Tax Design

Establishing a local tax requires an awareness of both general tax design and the environment in which the tax is to be levied. Bird identifies the properties of a good local tax and suggests consumers of his research seek to equalize benefits and costs at the margin *when possible*.[3][13] A truly local tax features four major characteristics:

1. Local assessment;
2. Local rate setting;
3. Local collection; and,
4. Accrual of proceeds to the local entity.[4]

Having established the operational handles of an abstract local tax, the choice of specific taxes should strive to capture the ideal elements of such a tax: immobility, adequacy/buoyancy, stabilty/predictability, fairness, administrative ease, non-exportality, and visibility (i.e. transparency). For the most part, these characteristics are goals for any tax at any level.[5]

The property that stands out in the local context is immobility. In the revenue schema of fiscal federalism established by Oates in 1972[80] (and subsequently supported by Bird, Gramlich, and others), the idea of open and closed jurisdictions plays a prominent role. Closed jurisdictions are characterized by sufficiently high exit costs as to discourage departure from the jurisdiction over a wide range of tax prices. While the national government may feature this property, local governments do not. Local governments must contend with open

[3] Bird captures the latter suggestion directly: "Whenever possible, charge."

[4] Note that the third and fourth characteristics are distinct insofar as collection is simply an activity, while the absorption of proceeds dictates where the resources will ultimately reside.

[5] Note that these are theoretical objectives for tax design, identified for the purpose of maintaining a tight coupling between revenue generation and expenditure allocation. Such a coupling seeks to create a tight response for taxpayers, so that they may link the costs they feel from taxes with the benefits of service delivery in a manner that minimizes noise from other factors. The stronger this linkage, the greater the capacity for taxpayers to equalize costs and benefits at the margin. In practice, however, political expediency has an outsized role in the selection of available revenue handles, and can distort the role of other characteristics. For example, from a political perspective, exportability becomes an asset for those promoting a given tax.

borders, also known as low costs of exit. It is for this reason that a graduated income tax with comparable progressivity to the national model does not exist at the subnational level. Local officials are worried that taxpayers may simply choose to reside somewhere else. In this light, the fixed nature of real property makes it an attractive base upon which to levy a local tax.

2.1.1.3 Duality in Public Finance

> "The classical approach to the theory of Public Finance - with its neglect of the expenditure aspects of public economy and its overemphasis of the consideration of justice in its treatment of the revenue aspect of the problem - had left the revenue-expenditure process outside the body of economic theory." - Richard Abel Musgrave, 1939

Professor Musgrave described here a concept that dates at least as far back as Adam Smith's *Wealth of Nations.[101]* Smith's work is probably among the most prominent writings in economics that advocates for the ability-to-pay principle.[6] While ability-to-pay does well to explicitly address equity concerns, using the concept as an analytic base facilitates neglect of a fundamental characteristic of public finance. Musgrave's "revenue-expenditure process", Wagner's "quid pro quo" or "consensual democracy"[113], and Burkhead & Miner's "general equilibrium analysis" or "balance sheet" approach[19] are all slices at the same underlying concept: duality.

Revenue systems cannot, and should not, be divorced from the public services they finance. Though this fact was recognized with the advent of marginal utility economics (particularly as advanced by Wicksell), it has not yet made much headway in popular discourse over economic policy in the United States. Too often we see tax discussions without thought to programmatic impacts and vice versa. As we will see, this disconnect has created conditions that drive an even larger wedge between considerations of public revenue and expenditure.

2.2 What does Subnational Finance Look Like in Practice?

Theoretical knowledge of "proper" tax design and a strong appreciation for the normative role of subnational finance are important from a foundational perspective. However, theoretical constructs are insufficient to operate in the real world. The competent fiscal manager requires knowledge about the characteristics of the revenue bases in question, trends in base activity and expenditure risk, and the institutions that govern the linkages between the economic capac-

[6] Adam Smith, himself, did not actually support the neglect of the expenditure side of public finance in his writings. Rather, this phenomenon was a product of his successors - McCullock, Nassau Senior, James Mill, etc. - who distilled Smith's message down to a narrower vision.

ity of a given population and its desired basket of public services. In short, one must understand the operating context.

2.2.1 The Economic Significance of the State and Local Government Sector

The role of government, as measured by its size relative to the total economy, has grown signficantly since the beginning of the early 20th century. Given the comparatively low-level of resources allocated to the judicial and legislative branches, this growth has been driven by increases in the executive and regulatory capacity of government at all levels. Figure 2.1 depicts the trajectory of total government receipts and expenditures as a percentage of gross domestic product. As one might expect, both receipts and expenditures tell similar stories. Between 1929 and 2013, receipts grew from 10.04% of GDP to 28.56%, while expenditures grew from 8.03% to 33.77%.

This growth reflects the rise of what Dwight Waldo referred to as the "administrative state".[115] Although the growth in government we were to experience in the US was unprecedented, it was by no means an accident. Rather, it was a consequence of the intersection between a growing population and the prevailing culture.

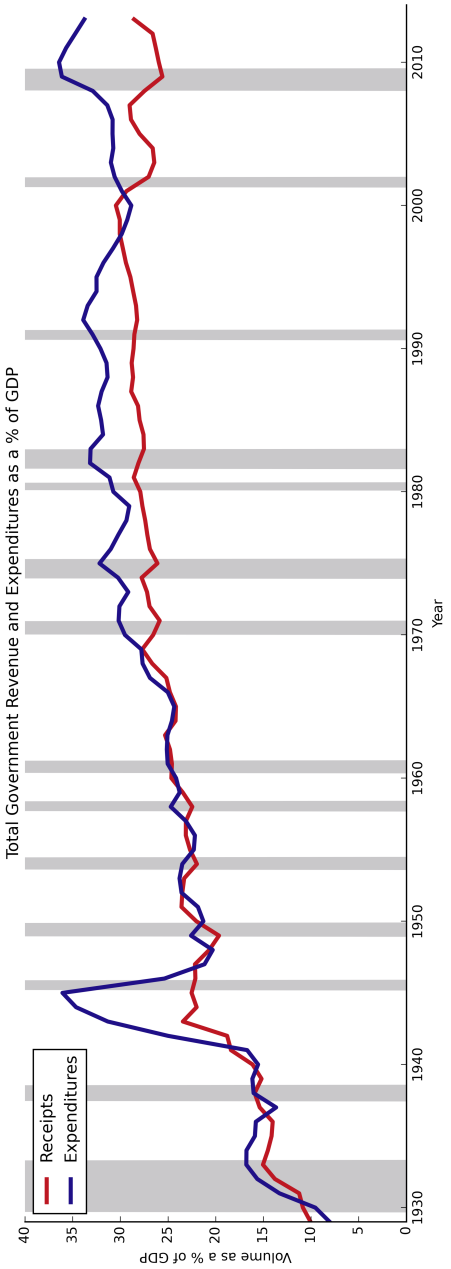
> "[D]espite occasional claims that public administration is a science with principles of universal validity, American public administration has evolved political theories unmistakeably related to unique economic, social, governmental, and ideological facts."[115]

In effect, the growing population placed a strain on existing methods of allocating resources and conducting the business of running a country. Interdependence amongst people was growing, which highlighted the need for methods of promoting common expectation. If two parties are to engage in a fruitful manner, some common set of rules is required. The sheer number of such engagements grows faster than the population[7], and the potential for variation in the engagements grows with it. Furthermore, as the economy matured, industrial activity became more differentiated, specialized, and technical. Establishing common expectation in this circumstance requires a regulatory apparatus with specialized training. Ignorance of this fact was a perilous strategy.[22] The resource base required for a governmental apparatus to achieve these efficiencies was larger than had been previously required.

Although the federal government has expanded more rapidly than the state and local sector, subnational finance still increased its share of the economy over the course of the past century. Over the 1929-2013 period, Figure 2.2 shows that subnational receipts grew from 6.79% of GDP to 12.68%, while subnational expenditures grew from 5.45% to 14.02%. As can be seen, the sector grew quite rapidly early on, before a temporary decline in the mid-1930s. Much of the

[7] Consider a population of two people. The addition of a third person adds not one, but two additional avenues for engagement.

Figure 2.1: Growth in the Size of Government



early experimentation with new methods of administration accordingly started in state and local governments.

2.2.2 The Role of the Property Tax in Financing Local Government

Over the course of US history, financing the array of service responsibilities contained within any given local government entity has required careful and ongoing cultivaton of a revenue portfolio that seeks to draw upon the economic activity contained within (or near) the jurisdiction in question.[8] Amongst all revenue options, taxes dominate the space. That being said, as Figure 2.3 shows, their importance has declined over the past century. Between 1929 and 2013, taxes dropped as a percentage of total subnational receipts from 90.14% to 69.24%.

Focusing on local governments, despite a variety of revenue instruments from which to choose, one has stood out over time as the dominant source of local receipts: the taxation of property. This instrument serves as both the motivation behind, and the primary driver of, the empirical analysis that follows.

The property tax as an object of study is an immense topic worthy of the extensive literature devoted to it. This study is specifically motivated by what has been popularly described as the erosion of the property tax base. Insofar as they reduce property tax revenue by construction, the impact of deviations from the property base carry clear first order effects. The ultimate systemic impact on revenue performance and utilization is less than clear. It is not known, for example, whether or not these deviations make the property tax a more palatable revenue instrument for taxpayers. As noted by Glenn Fisher [43], there are competing forces at work in a complex political economic system. The resultant of these forces appears to require empirical identification. This study does not address this question per se, but it does explore the related topic of the implications associated with policies seeking to limit the property tax's scope of application.

Property taxes have managed to maintain strong yields over time, and still remain the single largest revenue source for local governments. This compositional prominence, however, has experienced a notable decline. Between 1959 and 2012, property tax revenue declined as a percentage of local current receipts from 53% to 36% (Figure 2.4).

As with the entire state and local sector, we see that the declining importance of property taxes for local governments coincides with the declining importance of local taxes generally (Figure 2.5). Tax receipts as a percentage of total current receipts has declined from 63% to 50% over the 1959-2012 time period, offset entirely by a larger rise in current transfers from other governments (31% to 48%). Within tax receipts, the decline in proportion of property revenue is still significant, if less dramatic (84% to72%). Sales taxes (7% to 16%) and income

[8] This characterization encompasses only own-source revenues and not intergovernmental transfers.

Figure 2.2: Growth in the Size of Subnational Government

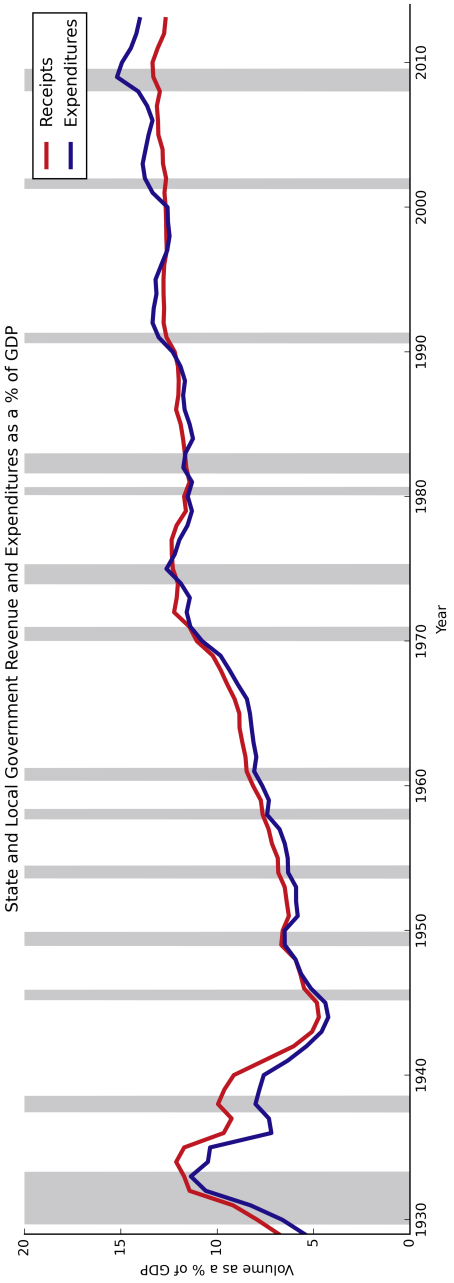


Figure 2.3: Decline in Tax Proportion of Subnational Receipts

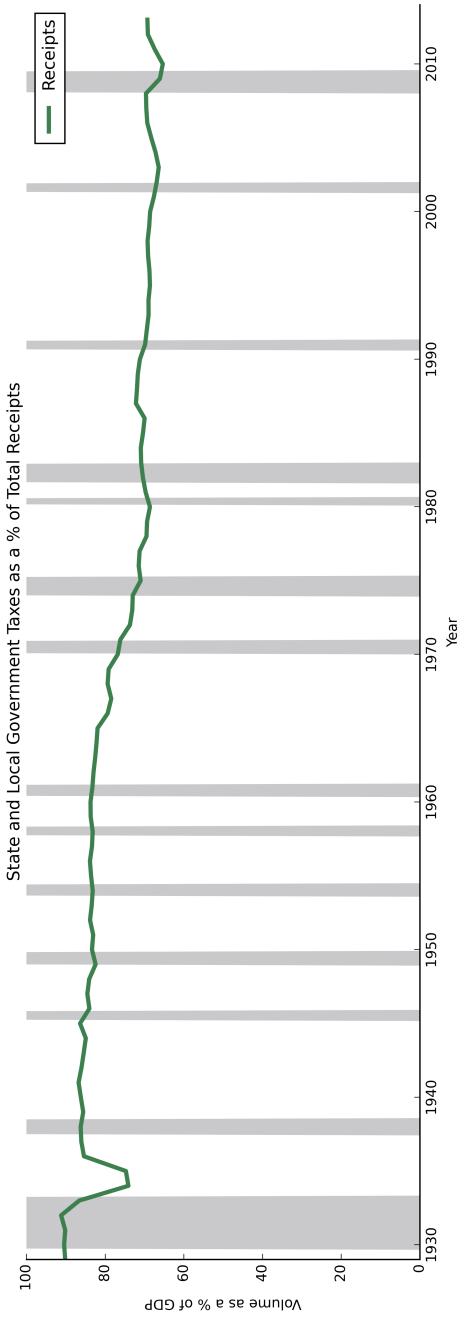
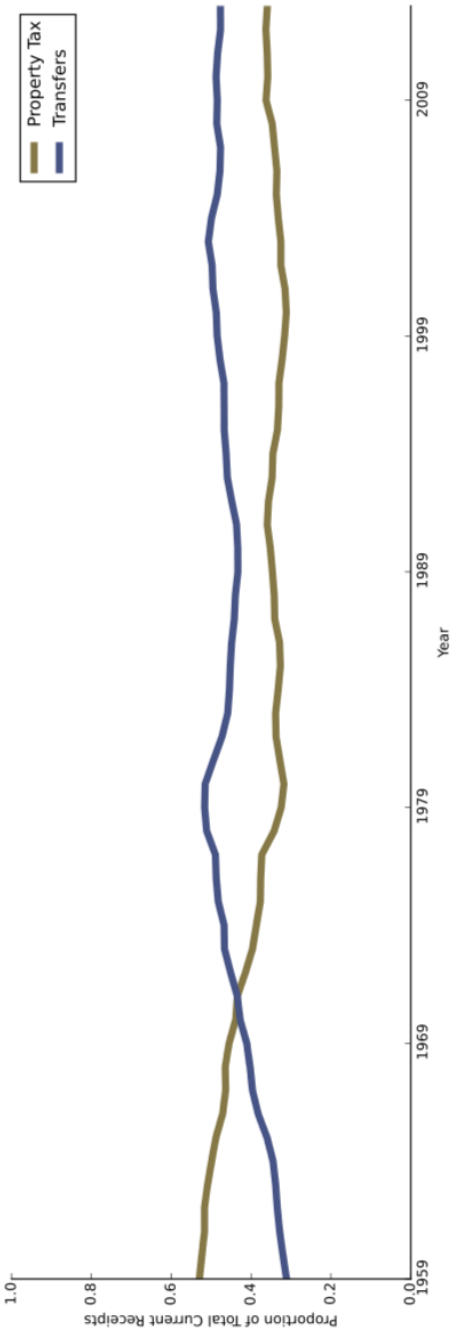


Figure 2.4: Property Taxes and Transfers as a Proportion of Total Local Current Receipts



taxes (1% to 4%) have filled the void. Nevertheless, the continued importance of the property tax cannot be overstated.

The decline of the property tax is quite marked beginning in the 1970s. The likely culprit is the tax revolt that occurred during this period, which brought a wave of base eroding measures. The impact of this class of measures on fiscal behavior is the subject of this study.

This so-called tax revolt was the product of a confluence of economic and social factors. The 1970s saw two recessions, a marked decline in real GDP growth, and a sharp increase in inflation (Figure 2.6). Citizens still recalled the remarkable expansionary period that had preceded the decade, a time of growing incomes and a voracious appetite for social progress. Irene Rubin captures well the environment that spawned the strong anti-tax sentiment:

> "Citizens have often endorsed or even demanded rapid expansion, but when projects fail, when citizens' incomes lag and they no longer feel they can afford these projects and programs, or both, they withdraw their support for additional taxation or try to reduce their tax burden."

The consequence was a wave of reforms, designed to aggressively lower taxpayers' most visible local liability, the property tax.

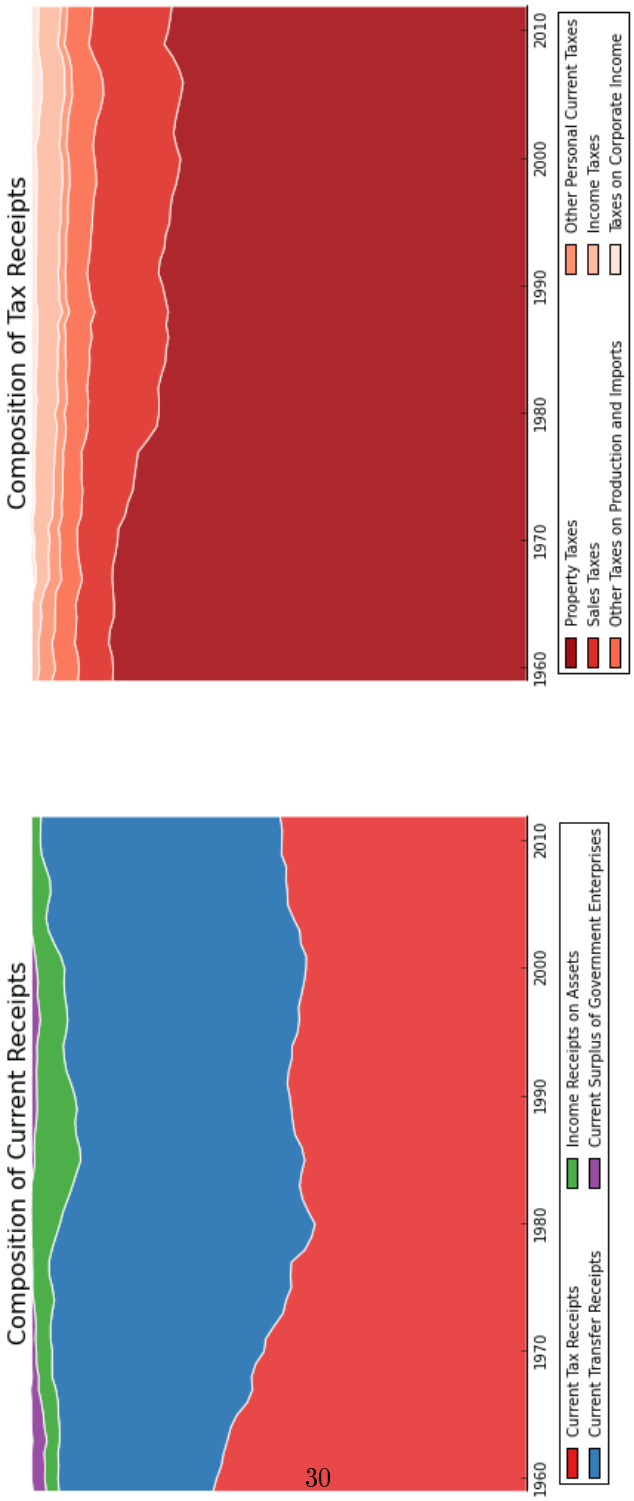
The implications of these reforms was far-reaching. The central role played by the property tax makes it a critical tool of fiscal autonomy. Unlike transders, which rely on the willful participation of other jurisdictions, taxes are designed by the collecting jurisdiction. They are thus customizable, tailored to suit said jurisdiction's needs. As has been demonstrated, the property tax plays a dominant role within this space.

2.2.3 Growth and Volatility Factors in Local Public Finance

> "'Policy handles' are merely levers that local officials can use to adjust at the margin the fiscal health of their local governments as opposed to precision tools that can bend and shape the environment to their will."[57]
>
> Figure 2.7[9] represents the strategies that a local fiscal manager can take to effect changes in the operations of his/her jurisdiction. The size of each circle reflects the amount of opportunity the manager has to pursue such a strategy. Note that the smallest circle contains the "Control" strategy. The interpretation is that there are few scenarios in which the local fiscal manager has complete deterministic control over the outcome of a particular policy. One example of such an opportunity would be the selection and implementation of

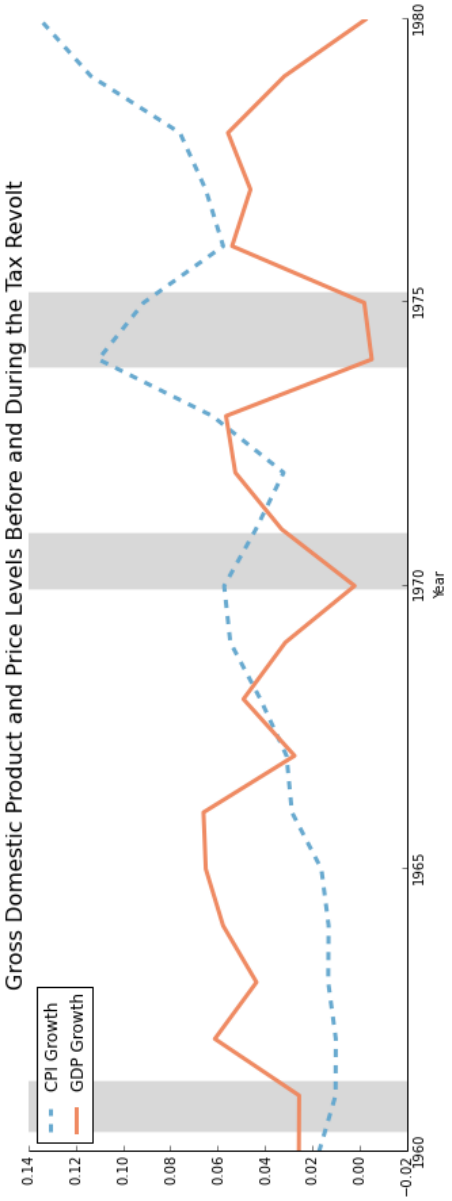
[9]The figure is a recreation of Honadle et al.'s adaptation of the framework developed by Smith and Thoolen.[112]

Figure 2.5: Sources of Local Receipts



Note: "Income Receipts on Assets" indicates interest, dividend, and rental income on assets.

Figure 2.6: Macroeconomic Turmoil in the 1970s



the accounting system used to track receipts collected by the jurisdiction's tax authority. With each successively larger circle, the subset of variables controlled by the manager for a given policy outcome decreases. The largest circle, the "Appreciation" strategy, captures those outcomes for which the manager has almost no control at all. A decision by the state to cut state aid to local governments would likely fall into this category. The implication of the small area allocated to "Control" is that very little of the forces that act upon a local government are under the control of the manager, creating a tumultuous environment for fiscal responsibility. It is this uncertainty, the details of which will be elaborated upon shortly, that drives the need for a stable and reliable revenue portfolio.

Tax and expenditure limitations would fall within the "Adaptation" sphere. In our case (Colorado), they are imposed by the state on local authorities. The impacts of these policies are mitigated only by utilizing supplemental revenue sources, or successful execution of a local override ("deBrucing"). In general, local authorities have little opportunity to avoid these policies completely.

2.2.4 The Importance of Demography

One of the primary challenges facing fiscal managers at any level of government in the US is the deomgraphic shift that is occurring in the country. For local managers, there are three key areas that must always figure prominently in planning for the future: the senior population, school age children, and migratory patterns.[57] The first two deal directly with the provision of expensive services while the last drives both expenditure and revenue side concerns. At the current time, the imminent growth in the senior proportion of the population represents the elephant in the room:

> "[T]he growing debt [...] reflects an imbalance between spending and revenues that predated the recession. Whether that debt will continue to grow in the coming decades will be affected by not only long-term demographic and economic trends but also by the policymakers' decsions about taxes and spending. The aging of the baby boom generation portends a significant and sustained increase in the share of the population receiving benefits from Social Security and Medicaid, as well as long-term care services financed by Medicaid. Moreover, per capita spending for health care is likely to continue rising faster than spending per person on other goods and services for many years [...]."[20]

While healthcare spending growth has actually slowed significantly in recent years[29], the point is still a salient one with respect to drivers of fiscal exposure. Furthermore, provision of economic security in the "out years" of life is not a new concept.[10] The idea is fundamentally based upon the insurance concept and it

[10] One can find a history of the concept on the Social Security Administration's website.

dates back to the Ancient Greeks who stockpiled olive oil to fortify themselves against fluctuations in the economy. The modern US Social Security program was initiated in 1935. The life expectancy in that year was 61.7 years[5]; the earliest benefits from the program are payable at 62 years of age.

Medicare is essentially a healthcare-specific variant of the same concept. Congress initiated this program in 1965, a year in which life expectancy in the US was 70.2 years. This program pays out full benefits at age 65. Both Social Security and Medicare have grown substantially as a function of improving health outcomes, and this effect is exacerbated by bulges in the age distribution. In particular, the "Baby Boomer" generation has already begun to place considerable strain on the solvency of these initiatives.

This macro-level environment has direct and indirect consequences for local fiscal managers. The first direct impact involves increased expenditure exposure in functions related to emergency services and any funding for senior care. The second direct impact reduces receipts by way of senior-related tax non-neutralities (e.g. property tax credits for seniors). Indirect impacts are driven by increased expenditure risk for governments at the state and federal level. To the extent that the administration of these programs reduces the available funding for aid to local governments, the local fiscal manager must find creative solutions to funding shortfalls.

2.2.5 The Evolution of the Economy

One of the greatest challenges facing local jurisdictions is the evolution of the economy. The well-recognized trend away from hard goods production to services[106] undermines the traditional revenue handles held by local governments. As mentioned previously, one of the most critical aspects of a local revenue portfolio is a reliable, and preferably, *immobile* revenue source. The immobility of the property tax base, for instance, derives much of its value from the decision of economic actors to site themselves within the jurisdiction in question. To the extent that economic coordination requires spatially proximate association to a decreasing degree, local governments are losing the capacity to leverage this siting choice. Even if the country as a whole experienced no net loss in population, those local jurisdictions with comparatively high revenue requirements stand to lose a great deal. Beyond that, siting within the US in general is not quite as necessary as it was at one time.

This phenomenon is not entirely driven, however, by revenues. Before any consideration of remote coordination occurs, jurisdictions must have the capacity to support it:

> "An information-based economy that is fueled by advanced telecommunications may mean that small cities and rural areas - many already with declining population and job bases - lose locational advantages derived from proximity to railroads or water."[57]

In general, the onset of the information age is catalyzing a fundamental shift in the nature of economic interaction in this country. This shift is necessarily

coupled with a shift in the relative value of factor inputs. Strategic governance decisions of the past are, for many local jurisdictions, becoming liabilities. The challenge for local officials is to adapt in a manner that retains or recreates relevance for the their jurisdiction. The transition is costly, placing further emphasis on the need to safeguard reliable sources of revenue (even when said sources are plagued by base erosion).

2.2.6 Macroeconomic Events

One of the lessons learned from analysis of local fiscal capacity is the following: *successful fiscal operations require anticipation of, and responsiveness to, macroeconomic shifts.* This issue is particularly acute at the local level since the available responses are more related to adaptation than influence. Obviously the capacity for anyone to anticipate a specific occurrence of an economic downturn is quite limited. The appropriate course of action is a probabilistic assessment, coupled with the appropriation of a sufficient multi-year revenue buffer to help weather the storm.

For the local fiscal manager, the assault on revenues during a recession comes from multiple fronts. The first, and most direct, impact comes from the reduced tax collections stemming from a reduction in economic activity.[11] The second front involves the "automatic" fiscal response stemming from a sharp increase in the dependency ratio.[12] The third front is a function of the intergovernmental fiscal transfer system.

For good cause, the intergovernmental transfer system has emerged as a method of mitigating the intrinsic difficulties in local revenue generation and expenditure responsibility. Local governments must contend with mobile tax bases, and often expenditure needs that are geographically out of phase with revenue capacity. The downside of this development is a strong dependency by local governments on transfers from both state and national coffers. When the economy enters a recession, while the impacts on own source revenue may differ as a function of revenue base disparities, a certain amount of conditional correlation in revenue yield occurs. Not only are local fund sources depressed, but state and national governments are far less able to provide the same contribution via transfers. States are far more constrained given prevailing balanced budget requirements, but national governments can also be constrained (particularly given pre-existing debt or more pressing political factors).

[11] Economic activity, as used here, captures both the value generated from transactional interactions among economic actors and the change in capital value associated with said transactions. For example, many buyers and sellers in a local real estate market generate value with marginal returns to each transaction on average. Such a market is also likely to see increases in the value of the housing stock as a whole. Both are functions of underlying demand, which would be depressed in a recession.

[12] In this context, "dependency ratio" cost captures increased expenditures that occur with growth in the impoverished portion of the resident population. This is in contrast to the traditional age-related definition, which is defined by the proportion of children and seniors.

2.3 Motivations for Limiting the Property Tax

Public opinion is of the upmost importance in a democratic country. For the most part, the distant tails of the political distribution have limited impact on the policies actually effected by policymakers. However, once opinions gain critical mass, they can have large effects. This can be particularly so when facilitated by legally sanctioned citizen participation vehicles like ballot initiatives. Proposition 13 in California, Proposition $2\frac{1}{2}$ in Massachusetts, and TABOR in Colorado are likely to be the most well-known examples. Nevertheless, statutory deviations from the property tax base have occurred as a general phenomenon in the US.

2.3.1 The Argument Against the Property Tax

The tax revolt of the 1970s was not the first effort seeking to limit the scope of the property tax. The unpopularity of the tax has an extensive history, including a period characterized by disdain from both the general public and students of fiscal affairs.

> "If any tax could have been eliminated by adverse criticism, the general property tax should have been eliminated long ago. [...] No commission appointed to investigate any tax system, which has had time, means, and inclination to secure the evidence, has failed to recommend the abolition of the tax or measures tending toward fundamental modification."[60]

This quote captures a prevalent view among academics in the late 19th and early 20th centuries in the US. The animosity was borne of both seemingly intractable theoretical problems with the revenue instrument as well as deficiencies in administration. Edward Seligman of Columbia University constructed a multi-facted attack in his *Essays on Taxation*.[95] In his view, there were five damning features that made the tax "unendurable".

2.3.1.1 Lack of Uniformity

The tax is not actually an ad valorem tax in the sense that it is not levied on a fixed percentage of property value. Instead, the assessment ratio and/or tax rate are calculated in a way that takes the taxing jurisdiction's desired total levy as a primary argument. This construct creates the capacity for significant variation in burdens across jurisdictions, due to the variations in fiscal requirements. The result is horizontal inequity.

2.3.1.2 Lack of Universality

Despite numerous historical attempts to create a general purpose tax (which Seligman discusses in some detail), the practical problem of capturing personal property in a way that is commensurate with levies on real property creates

disparities in burden that are driven by occupational genre rather than ability to pay or benefits received. These practical problems are a function of both political manipulation and the difficulty in getting a handle on intangible/administratively inconvenient personal property.

2.3.1.3 Incentive for Dishonesty

When entire classes of property are exempt from taxation, Seligman correctly argues that avoidance incentives are high. The rational taxpayer will shift assets to protected classes whenever possible. In many cases, such practices have exerted pressure on, or entirely breached, the boundary between avoidance and evasion.

2.3.1.4 Regressivity

Seligman's context for this complaint involved his observance of the transition away from the agrarian social context that characterized the early period in US history. In particular, farmers were disadvantaged in the practical taxation of property because their assets were quite intangible and visible. In contrast, holdings derived from trade often enjoyed tax exempted status, either de facto or de jure, as a consequence of their intractability as administratively feasible tax handles. Since trading wealth often exceeded that which was derived from agriculture, this feature was a regressive one. This framework holds today in the sense that personal property can drive a tremendous wedge in aggregate asset holdings across homeowners. To the extent that personal property is taxed inconsistently at best, Seligman's concerns are still valid.

2.3.1.5 Double Taxation

Property is taxed in practice based upon the value of the asset, *not the value of the property owned by the taxpayer.* Insofar as the development of modern finance techniques has bifurcated equity stakes in a given piece of property, the individual that physically holds the asset is being taxed on his/her property *and the property which is owned by the financial entity that has provided the liquidity for the taxpayer to buy the asset.* This was perhaps Seligman's most significant condemnation because it identified a structural phenomenon with the potential to divorce the basis of taxation from an individual's ability to pay.

2.3.1.6 Periodicity

Unlike the sales tax which is levied at the point of sale, and the income tax which is largely withheld, the property tax stands out for the timing of payments. Property tax payments are collected rarely and are correspondingly large when collected. This creates a very high level of visibility of property tax liability, and the economic pain of payment is comparatively acute. From a theoretical standpoint, *this is actually a positive feature.* The nature of property tax payment promotes transparency, as taxpayers cannot avoid thinking

about the liability. In the real world, however, it is largely this feature that has contributed to widespread popular disdain for the tax. This is partciularly so for taxpayers with fixed incomes that reside in property they own.[13] That being said, in practice, the ability to leverage escrow accounts has attenuated the "pain" issue to a limited extent.

2.3.2 The Argument For the Property Tax

For all of the reasons detailed in Subsection 2.3.1, the property tax endured an aggressive movement to develop other sources of revenue. Furthermore, there were widespread statutory and constitutional efforts to narrow the property tax base and reduce its role in financing public expenditures in the early 20th century. These efforts were, however, undermined by changing fiscal circumstances. The same period saw a sharp increase in public expenditure responsibilities as a consequence of a growing, urbanizing population and a "lengthening of the period of cumpulsory school attendance."[79] In particular, the productivity of the property tax as practiced was the source of a new lease on life. That is, the expanding role for the state was well-served by the reliable revenue provided by the property tax. It should also be noted that the property tax, due to the timing of the assessment/collection cycle, has favorable cyclical properties. As a practical matter, local officials must be concerned with the decline in revenue associated with economic downturns. As a consequence of assessment lag, the property tax will typically not decline in yield immediately (as would income and sales taxes). The delay helps to smooth local revenue profiles and lessen the impact of macro-level shocks.

Bolstered by the strong practical rationale for continued reliance on the property tax, scholars have taken note of strong theoretical arguments. As previously mentioned, the immobility of the property tax base reduces concerns regarding the flight of the tax base from a given jurisdiction. Furthermore, the property tax can be supported from a benefits received perspective. While there are difficulties coupling liability to home value, on the public consumption of services side, the property tax can be viewed as the price of services rendered in the jurisdiction.[81] School finance, in particular, features a significantly interdependent relationship with home values. Home values drive the *capacity* of the revenue base, but these home values simultaneously incorporate school availability via capitalization. From an ability to pay perspective, to the extent that home values are at least partially correlated with incomes, the instrument does have a progressive component to it (non-neutralities notwithstanding). In general, despite Seligman's critique, there is a strong rationale for the property tax's continued use.

[13] In 2013, the Washington Post published a four-part series (*Homes for the Taking)* detailing the circumstances by which many fixed income residents fell behind on their property taxes. In many cases, these leins led to eviction. Such stories grow the disdain for the tax. A more nuanced consumption of the information revealed that challenges in administration may have been more influential than the city's property taxation regime.

2.4 What are Fiscal Institutions?

> "Fiscal institutions are not just there; they come into being and develop over time. To understand more fully the workings of the public sector, we must recognize that fiscal institutions are themselves endogenous. [...] Moreover, since fiscal institutions are themselves a subset of governance institutions, their evolution cannot be adequately described or understood solely within the framework of public finance."[83]

To understand the impact of tax and expenditure limitations, it is critical to have some idea of the other reforms that have their genesis in the same environment. Furthermore, in setting the stage for the institutional reforms that have beset the property tax in modern practice, it is critical to understand the social context that permitted such reforms to take place. As discussed in Section 2.3, there are theoretical underpinnings to legitimate criticism of the property tax as a method to finance public services. These fundamental concerns are complex and in many ways require a nuanced understanding of taxation in general to sufficiently comprehend and design constructive reform in practice. In the real world, however, students of public finance are all too rare. Admiteedly, the author's bias shines through here, but there is a kernel of truth in the sense that the motivating factors for reform are often discordant with constructive progress. Students of public finance need not possess any undue hubris in identifying with Oates' observation:

> "[Political decisionmakers] sometimes design fiscal institutions to solve political rather than efficiency problems. When fiscal solutions have unintended effects, particularly when changes in fiscal institutions at one level of government influence fiscal or political outcomes at another level of government, these changes in one period generate forces makeing for further changes in later periods."

In this sense, Oates is making a revenue side observation that parallels a consistent theme in the expenditure side work of Aaron Wildavsky.[116] To paraphrase, *a theory of public finance is a theory of politics also.* Social dynamics and political developments are fundamental arguments in public finance, and not simply because they have some impact on outcomes. Political structure is the substrate upon which public finance, as a field, is built. In subnational finance, welfare potential is a direct result of the political institutions that govern the capacity of the citizenry to associate, express governance opinions, and make siting decisions. The link between welfare potential and political structure lies in the latter serving as an input into the cost structure of the permissible and "prohibited" activities available to the citizen.[14]

Thus, while we can advance the economic critique of reform movements and outcomes, we cannot lose sight of the fact that the economic calculations reveal

[14] This point can be interpreted as an abstraction of the point made by Oates: variance in local demand drives the potential for welfare gains.[81]

only a part of the broader tapestry of social interactions. There is an emerging literature that has sought to shed light on this perspective which Oates has referred to as the "political economy approach to fiscal federalism." It differs from the fiscal federalism approach that Oates advanced in 1972, largely due to differing evaluations of two key assumptions. First, traditional fiscal federalism assumes that officials seek to maximize the welfare of the jurisdiction they serve. This pursuit leads naturally to strong welfare gains as a consequence of local variation, leading to tax-expenditure bundles that can be better tailored to local conditions. The political economy approach makes no such assumption, leaving room for political calculation that may be out of phase with actual maximization of constituent welfare.[85, 11] Second, the political economy literature does not assume, as traditional fiscal federalism does, that central provision implies uniform public output. Variations in output can and do arise from the legislative process and the insertion of non-neutralities. These non-neutralities typically arise as a consequence of the variety of political power endowments and cultivation efforts across local jurisdictions.[93] I would extend this further to remark that, in the context of varying local conditions, the effect of non-neutralities is far from clear cut. Moreover, variance in local implementation carries its own additional source of variance in public outputs.

This view of political economy of public finaince is salient in the current discussion because it suggests that political palatibility is a major element in the assessment of good public financial practice. Although the institutional reforms have limited the efficacy of the property tax at any given point in time, these reforms may bear fruit when assessed over time. If these reforms prolong the use of the property tax, then a tool of fiscal autonomy - whatever its faults - has been preserved. Indeed, the third empirical section in this study scratches the surface on the idea of fiscal institutions as an instrument of democracy. This is not to imply that the operational impacts of the day are to be ignored. Some limitation of efficacy can arguably be tolerated in the service of prolonged use *so long as the reforms do not result in fiscal impotence.* It is thus critical to evaluate each of the institutional reform classes that have taken a foothold in the modern US subnational finance environment. However, in the interests of continuity, the detailed discussion of non-TEL fiscal institutions has been relegated to the Appendix. Only generally applicable tax and expenditure limitations are discussed here.

2.4.1 Tax and Expenditure Limitations

Tax and expenditure limitations, or TELs, are direct attempts to limit the growth in property tax liabilities. The vehicle for this limitation is an explicit constraint on one of three targets: the tax rate, the assessment base, or the entire levy. Mullins and Joyce defined six types of limitations[61]:

1. *Overall Property Tax Rate Limits* set a ceiling on the property tax rate for all jurisdictions in the state;

2. *Specific Property Tax Rate Limits* set a rate ceiling for particular types of

government or different service areas;

3. *Assessment Increase Limits* cap the growth rate of the assessment base;

4. *Property Tax Levy Limits* cap the growth of property tax revenue;

5. *General Revenue or Expenditure Limits* cap the growth rate of total revenues or expenditures for the state; and,

6. *Full Disclosure/Truth-in-Taxation* provisions require explicit information to be supplied to the public regarding tax changes, and often require a specific vote to increase rates or levies.

It is all too common for these devices to be used in tandem. A perfect example would be California's Proposition 13, which has oft been cited as the beginning of the most recent TEL movement.[38] Within two years of the passage of Proposition 13, 43 states had also implemented some kind of property tax limitation measure, 15 states had lowered their income tax rates, and 10 states indexed their income taxes to the rate of inflation.[94]

Admittedly, Proposition 13 was a particularly aggressive limitation effort. It does serve, however, to demonstrate the types of impacts that can occur with these reforms. Such effects do not occur everywhere, particularly when reforms are not of the binding variety defined by Mullins and Joyce. Binding limitations provide no workaround to achieve the same revenue targets. A two-part composite reform created this environment in California. Passed on June 2, 1978, Proposition 13 limited assessment increases to 2% annually and mandated a rate ceiling of 1%. Rather than address the revenue yield directly, voters chose to limit the base and rate inputs. Furthermore, assessed values reverted back to 1976 levels. Couple this reduction in the base with the practice of acquisition value assessement, in which real estate values only reflect the market value at the time of sale, and one gets a potent mix for revenue reduction.

> "The effect was dramatic. Property tax revenue immediately fell by 57 percent across the state. Local governments in California collected over $6.6 billion less in property tax revenue in 1979 than they did in 1978 (Citrin 1984). California property taxes went from 51 percent above the national average in 1978 to 22 percent below the average in 1981."[117]

The stringency, scope, and type of limitations vary across states, and in turn, so do the impacts of these reforms. Many observers, however, have noted some common themes. TELs appear to be related to a reduction in educational services output. Figlio and Rueben find that the quality of teachers produced, as measured by the relative test scores of education majors, is lower in TEL states.[41] Downes et al. find limited evidence of poorer student performance in TEL districts, but caution that 1) the variation in impact suggests that only some districts are adversely impacted and 2) the impacts of TEL implementation have not yet forced dramatic cuts to education.[31] Downes and Figlio has more

to say on this front, noting that local governments impacted by TELs tended to feature lower math testing scores from students.[32]

TELs have been defended as grassrotts efforts, but the ironic reality is that they often adversely affect local autonomy. Mullins & Joyce[61] and Edwards[38] have observed that TELs encourage greater reliance on non-tax revenue, but this source has been insufficient to cover the gap. The consequence is greater reliance on state funding for local services.[102, 103] The increased reliance has resulted in an upward shift in the locus of authority for local services, and a proliferation of special districts at the local level.

While Colorado's TEL regime is not quite as extreme as California's, it still features overlapping policies. In particular, there is the SLPTR, TABOR, and the Gallagher Amendment. The impact of these policies is the focus of this study, and their characteristics will be explored in detail in Section 3.4.

2.5 Do TELs Alter Local Fiscal Behavior?

In their study of Proposition $2\frac{1}{2}$ in Massachusetts, Cutler, Elmendorf, and Zeckhauser[28] noted that "[c]itizens have increasingly resorted to referenda when they do not trust their elected officials to serve their interests." The situation appears to be a classic agency problem[15], insofar as constituents often have insufficient information to evaluate the implications of changes in local fiscal policy. The same study references survey data related to Proposition $2\frac{1}{2}$.[65] The data suggest that voters largely did not want to change the basket of local services they enjoyed prior to its passage. Cutler et al. found empirical support for very different motivations:

- Due to the difficulty in closely monitoring government activity, voters assumed waste must exist.
- Voters believed waste was rampant, but came to regret the cuts associated with Proposition $2\frac{1}{2}$.
- Voters believed their property taxes were too high, irrespective of their satisfaction with current service levels.

In general, the sentiment seemed to suggest a widespread belief that taxes could be limited without substantial implications for fiscal operations. In reality, the literature suggests that TELs have very real impacts on local revenue and expenditure behavior.

2.5.1 Revenue Implications

TELs are often motivated by dissatisfaction with the property tax. Alm and Skidmore[1] find that states with increasing levels of property taxation and/or

[15] It is important to note that Cutler, Elmendorf, and Zeckhauser examine a range of theoretical models of behavior.

increasing ratios of local to state revenue are more likely to pass TELs. The focus on the property tax may be a consequence of the visibility of associated tax prices, another significant predictor of TEL passage. To this end, TELs have been quite productive in reducing the growth in property tax revenue[97, 89, 35] and tax revenue generally.[98, 76, 100] Ballal and Rubenstein conducted a meta-analysis of the literature, and concluded that more recent studies are in strong agreement about the depressing impact of TELs, in contrast to the older literature.[8] They posit that this shift is likely due to either better measurement techniques, or constraints that are increasingly binding over time. This study finds support for both explanations. Accounting for spatial dependency across counties in Colorado does alter the depressive impact of TELs on local revenues. Furthermore, TELs in Colorado have a dynamic, cumulative effect due to the ratcheting property of TABOR.

The impact on resources for local service delivery is a more complicated matter. The reductions in tax revenue are partially offset by a shift in the local revenue portfolio. TEL-constrained local governments are more likely to increase reliance on miscellaneous revenue, fees, and charges.[76, 98] Such a shift does promote a benefit-based finance structure, insofar as constituents are increasingly asked to directly incur the marginal cost of service provision. There are also, however, distributional implications. Although it is less of a concern at the state and local level, fees and charges are generally more regressive than broad-based taxation that may be tied to indicators of income. Local governments are also limited in their ability to completely offset the loss in tax revenue. The more stringent the TEL, the more difficult the offset becomes.[98]

To help address the shortfall, TEL-constrained local governments are increasingly reliant on state transfers.[76, 100] Such a shift implies a reduction in local autonomy, which has implications for the ability of local officials to respond to the preferences of constituents. To the extent that local officials can negotiate with state officials instead of ask constituents to raise more revenue, the link between local preferences and local service delivery is weakened. Direct connection between own-source revenue and services rendered promotes better assessment of the opportunity costs associated with local policies. That being said, the extent of this offset is limited when TELs operate on both state and local governments[61], which is the case with TABOR in Colorado. In these cases, states are more reluctant to provide enough aid to fill the void.

It should also be noted that TELs impose constraints that vary widely across jurisdictions.[16, 89] In particular, they are more constraining on urban jurisdictions, which have greater numbers of disadvantaged constituents.[73] Thus, the imposition of TELs raises important questions related to equity. Indeed, it is this differential impact that serves as the motivational basis for this study.

2.5.2 Expenditure Implications

While it has been shown that TELs and related policies are associated with declines in local spending generally[97, 7, 40], most studies have focused on implications for the dominant service delivered at the local level: education.

Educational resources are increasingly coming from the state level.[99, 8] In Michigan, for example, the state proportion of K-12 education funding jumped from 30% to 70% between 1993 and 1995, once local approval for tax increases was required.[102]

Variance in implications for local service delivery is heavily dependent upon macroeconomic conditions. In their review of Proposition $2\frac{1}{2}$, Cutler et al. found that the impacts of the TEL were smaller than anticipated during the 1980s. The intended reduction in local revenue collection was offset by an increase in the tax base from new construction, and increased state aid to municipal governments. However, when a recession hit in the early 1990s, new construction slowed and the state was less willing to provide offsetting transfers. The impact of Proposition $2\frac{1}{2}$ became much more pronounced. Indeed, the strength of the policy in general has been explicitly weakened with amendments. One such amendment increased the levy limit to account for new construction. Another permitted local voters to choose to collect more revenue. In Colorado, TABOR features both of these innovations.

Bradbury, Mayer, and Case also studied Proposition $2\frac{1}{2}$.[16] They found that communities constrained by the limit were unable to finance increases in school expenditures. Moreover, they showed that school expenditures were capitalized into the home prices within a given community. Communities that could not match these increases experienced adverse impacts on the value of their housing stock. Thus, in addition to the equity concerns associated with the differential impact of TELs across communities, there are downstream effects that may exacerbate preexisting inequity.

Figure 2.7: Strategies of the Local Fiscal Manager

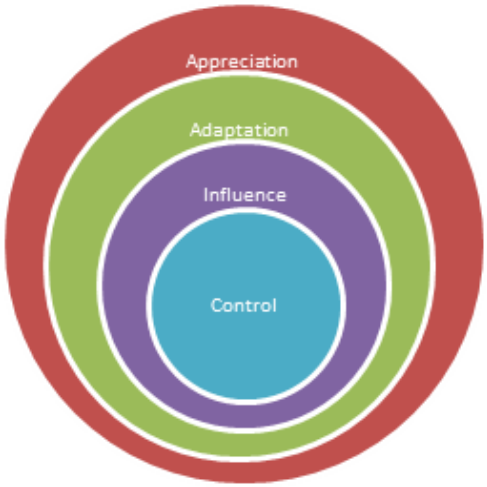


Figure 2.8: Trends in the US Age Distribution

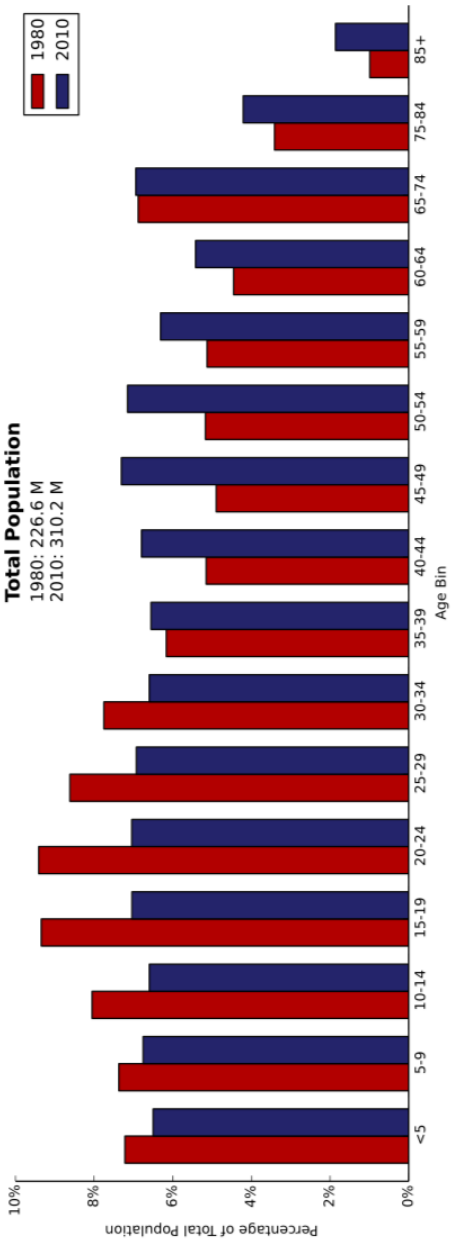


Figure 2.9: Volume of Intergovernmental Fiscal Transfers to Local Governments

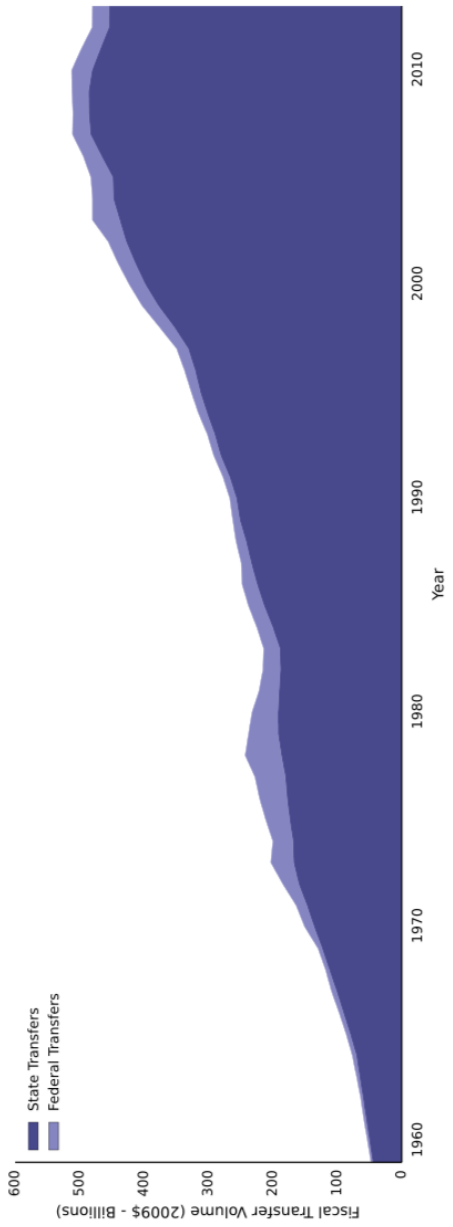
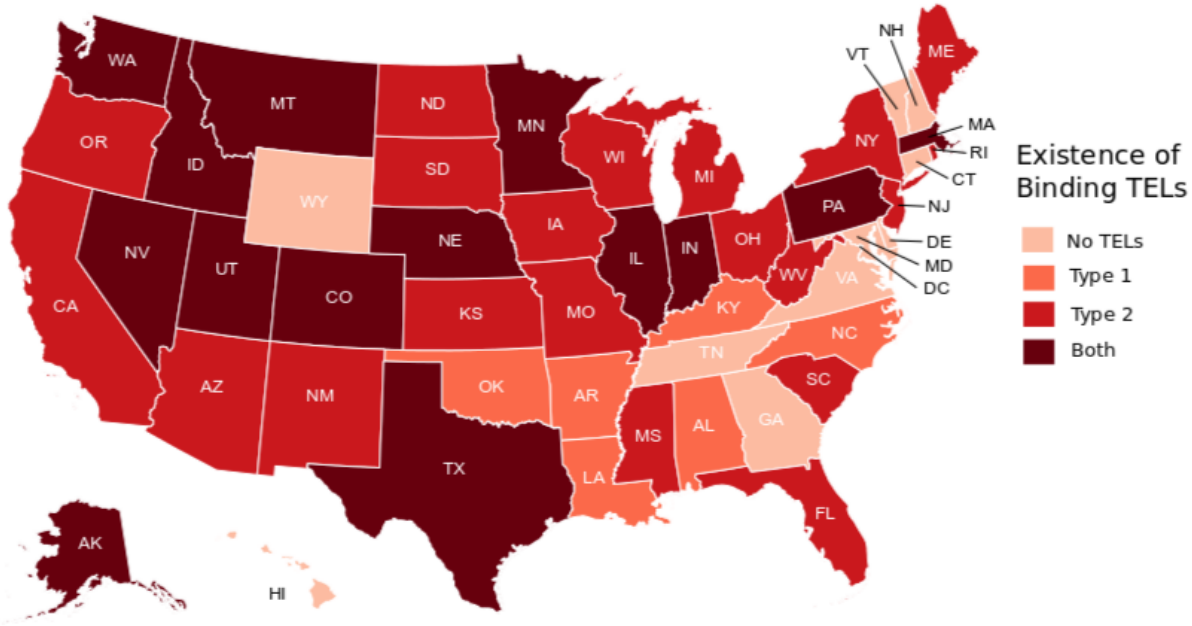


Figure 2.10: Binding TELs in the US



These data describe the variance in TEL regimes across the country. Not all TELs bind the revenue raising capacity of local governments. If, for example, a TEL restricts growth in assessment ratios, local fiscal managers can still use rate increases to grow property tax revenue. Type 1 TELs are vulnerable to circumvention, while Type 2 TELs are binding. Some states have neither, while others have both.[72] These data have been compiled by Daniel Mullins over a number of years. They reflect qualified judgments about the capacity of each TEL to bind local fiscal managers because statutory information is not a reliable indicator.

Chapter 3

Fiscal Behavior in Colorado[1]

As of June 30th, 2012, Colorado contained the 11th highest count of governmental entities in the nation: 2,905.[39] As previously mentioned, there were 62 counties in the state, and two city-county governments: Broomfield and Denver. There were also 271 cities and towns of the general purpose variety, and no townships.[2] On the specialized jurisdiction side, there were 180 school districts and 2,392 special districts. While this analysis focuses on counties entirely, it is important to recognize the complexity of the jurisdictional structure.

Footnote: For long-term price changes, it is desirable to use the Chained Personal Consumer Expenditures Index. The primary reason is that the PCE, in contrast to the Consumer Price Index, accounts for changes in the basket of consumed goods over time and substitution for less expensive alternatives when the price of a particular good increases.[24]

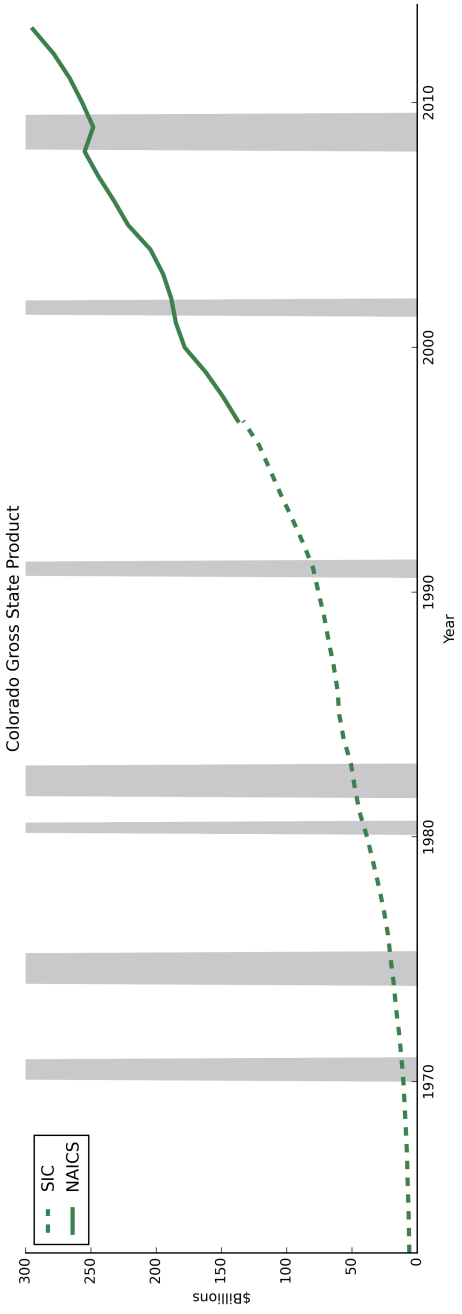
3.1 Which Socioeconomic Dynamics Characterize the Study Period (1993-2009)?

As can be seen in Figure3.1, although economic growth clearly stagnated during national recession periods, the Colorado economy grew dramatically in real terms over the study period. Between 1993 and 2009, the real gross state product grew over 90%. Nevertheless, the recessionary periods had outsized influence. Insofar as revenues declined in those years, the baseline against which future revenues were to be compared was reduced. The "ratcheting" implications of this process will be discussed further when the TEL policies are presented in more detail.

[1] For long-term price changes, this analysis uses the Chained Personal Consumer Expenditures Index. The primary reason is that the PCE, in contrast to the Consumer Price Index, accounts for changes in the basket of consumed goods over time and substitution for less expensive alternatives when the price of a particular good increases.[24]

[2] These tallies include Broomfield and Denver in the municipal government count, in order to correspond to Census figures.

Figure 3.1: Colorado's Real Gross State Product (1963-2013)



Over the 1975-2009 time period, according to demographic information acquired directly from the Colorado Division of Local Affairs, the population across all counties grew 93.4% (2,589,171 to 5,008,427). Figure 3.2 displays total population growth and the distribution of county population by year via violin plots.[3] While the population has grown notably over time, the violin plots indicate that a relatively small portion of this growth is due to increases in the median county population. Rather, most of this growth is due to an increase in the size of the largest counties.

With respect to the tax base, as expected, the number of housing units scales tightly with population. Interestingly enough, however, the highest value housing tends to reside in the comparatively smaller counties. Home values do not scale tightly with population, which may suggest that the desire for land scales with income. Most counties contain less than 100,000 people, further supporting the notion that outlier counties are driving the population growth. The distribution of housing stock value is characterized by a high level of variance, which is highlighted in the second panel of the plot. As may be expected, the income base also exhibits a great deal of variation. Figure3.3[4] demonstrates that this variation in magnitude has a strong spatial contigent as well. Wealther counties reside disproportionately in the northern and northwestern portions of the state. Median houshold incomes range from $25,309 to $101,108.

As we will see, this spatial variation and apparent spatial clustering plays a role in parsing the impact of TELs in the state.[5] Unemployment and poverty rates exhibit wide variation. Unemployment rates varied from 2.4% to 20.1% during the survey period (2008-2012), while poverty rates varied from 3.9% to 22.5%. The inverse relationshp between median household income and measures of economic stress is material.

3.2 Which Revenue Sources are Employed?

In 2011, the Census Bureau estimates that local governments in Colorado raised $29.7 billion in revenue from all sources. Tax revenue, the source most directly affected by TELs, amounted to $12.3 billion. The largest single source of tax revenue was the property tax. Local governments collected over $8 billion in property tax revenue, approximately 67.5% of tax revenue and 28.0% of total revenue. Sales and gross receipts revenue, the next largest source of own-source revenue, accounted for $3.3 billion.

In real terms, Colorado experienced consistent growth over the 1975-2009 time period. Overall, county revenue increased by 72% over the period on

[3] Violin plots are essentially richer versions of box plots. The median value is given by the"heavy" dashed line, while the first and third quartile values are given by the"light" dashed lines. The sides of each"violin" are actually mirror images of the kernel density estimate. Thus, wide portions indicate regions in which many observations lie, while narrow portions indicate a relative paucity of observations.

[4] Blue indicates higher values while red indicates lower values.

[5] Although the data are collected from the 5-year ACS over the 2008-2012 period, they can be loosely interpreted as a point in time.

Figure 3.2: County Population Dynamics Over Time

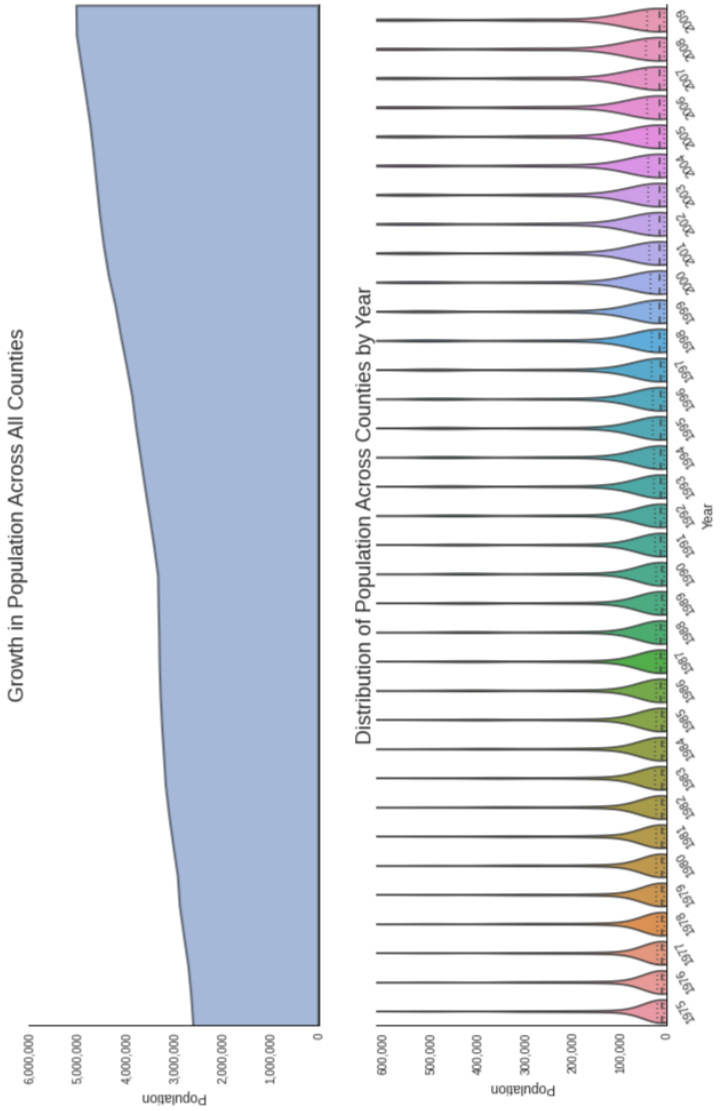
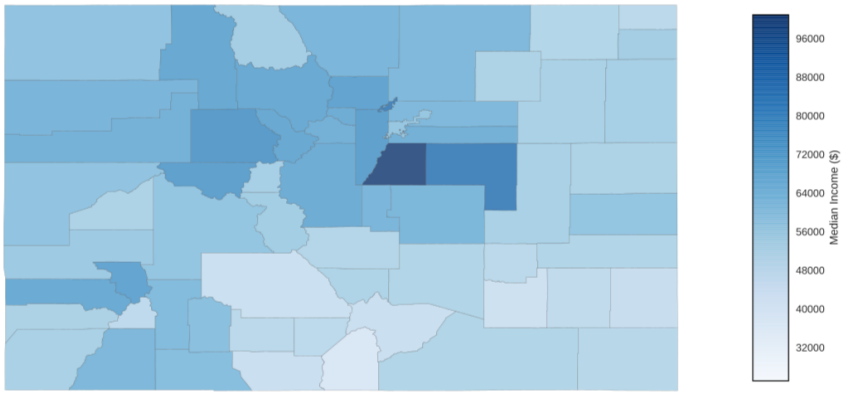


Figure 3.3: Distribution of Income



average (from $1,013 to $1,741). These measures of central tendency, however, mask considerable variation in the individual trajectories of specific counties. The average range of per capita revenue was $3,772 over the same period. Note also that the median revenue per capita increase (63%) did not significantly lag the mean increase, suggesting a relatively stable distribution of county revenue across time.

Somewhat surprisingly, the growth in tax receipts (+187%) over the period outpaced growth in intergovernmental transfers (+42%). As Mullins and Joyce have noted, there has been a general increase in local dependency on higher level transfers in addition to dependency on fees and charges associated with the imposition of strong TELs.[61] In fairness, however, the target of these TELs is usually the property tax. While the property tax has grown in terms of receipts (+168%), it has fallen as a percentage of total tax revenue (-6.5%). Moreover, the growth in sales revenue as a percentage of all tax revenues has increased dramatically (+30%). It has also stood out as the fastest growing revenue source (+273%). Although it remains a small portion of the overall portfolio, license revenue grew faster than all other sources (+489%), followed by revenue from charges (+406%). This growth is consistent with the expected impacts of TEL policies.

3.3 Which Expenditure Responsibilities Exist?

On the expenditure side, local governments spent $29.5 billion in 2011. Virtually all expenses were direct expenditures (99.8%). As is typically the case, the single largest line item was elementary and secondary education, amounting to $8.1 billion (27.7% of total expenditures). At $4.2 billion and $4.0 billion, environment/housing and public safety are the next two dominant functions from a budgetary perspective.

both growth in average (+65%) and median (+61%) liabilities per capita has remarkably lagged growth in revenues over the 1975-2009 period (Figure3.7). As with the revenue trajectories, median expenditures mirror average expenditure growth rather closely.

While debt service has been the fastest growing liability for counties in Colorado (+633%), it still remains a small portion of the overall budget (4.7% in 2009). The dominant liability resides with operating expenditures. Given the preponderence of direct spending activity at the local level, this is unsurprising. Operating expenditures increased 116% over the period, but fell as a percentage of total expenditures (79% to 76%). Within operating expenditures, the fastest growing line item was judicial expenditure (+263%), although it constituted only 3.6% of operating expenditures in 2009. The real story is in public safety, which grew 231% over the period. This spending increased its compositional importance notably, growing from 19% to 29% of operating expenditures and 15% to 22% of total expenditures.

Figure 3.4: County Revenue Growth

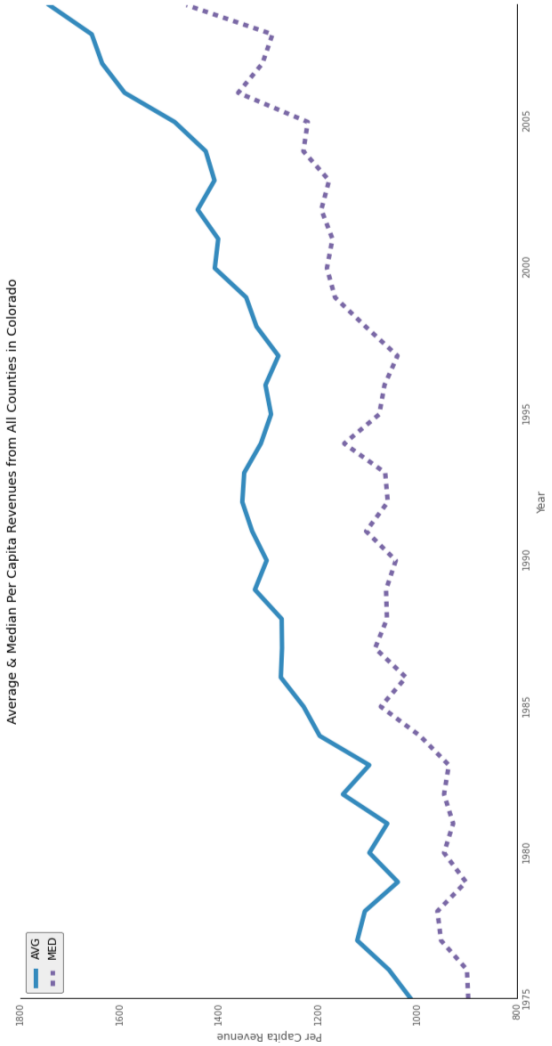


Figure 3.5: Revenue Composition

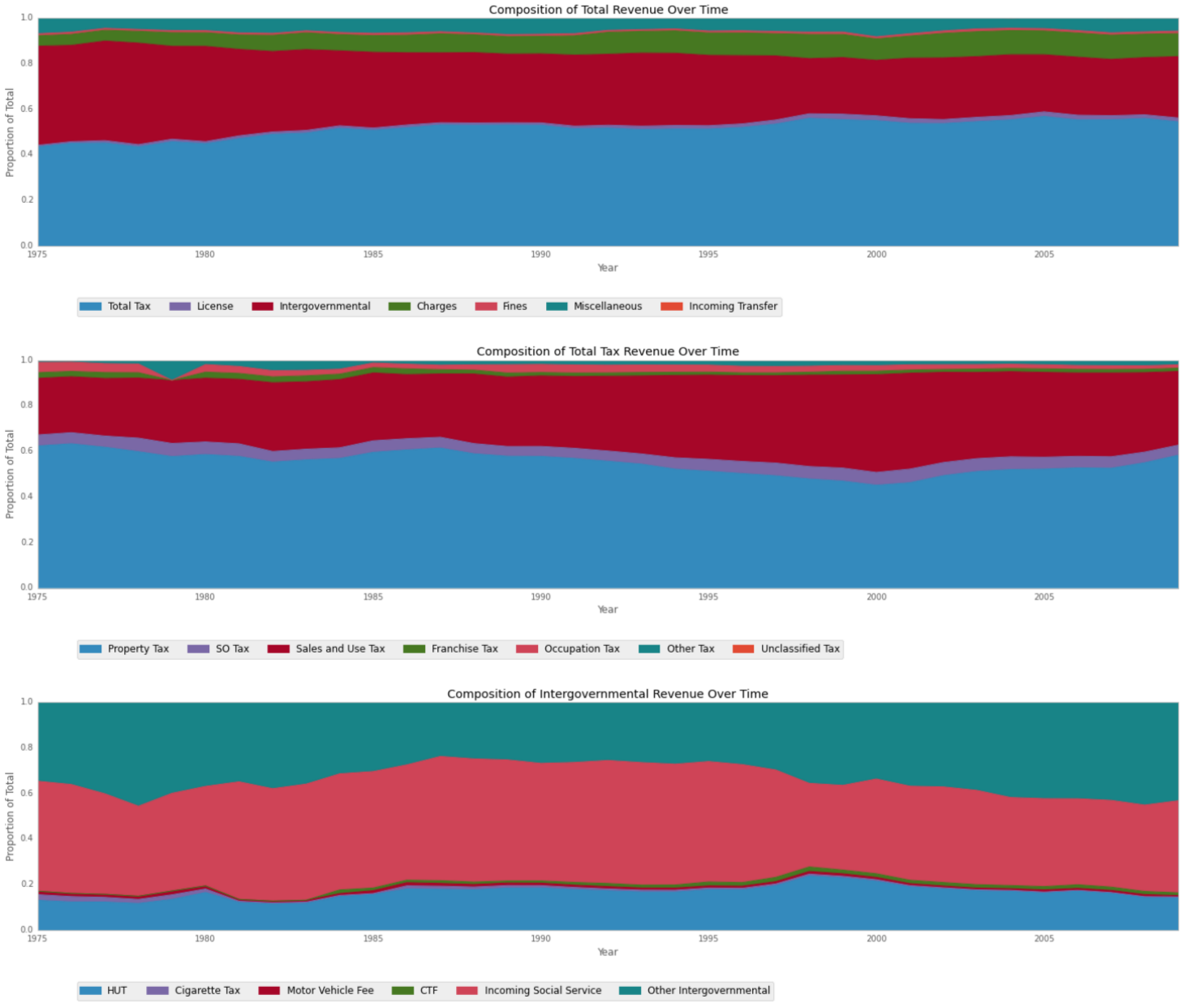
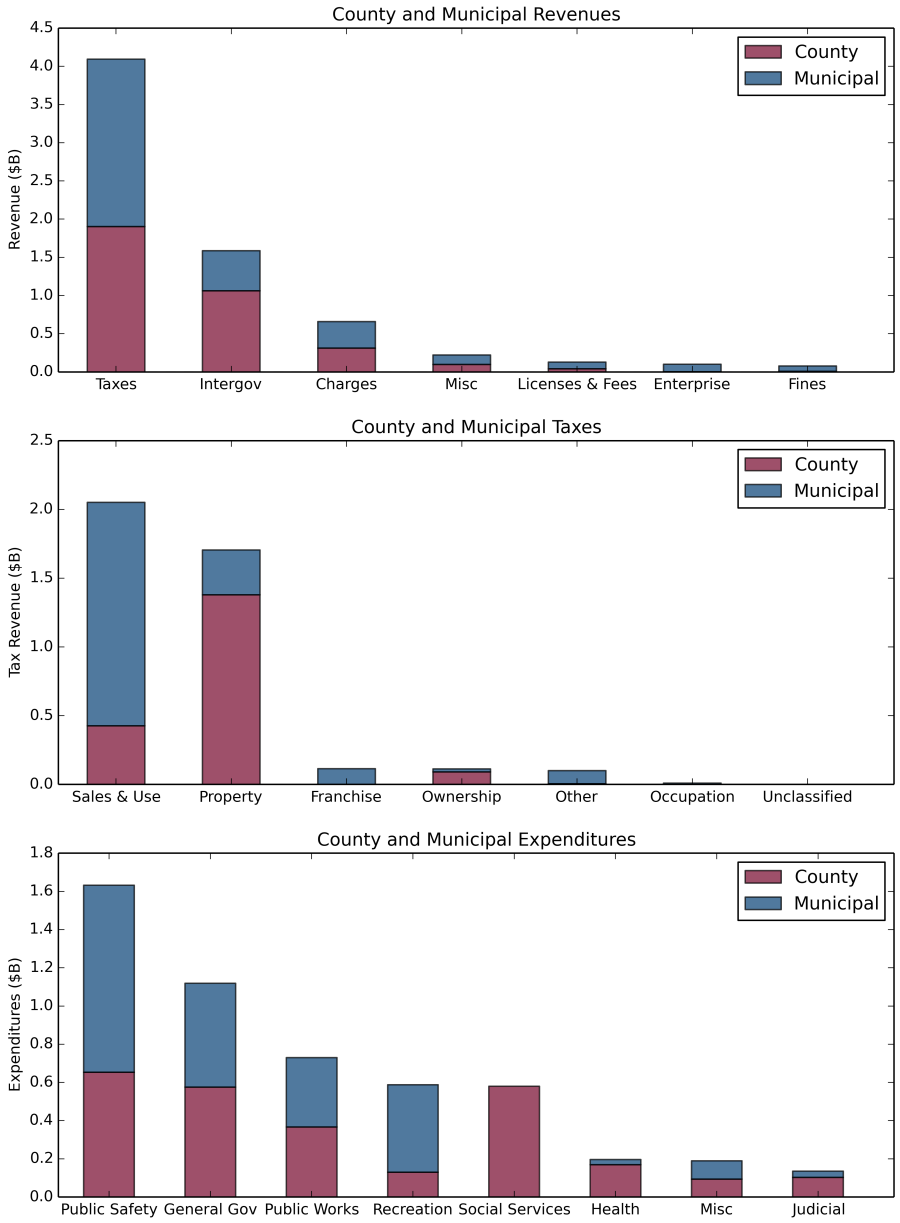


Figure 3.6: Summary of County and Municipal Finances in Colorado



The Colorado Division of Local Affairs provides 2010 fiscal data for counties and municipalities. Relative to the Census data, these data permit a more nuanced view of the functions served by general purpose jurisdictions in the state. There are three particularly noteworthy insights revealed by the data. First, property taxes are the revenue source most directly impacted by TELs, and they are predominately levied by county level governments. Second, taxes in general are far and away the dominant sources of revenue for general purpose jurisdictions. Third, counties play a major role in the direct delivery of services. All three of these facts suggest that policies that impact the property tax, in particular, have substantial potential to directly affect the public services consumed by Colorado residents.

Figure 3.7: Real County Expenditure Growth

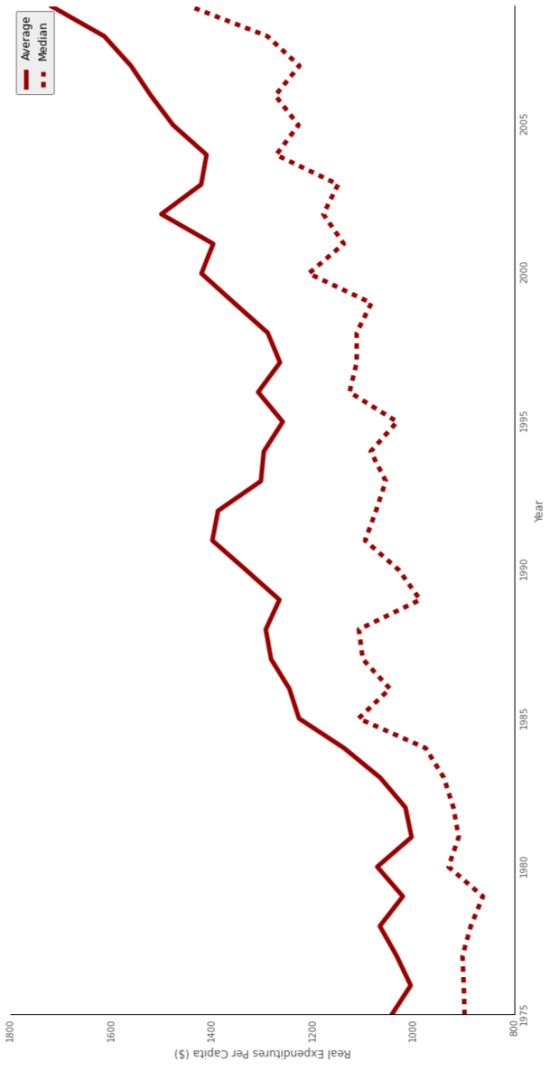
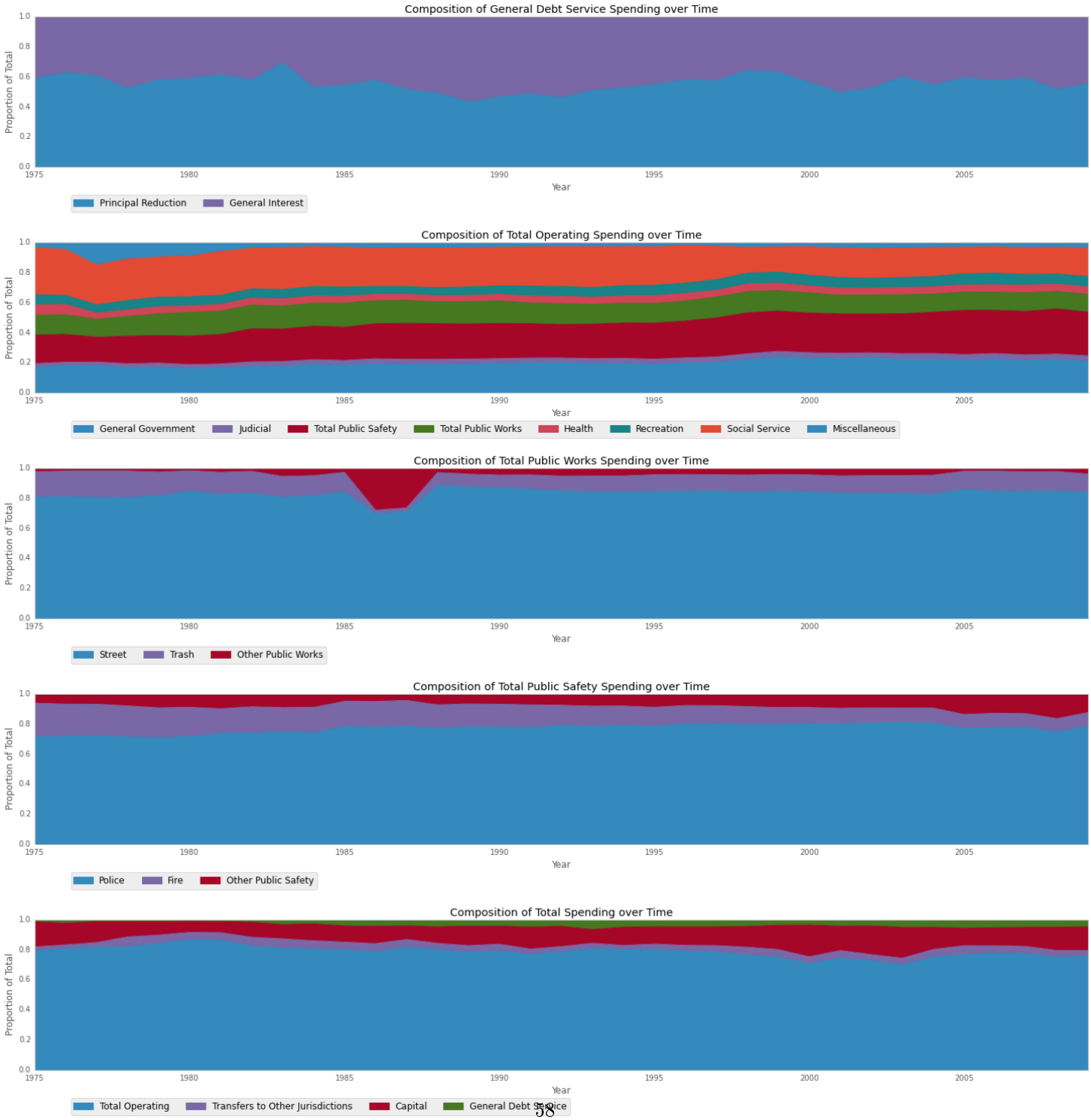


Figure 3.8: Expenditure Composition



3.4 What is the TEL Landscape in Colorado?

As noted in the beginning of this study, the TABOR amendment was passed in 1992. TABOR is by far the most well known of the Colorado TELs, but in fact, the history of TELs in Colorado started much earlier. What follows is a timeline of major TEL initiatives in Colorado:

- 1913: Colorado General Assembly approves a measure limiting the annual growth in state-level property taxes to 15%.[6]
- 1964: The state property tax was abandoned, but limits on local property tax revenue growth were set to 5% annually.
- 1976: Statewide limitations on local property tax growth were increased from 5% to 7% (this refers to the Statewide Limit on Property Tax Revenue).
- 1977: The"Kadlecek Amendment" limited annual growth in state General Fund Appropriations to 7%, and required the maintenance of a 4% reserve.
- 1979: The Kadlecek Amendment was made permanent.
- 1982: The Gallagher Amendment was passed, limiting the allowable assessment value of residential property.
- 1984: The Kadlecek Amendment increased the limit to 7%, plus the costs of property tax reappraisals.
- 1988: The SLPTR was decreased to 5.5%.
- 1991: The statutory state-level General Fund appropriation limit (a.k.a the Arveshoug-Bird Limit or ABL) caps growth at the lesser of either 5% of growth in statewide income, or 6% growth over the previous year's appropriation level.

While multiple limits act at the state level, our focus for this analysis is local revenue behavior. In particular, we are concerned with the property tax, which has stood out over time as the most important revenue source for local governments. For this reason, we will further unpack the three most significant reforms in this areas a bit further: TABOR, SLPTR, and GA.

3.4.1 Taxpayer's Bill of Rights

TABOR is, in and of itself, a composite measure that acts on individual tax districts. Tax districts in this case represent local jurisdictions that raise revenue, such as general purposes municipalities, counties, and school districts. It features three major elements that work in concert to limit revenue growth: voter

[6]The state property tax was eliminated in 1964.

approval for tax increases, a limitation on the growth in revenue, and protection of the existing limits.

For the purposes of TABOR, a tax increase is defined as any one of the following:

- New tax instrument;
- Tax rate increase;
- Local mill levy increase;
- Property assessment valuation ratio increase;
- Extension of an expiring tax; or,
- Any tax policy resulting in a net tax revenue gain.

If any of the above are proposed, they must be validated by explicit voter approval in the jurisdiction in question. On the other side, no voter approval is required for a tax decrease. Note, however, that such a decrease resets the baseline to a new, lower level. This is one manifestation of the so-called "ratchet effect" which will be explored further below. TABOR also explicitly prohibits some types of new taxes.[7]

The limit on annual revenue growth for a tax district is set by formula, which generally accounts for increases in inflation[8] and some measure of growth. At the state level, revenue growth is limited to CPI plus population growth. For local general purpose districts, growth is limited to CPI plus growth in the volume of jurisdictional housing stock. School districts, by contrast, are bound by CPI growth plus growth in school enrollment. Any surplus revenue must be returned to taxpayers as credits or refunds. [9]

TABOR also raised the bar for efforts to modify existing limitations. Prior to its passage, ABL could have been weakened by a simple majority vote in the General Assembly. TABOR requires explicit voter approval for changes to ABL or any other limitations. This element of the reform is viewed by Colorado legislative analysts as being incorporated with ABL specifically in mind.

Perhaps the most restrictive feature of TABOR is the implicit "ratchet effect". If, in a given year, revenue fails to exhaust the allowable increase, the new baseline is set at a lower level. For example, if in year zero a jurisdiction received $100 million in revenue, and the CPI plus the growth factor totaled 6% in the allowable increase, the TABOR limit is $106 million in year one. Similar inflation and growth activity in the following year would allow for approximately $112.4 million in year two. If, perhaps for economic reasons, only $105 million is actually collected in year one, the maximum allowable revenue in year two

[7] Prohibited taxes include new or increased real estate transfers, local income taxes, state property taxes, and surcharges on state income taxes.

[8] The Consumer Price Index serves as the inflation measure.

[9] Note that at the state level, the revenue subject to TABOR (a.k.a. the TABOR base) constituted only 58.5% of the entire budget in the FY02-03 fiscal cycle. The two largest sources were the individual income, sales, and use taxes.

would be $111.3 million. Thus, failing to hit the limit in a given year has a dynamic effect, forever lowering the baseline growth trajectory of revenue. This becomes problematic when expenditures are out of phase with revenues.

3.4.1.1 DeBrucing

One characteristic of TABOR that appears to be a confounding element initially is the capacity of local jurisdictions to "deBruce". DeBrucing is the process by which a local government can vote on whether or not its tax base should be subject to the constraints of TABOR. One may consider this override capacity to be a robust safety valve, sufficient to invalidate any claims of undue restriction imposed by reform. If a jurisdiction can actually vote to exempt itself from reform, how can it impact fiscal choices? The analysis that follows will reveal that there is indeed a very real impact from this reform that results in observable impacts on the revenue and expenditure behavior of affected jurisdictions.

Ultimately, despite initially appearing to be an analytic liability, the existence of deBrucing emerges as an opportunity for greater estimating precision. In particular, the practice provides an important source of horizontal variation, allowing us to more cleanly separate macroeconomic conditions from the policy structure. The nature of this separation will be considered in further detail in Subsection 4.1.

3.4.2 Statewide Limitation of Property Tax Revenue

As mentioned above, the SLPTR is among the oldest limitations in Colorado. It was originally enacted in 1913, but its most recent level (5.5%) is a vestige of its last modification in 1988. The structure of the limit, a constant ceiling, is quite straightforward. For our purposes, the interest is in how this limit interacts with TABOR. To the extent that the TABOR limit may be above or below 5.5% in any given year for a given county, we must account for variation in which limit binds over time.

3.4.3 Gallagher Amendment

In response to a dramatic increase in residential property values and the lack of uniformity in assessment practices that characterized the 1970s, voters passed House Concurrent Resolution 82-1005 in 1982. It included the following elements:

- Provisions to ensure uniform and fair assessment practice;
- An assessment rate of 29% for nonresidential property;
- A reduction in the residential assessment rate, from 30% to 21%;
- A business property tax exemption for inventories;
- A property tax exemption for certain agricultural materials;

- A new valuation scheme for agricultural land;
- A new valuation scheme for value producing mines and oil/gas properties;
- The State Board of Equalization, tasked with evaluating property tax valuation schemes; and,
- The Gallagher Amendment (GA).

In addition to the residential assessment rate reduction, GA provided a dynamic relief mechanism for residential property taxpayers. GA automatically adjusts the residential assessment rate each year to hold the residential share of total assessed value constant. That is, even when residential assessment growth outpaces nonresidential assessment growth, the proportion of the property tax paid by residential taxpayers will not increase as a result. That being said, modification is allowed in the event of new construction. In other words, *the residential share of property taxes in Colorado cannot increase as a consequence of an increase in tax unit value (the intensive margin), but it can increase when the number of tax units increases (the extensive margin).* Modification of the rate for new construction has been limited in practice. The residential share of assessment value was approximately 45% when GA was implemented in 1982. As of 2003, the rate had only increased to 47%.

The residential assessment rate imposed via GA is calculated based upon the aggregate assessed values in the state. Thus, the rates are calculated in a manner which masks substantial variation in growth profiles and the mix of properties in individual counties. Indeed, we will leverage this variation in modeling the impact of reform.

It is also important to note that TABOR has has an impact on how GA works in practice. Prior to TABOR's passage, if non-residential property increased in value at a rate greater than residential property, residential assessment rates could be adjusted upward automatically to maintain the statewide ratio of residential to non-residential assessment. After TABOR, assessment increases were counted as tax increases, and thus required explicit voter approval. In this way, TABOR not only introduces TABOR-specific asymmetric pressure (it is easier to lower than raise taxes), but it also produces asymmetric interaction effects with other policies.

Chapter 4

Methodological Innovations

4.1 How are TELs Operationalized in this Study?

The focus of this study, and the common theme throughout the three empirical sections, is the measurement of the impact of TELs on *individual counties.* Furthermore, this impact must be measured *conditional on each county's circumstance.*To reiterate the point made in the discussion of this study's value added in Subsection 1.0.3, this objective represents a departure from the vast majority of literature in the field. In measuring the differences in impact of TELs on intra-metropolitan jurisdictions, Mullins stands out as one of the few scholars to have explored this angle.[73]

> "Cross-state studies have all but neglected an assessment of the effects of tax and expenditure limitations on the fiscal structure within the local public sector. Even within the ranks of the individual state studies, there has been limited attention to these types of effects. While results point to the use of alternative revenue sources and intergovernmental transfers, effects on the actual composition and response of the local public sector are largely absent. Have tax and expenditure limitations changed the face of the local public sector and its interaction with local populations? Has it done so uniformly? And what are the implications of any of these structural changes for local governance? [...] The outcome with regard to local discretion may be one of asymmetric truncation of the ability to exercise local choice, such that the variation in service availability across jurisdictions increases. While this increased variation may superficially appear as Tiebout inspired, it will be driven not by responsiveness to local desires, but by a reinforcement of differential abilities to respond."[73]

The author would be hard pressed to state the implications of the change in focus any better. In effect, incorporation of local characteristics changes the types of

questions that one seeks to answer. Instead trying to extrapolate from average effects, conditional analysis provides more actionable intelligence to local fiscal managers trying to understand how tax and expenditure limitations affect their own jurisdiction, and the implications for how they serve their constituents.

Surprisingly, there has been relatively little additional work over the decade since Mullins' piece that sought to evaluate differential impacts based upon local conditions. Subsequent research that has cited the article generally extracts the association between TELs and both the general propensity to shift revenue sources outside of the jurisdiction and a difficult environment for the collection of fiscal resources. One Colorado focused study explored the deleterious effects of recessions for jurisdictions affected by TABOR [68], while another surprisingly found that being unable to override TABOR was not associated with increases in special districts.[12] In neither case was county-specific socioeconomic context treated as a primary driver.

The author posits that this lack of work is driven in large part by the limitations of the methods used to measure the impact of TELs. Though we have learned a great deal from the approach, measurement has largely been conducted within the "existence paradigm". That is, TEL effect is generally represented as a binary indicator or some close derivative. Even Mullins (2004), path breaking though it may be, employs a refinement of this technique.[1] One limitation of this approach is the inability to model certain kinds of interactions between overlapping TELs. This is particularly relevant, as we will see, in the context of TABOR and SLPTR. Another limitation is the inability to differentiate the cumulative effect of a TEL regime across counties. In other words, there is little reason to believe that, given differing socioeconomic dynamics, five years under a TEL regime for county A will have the same implications as five years under a TEL regime for county B. Both limitations constrain the direct applicability of findings for local fiscal managers.

The solution proposed here is abstraction away from the specific elements of the TELs in Colorado (COTELs) as the basis for operationalization. Rather, this study captures COTEL design indirectly, by evaluating the implications of COTELs for local revenue yield. By shifting the focus, we can overcome the aforementioned limitations. In effect, we want to capture some measure of COTEL intensity that captures three primary characteristics of a given county at time t:

1. Cumulative effect of overlapping policies;
2. Proliferation of local overrides of TABOR and SLPTR; and,
3. Local dynamics that might trigger a breach in the ceilings imposed by the aforementioned legislation.

[1] This work measures TEL effect as a discrete variable which, at different points in the analysis, reflects simple existence, the extent of the TEL's binding nature, and/or the scope of the TEL's application.

4.1.1 TABOR and SLPTR - A Composite COTEL Intensity Measure

The indicator used in a previous version of the analysis in the first empirical section was simply an ordinal score that captured information on the first two characteristics. Effectively, the score added a point for each additional constraint. For example, all counties in 1987 would have a score of two given the general application of SLPTR and GA. The scores were subsequently modified by deBrucing, which occurred to some degree in 47 of 64 counties over the 1993-2009 time period. If only one of the policies was exempted, only one point would be removed. In effect, it was a cumulative indicator function. The reason it has value now is because it provided a clear view of the variety of policy application across counties (Figure4.1).

While this score was a useful starting point, the subsequent measure incorporates the county-specific dynamics captured in the third desired characteristic: the likelihood of a binding constraint. The new score was constructed based upon comparing the property tax base growth to the limit imposed by the conjunction of SLPTR and TABOR limits when both apply in a given year. If only one or the other applies (due to deBrucing) in a given county-year, then the limit is just that which is imposed by the policy in effect. The construction of a composite limitation variable is useful because *only one of the limits can be binding in any given county-year*. To get a sense for why this occurs, Figure 4.2 plots the limits of both TABOR and SLPTR over time for Adams County.

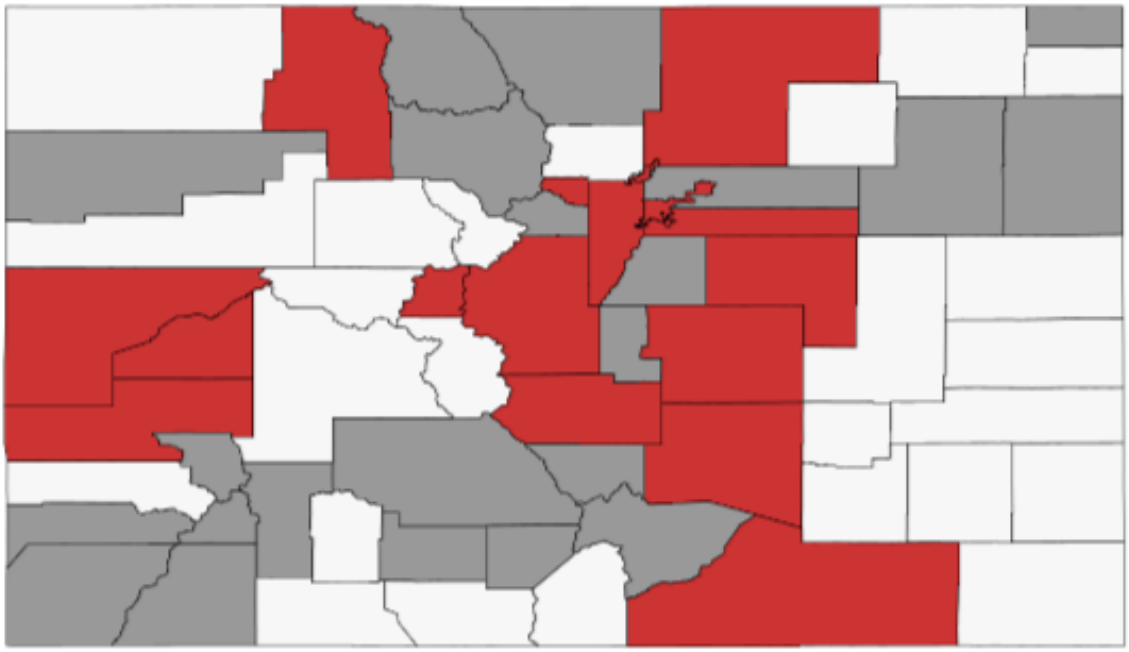
If the difference between the TABOR constraint and the SLPTR constraint is negative (TABOR less SLPTR), it indicates that TABOR was the dominant in a given county-year. This is the kind of interaction, referenced earlier, that does not lend itself to easy capture by the existence paradigm of representing TELs. The TABOR/SLPTR constraint has been calculated as the minimum between the two for each county-year. Given this composite limit, we can consider the impact on the property tax revenue raising capacity of a given county in year t.

The Model 1 governs the property tax revenue yield for each and every county subject to TABOR and the SLPTR in the absence of a local override. Given that the millage rate is subject to explicit voter approval and the assessment ratio is set at the state level, the economic activity within a county is the relevant action to focus on when questioning whether or not the composite limit will be breached. In other words, absent some sort of deBrucing vote which would allow for increased revenue, the growth in the value of the base should be compared to the composite limit to determine whether or not the limit will be breached.[2] The value of the TABOR component of the constraint (second argument in the minimization function) utilizes CPI-U data from the Bureau of Labor Statistics and housing count information contained in the demographic profiles constructed by the Colorado Department of Local Affairs.[3]

[2]The residential assessment rate was 12.86% in 1993. It fell four times during the study period to 10.36% (1995), 9.74% (1997), 9.15% (2001), and 7.96% (2003).

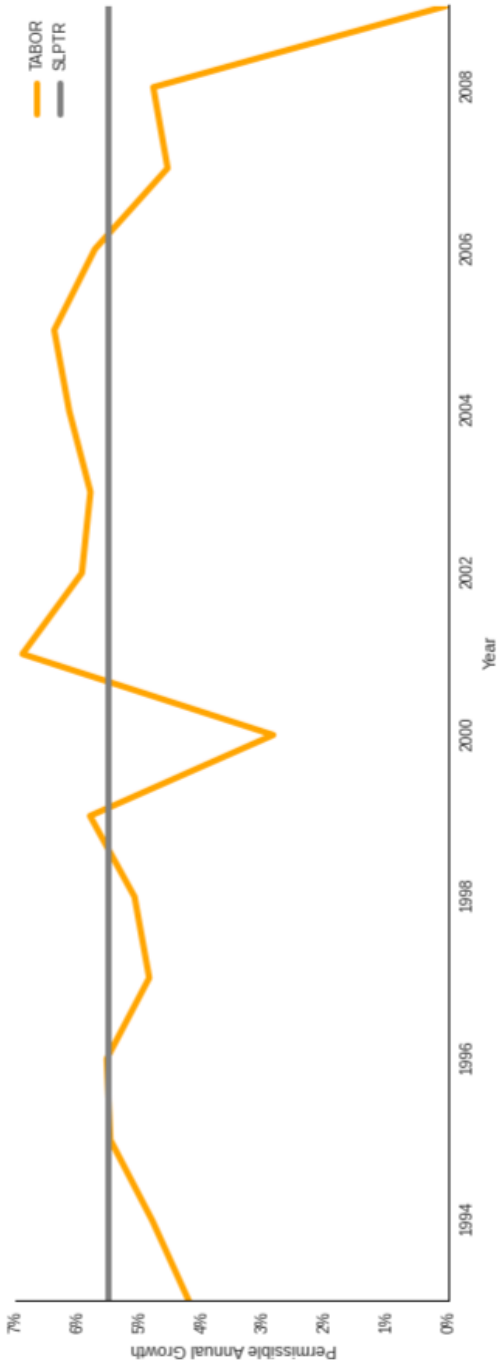
[3]The query tool for the database containing demographic profiles by county is located here: https://dola.colorado.gov/demog_webapps/psParameters.jsf?counties=T.

Figure 4.1: Distribution of COTEL Policy Application by County



Grey counties feature two overlapping TEL policies in 2009. White counties feature three overlapping policies, and red feature four.

Figure 4.2: Visual Rationale for a Composite Limit



The market value of the base (both residential and non-residential) may itself be decomposed further.

Ideally, we would construct the value of the base of each county from the components in Equation 2, but we do not have this data available (particularly on the non-residential side). The approach taken leverages the relationship in Equation 3 to back into market value, which is a useful figure for thinking about economic activity in a county. It is important to note that because assessments are generally susceptible to discretionary definition, the assessment base can generally become uncoupled with market value. In this instance, however, the potential for this decoupling is reduced. In the absence of a deBrucing vote, local officials cannot raise revenue by changing assessment rates or values. The real deficiency with this approach is the downside risk. Assessment values can decline if the yield is too high. Thus, it is certainly not a perfect proxy for value, but it is a better fit than it would be in other situations. In interpreting the analysis, one must also recognize that assessments take into account exemptions, which decrease the assessment value by a fixed amount relative to market value.

That being said, in 2014, the Colorado Legislative Council contracted Wildrose Appraisal Incorporated to evaluate the assessment to sales ratios by county. Among other things, the county-specific reports include the median ratios for four property classes by county: Commercial/Industrial, Condominium, Single Family, and Vacant. These ratios (where provided) can be seen in Figure 4.3. The median ratio manages to cluster about one fairly well. This suggests that the extent of the divergence between assessment and market value is limited.

The property value dynamics vary dramatically over space and time within Colorado. Data on assessment value by property type and the assessment rates by residential and non-residential property has been collected from the Colorado Division of Local Affairs, and it covers every county during the 1993-2009 period.[4] Ultimately, changes in the assessment base are the most relevant, insofar as they are more directly limited by the composite constraint than market value. By comparing assessment value growth with the allowable growth under the composite limit, we can construct two "COTEL intensity" variables.

intensity_flow is the *single-year* difference, percentage change in assessment value less the percentage of allowable revenue growth under the composite limit.

intensity_stock is the *cumulative* difference, percentage change in assessment value less the percentage of allowable revenue growth under the composite limit.

Both intensity variables seek to capture the fiscal stress caused by TABOR and SLPTR. The higher the values of either, the more binding the constraint and, therefore, the higher the level of fiscal stress. *intensity_stock* is of particular interest, the hypothesis here being that it captures a growing disparity between

[4]Thank you to Denise Castro of the Division of Property Taxation.

Model 1 Property Tax Subject to TABOR/SLPTR

$$PropRev_t = MRate_t * AsmtRatio_t * BaseVal_t$$

$$\text{s.t. } PropRev_t \leq (1 + \min(.055, CPI_t + NewConstr_t)) * PropRev_{t-1}$$

where

PropRev$_t$ is the property revenue yield in year t.

MRate$_t$ is the millage rate in year t.

AsmtRatio$_t$ is the proportion of the asset's value that is considered taxable in year t, otherwise known as the assessment ratio.

BaseVal$_t$ is the market value of the asset in year t.

CPI$_t$ is the general change in prices (as indicated by the Consumer Price Index change) between years $t-1$ and t.

NewConstr$_t$ is the change in the housing stock volume between years $t-1$ and t.

Note: The value of .055 refers to the 5.5% Statewide Limit on Property Tax Revenue (SLPTR).

Model 2 Value of the Property Base

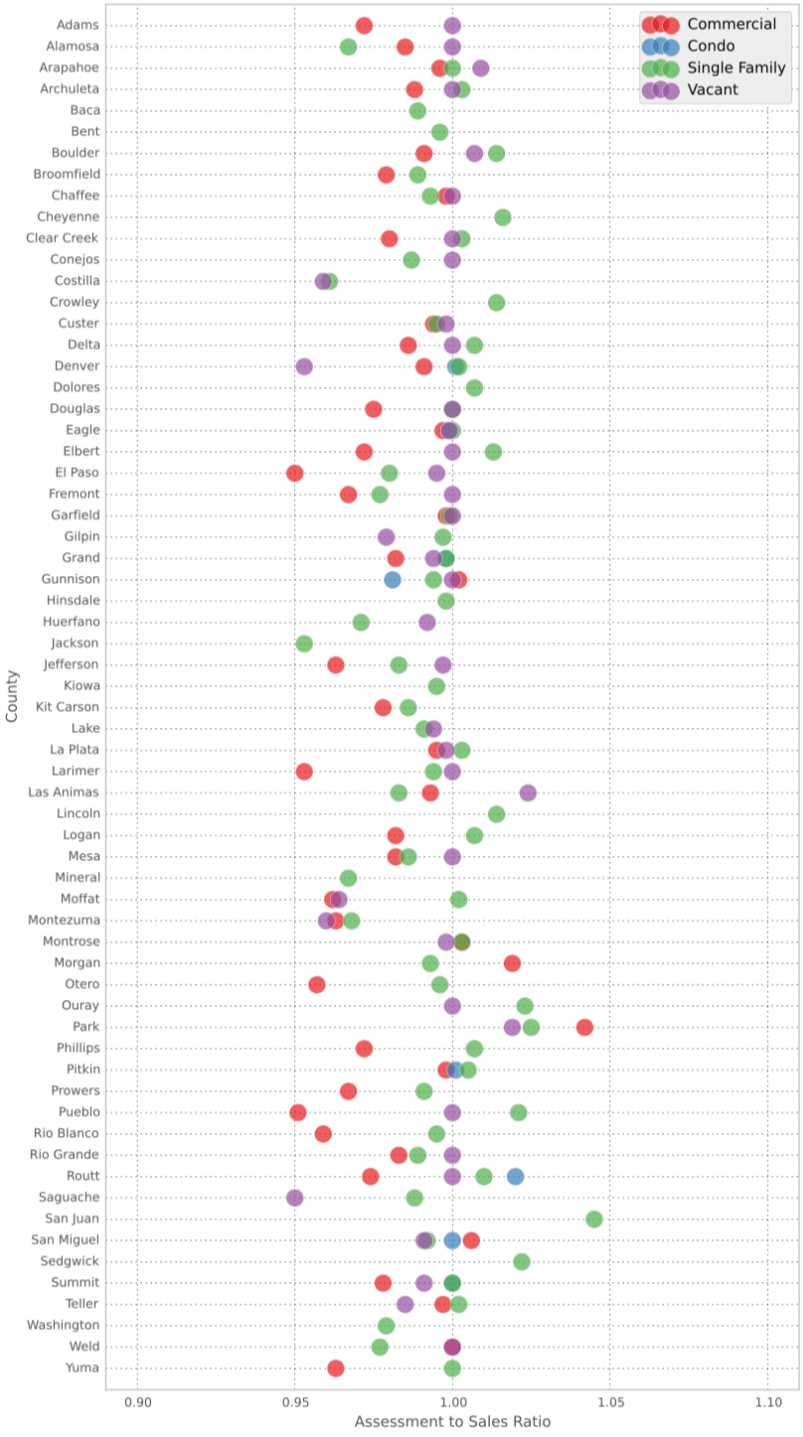
$$BaseVal_t = Stock_t + AvgValue_t$$

where

BaseStock$_t$ is the count of property units in year$t$.

AvgValue$_t$ is the average value of property in year$t$.

Figure 4.3: Unweighted Median Assessment to Sales Ratios in 2014



the economic activity that occurs in a given county and the governmental capacity to facilitate and/or regulate said activity. For example, one would expect it to be more costly to govern a county of 50,000 people relative to a county of 1,000 people. There are simply more interactions, both social and economic, to mediate. The need for infrastructure grows, as does the need to finance a larger educational demand. These constraints, then, act as an instrument to decouple the trajectories of revenue potential and expenditure need. The author expects this to be a dynamic effect.

The relationship between the flow and intensity measures can be seen in Figure 4.4. It depicts measures of intensity flow and stock for Adams County over the study period. Insofar as the flow measure moderates the rate of change in the stock measure, it may be though of as approaching the derivative. In this case, however, it is at best a weak analogy because both measures have a lower bound of zero. Adams County exempted themselves from both TABOR- and SLPTR-related restrictions in 2002.

It is important to recognize that the intensity measurements will generally be underestimated. The reason is that our market value concept is derived directly from the assessment value and rate. As mentioned previously, increases in assessment must be accompanied by a deBrucing vote, so there is a natural obstacle to assessment rates rising faster than market values. However, since there are no constraints on lowering assessment value, there is a threat that assessment values (and thus our concept of market value) will grow at a lower rate than actual market value. In effect, any findings in this analysis related to TEL intensity are likely to be conservative.

4.1.2 The Gallagher Ratio

Since the actions imposed by TABOR and SLPTR were conceptually similar, they lent themselves to integration. GA, by constrast, was modeled separately as simply the ratio between the residential and non-residential tax bases within a county. The idea here was to capture the impact of disparities between county ratios and the statewide ratio used to calculate allowable assessment rates. If a given county has a higher proportion of residential assessment value in its base, we would expect it to have a more difficult time raising revenue, since the residential assessment rates are held down to keep them consistent across the state. Conversely, higher proportions of non-residential assessment value serve to subsidize residential taxpayers in a given county, since only so much yield is required and their assessment ratios cannot be increased. The data required to construct this ratio come from the assessment information discussed in Subsection 4.1.1. The distribution of this Gallagher Ratio can be seen in Figure 4.5. Clearly the variation seen here suggests that county circumstances drive substantial variation in the impact of the Gallagher Amendment.

Figure 4.4: COTEL Intensity in Adams County

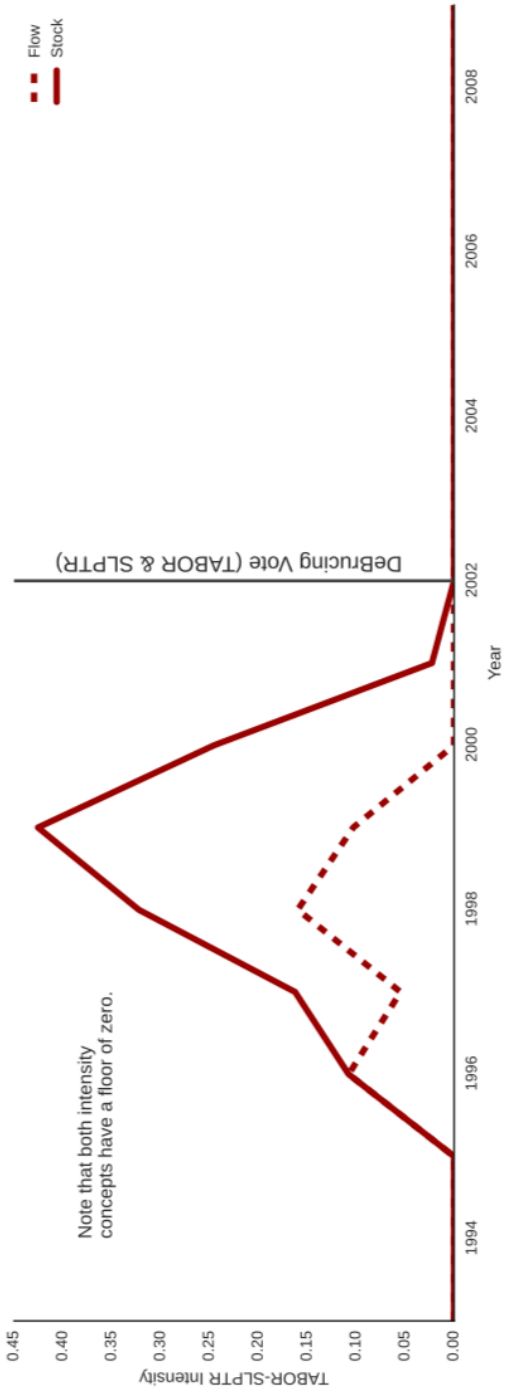
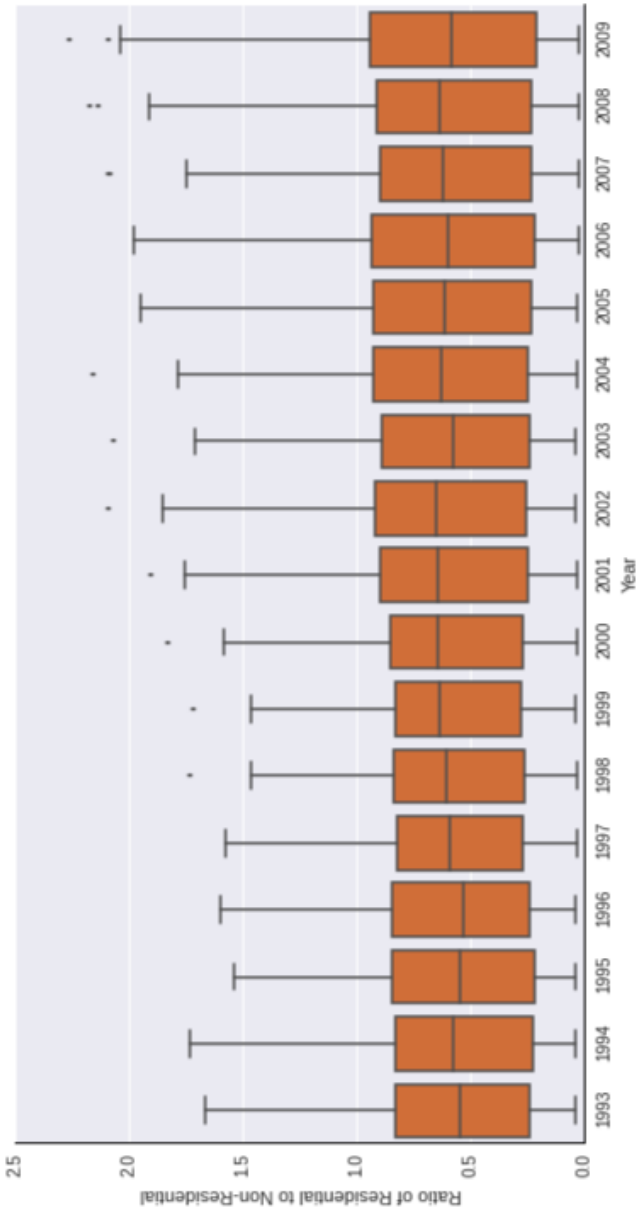


Figure 4.5: Variation in the Gallagher Ratio



4.2 The Implications of Space

> "[T]he first law of geography: everything is related to everything else but near things are more related than distant things."[109]

That a given data generating process may yield observations that are related to each other is not a new concept by any stretch of the imagination. So central has this concern been in the modern practice of statistical analysis, large swaths of theoretical development are devoted to methods of mitigating this confounding factor. The foundational model in econometrics - ordinary least squares - assumes it away with the assertion of independent observations for conceptual tractability. The analysis of real world data, however, often necessitates meeting this issue head on with a host of models designed to deal with this basic deviation from "well behaved" data.

The concern centers on the fact that, though approaches differ substantially, statistical estimation can generally be distilled down to a search for conditional expectation. The observed data have some central tendency, and each of the statistically significant variables that act on the system cause some sort of deviation from that central tendency. Measuring the deviation from that baseline expectation requires that the baseline be consistent throughout the observational space. If one desires to understand the relative heights of five people, he/she should either ensure they all stand on level ground, or capture five observation-specific adjustments that yield the same effect.

An important lesson that the field has learned is that variance in this baseline is not a deal breaker. If the relationship is systemic and estimable, the effect can be accommodated. The desire to understand when this stable reference can be relied upon is a strong argument for the establishment of stationarity. If we know that the relationship between observations follows a consistent joint distribution, or some reasonable facsimile, we can reliably estimate the impact of variables that impact the system.

4.2.1 Space as a Factor in Inference

Autocorrelation and autoregression are sometimes differentiated in the literature, but often conflated. In many cases the former refers to serial correlation in the errors, while the latter refers to correlation in observations.[110] We will use this distinction in this study, but in reality, scholars often use autocorrelation to describe correlation in both the errors and the observed values. Our definitional split will facilitate discussion of the implications of these two behaviors.

Given the split we have defined, the two are not necessarily linked, insofar as an autoregressive process is only one potential cause of correlation in the error term. Other factors, like additional variables that have impacts lasting longer than one period, can also contribute to autocorrelation. This is a theoretically important distinction, insofar as unbiased estimates are still possible with uncorrelated observations, albeit inefficiently. In practice, however, they tend to occur jointly.

> "In fact, as Wold showed, when all the sample serial correlations of the [independent variables] are zero the estimates of variance given by the least squares method are strictly unbiased whether the errors are serially correlated or not. It seems to us doubtful, however, whether this result finds much application in practice. It will only rarely be the case that the independent variables are serially uncorrelated while the errors are serially correlated."[34]

The concept of autocorrelation was first explored in time series analysis. Cochrane and Orcutt are among the early commenters on the dangers of failing to account for this behavior. Mitigation of this behavior proceeded in a task-specific fashion, designed to restore the assumption base of OLS.

> "If we have a relationship in which the error term is autocorrelated, it has been shown by Aitken [...] that the method of least squares still yields the best linear unbiased estimates of the regression coefficients provided the lack of independence in the error series is taken into account. One method of overcoming this lack of independence is to make the error term random by transforming all the variables according to the autoregressive structure of the error term."[23]

If autocorrelation is not explicitly addressed, variance in the estimates is generally larger and the standard procedure for understanding the variability in the estimates is no longer applicable.[34] Failing to account for an autoregressive process causes substantially more damage. Consider a noiseless autoregressive process.

If the first term on the right hand side is omitted, the model is misspecified. In effect, the problem is one of omitted variable bias. By failing to account for all of the structurally relevant regressors, we have limited our ability to generate an unbiased estimate of the phenomenon of interest. If consumption of good A is a function of the prices of both good A and good B, we cannot reliably estimate consumption of A based solely on the price of A or B in isolation.

Spatial dependence shares a great deal of the conceptual domain occupied by temporal dependence. Similar problems of inefficiency and bias arise in the context of spatial autocorrelation and the failure to correctly specify a spatially autoregressive process. Anselin (1999) presents three primary reasons why spatial dependence must be incorporated when present[3]:

1. "The 'structure' behind the instability is *spatial* (or geographic) in the sense that the location of the observation is crucial in determining the form of the instability." In such cases, we can expect heteroskedasticity to be a function of spatial location, or coefficients to indicate different slopes at different locations. Many phenomenon fit this mold. If one were to model the impacts on real estate prices of a given phenomenon, one better control for the location specific aspects of the sample. Different price regimes and economic dynamics prevail in different states, for example.

2. "[B]ecause the structure is spatial, heterogeneity often occurs jointly with spatial autocorrelation, and standard econometric techniques are no longer appropriate." This condition mirrors directly the variance-related issues for temporal autocorrelation mentioned above.

3. "In a single cross-section, spatial autocorrelation and spatial heterogeneity may be observationally equivalent." Spatial heterogeneity as used by Anselin refers to a spatially autoregressive process. Since these two phenomena can look the same, it is not clear at the outset if we are worried only about loss of efficient estimation of parameters (which is a non-trivial concern) or bias due to misspecification. Anselin suggests that analysts model both in all cases.

One major difference between temporal and spatial dependency is dimensionality. Whereas lags move along one dimension in the temporal context, lags move in all three cartesian dimensions in the spatial context. Figure 4.6, which identifies each lag with a consistent shade of blue, illustrates the concept. Conseqeuntly, "in contrast to the unambiguous notion of a 'shift' along the time axis, there is no corresponding concept in the spatial domain."[3] The approach taken has been to use a spatial lag operator that captures a weighted average of values from all spatial features in the local neighborhood W.

One might reasonably ask, why bother with the trouble of estimating spatial lags? Could we not use a more conventional method like fixed or random effects at the county level to control for the impact of neighboring counties? There are two reasons why this analysis has not gone this route. First, whether it be through repeated cross-sectional or panel analysis, this study is concerned with variation in circumstance over time. In a fixed effect or random effect world, one is faced with a decision about the scope of the effect to remove from each observation. If we keep the scope within county and do not vary the effect across time, we implicitly assume that the impact of neighbors does not change over time. If we allow for a two-way effect, we run the risk of washing out the uniqueness of the county. Remaining variable impacts would be of note, but the effect would likely be muted. Modeling neighborhood impacts directly avoids wrestling with these unpleasantries, at least in the context of neighborhood effects. To be sure, fixed effects are employed in some situations that follow, but direct modeling of neighborhood effects gives us more flexibility.

Second, fixed and random effects are both model parameters to be estimated. Consequently, in these situations, we must be concerned with degrees of freedom. Generally, the safe bet is to have many observations per group, so that said parameters may be reliably estimated. In the two-way scenario above, we wittle that observation count down to one for each county-year effect.

Third, fixed and random effects are useful "catch-alls" when the model is incorrectly specified. They are meant to be proxies for those elements that are not included in the specification. Due to their scope of application, one cannot parse out the impact of individual components of said effects. In general, it is preferable to model the specific phenomenon directly when possible (in this case, neighborhood effects).

Model 3 Market Value Hack

$$MrktVal_t = \frac{AsmtVal_t}{AsmtRate_t}$$

where

MarktVal$_t$ is the total market value of the base (residential or non-residential) in year$t$.

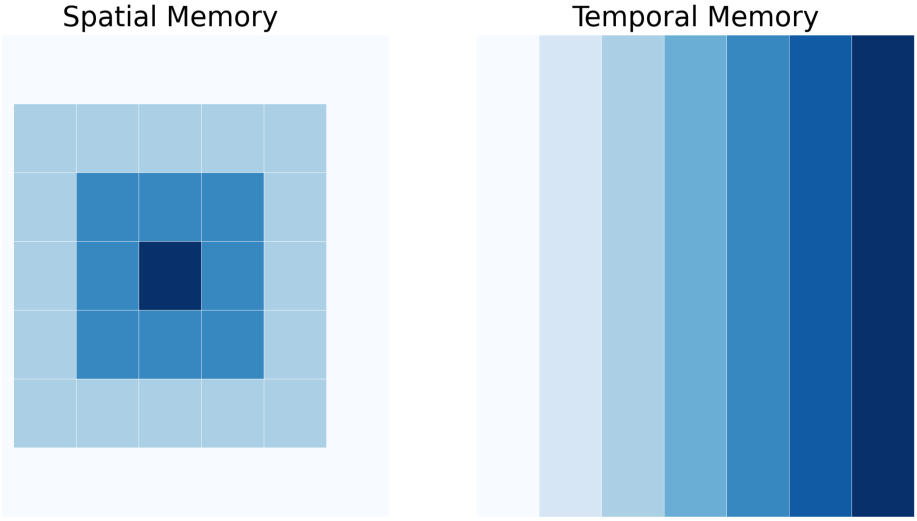
AsmtVal$_t$ is the assessment base value (residential or non-residential) in year$t$.

AsmtRate$_t$ is the assessment rate (specific to residential or non-residential) in year$t$.

Model 4 Noiseless Autoregressive Process

$$y_t = \Gamma y_{t-1} + \beta X_t$$

Figure 4.6: Parallelism in Temporal and Spatial Dependency



Finally, as Anselin and Arribas-Bel note, the spatial fixed effect approach only mitigates spatial dependence in certain situations.[4] In particular, "unless there are strong theoretical or practical reasons why distance decay should be ruled out, the use of spatial fixed effects will not be sufficient to correct for the presence of spatial correlation." Admittedly, there is only limited use of weight matrices that exhibit kernel decay in this study, but we do expect that distance will erode the effect on a given county. Consequently, the choice to model spatial dependency will better align with future extensions of this work.

4.2.2 Space as a Factor in Public Financial Theory

Spatial considerations also have a direct impact on our conception of public finance from a theoretical perspective. The more local the scope of consideration, the more important these effects become. Bennet (1980) identifies three main components that must be considered[10]:

Tapering captures the notion that services are generally delivered from a particular location. The farther one gets from this location, the smaller the benefit one may experience from a service emanating from said location. An easy example of this phenomenon is the provision of local fire fighting services. The farther one resides from the fire station, the longer it takes to consume the service in the event of a fire. This lag is likely to lead to larger amounts of damage if a fire is occurring. Thus, the expected benefit for residents who live "far" from the station is lower than those that live "near" the station. This effect has implications for the definition of a pure public good. Tapering inhibits the ability to provide a service uniformly. Even if resources were such that all fire calls at any given time could be accommodated, a form of rivalry has creeped into the picture. Stochastic consumption of fire services is more heavily consumed as a function of spatial proximity.

Jurisdictional Partitioning creates differentials in service delivery across localities. This is not inherently a bad thing. Indeed, Tiebout leverages this phenomenon to argue that differentiation is efficient.[108] We must, however, acknowledge that resource disparities do exist and jurisdictional boundaries neatly capture the joint distribution of resources, service costs, and service delivery. The more important element is an extension of this differentiation. An optimal jurisdictional area would efficiently capture the tax-expenditure bundle preferred by the constituents, and the optimal size for a jurisdiction is that which accords with the optimal range for delivery of the services rendered. To continue the fire services example, at some distance x from the station, the cost of transporting fire fighting resources outweighs the damage from a fire (to choose a particularly callous metric). Efficient jurisdictional size would be driven by the boundary at which the marginal benefit of service delivery and the marginal cost of

fire damage are equivalent.[5] In general, service range, a spatial concept, is important.

Spillover stems from jurisdictional partitioning. "[I]t is not possible to completely separate the 'service club' of one jurisdiction from another, not only because of tapering effects, but also because of the general mobility of people in modern economies who often live in one jurisdiction, work in another, and seek leisure and shopping outlets in yet others."[10] In general, the activities of one jurisdiction have significant implications for the choices of residents sited in a nearby jurisdiction. Indeed, this is the major motivation for the inclusion of spatial dependency in this study.

At a basic theoretical level, lack of uniformity driven by spatial considerations violates the absoluteness of non-excludability and non-rivalry. From an applied perspective, it is materially difficult to separate the industrial bases, preferences, and activities of neighboring jurisdictions when seeking to explain fiscal behavior. In truth, there are many examples of coordination across jurisdictions that are facilitated by spatial proximity. For all of these reasons, the case against at least exploring spatial effects in the analysis of fiscal behavior becomes increasingly untenable.

[5] Obviously this concept is complicated dramatically by political considerations and the existence of many services to deliver. The point, however, is made.

Chapter 5

Implications for Revenue Yield and Capacity

5.1 Introduction

The economic potential of any system is not only driven by the presence of natual and/or developed capital, but also the institutions that govern the exploitation of these valueable assets. In this sense, the term economic potential is misleadingly incomplete. The mechanism that drives resource allocation is a function of both the distribution of purely economic value and the feasible range of activities governed by political institutions. The goal of institutional design for economic growth, therefore, ought to be the facilitation of those activities that increase the marginal product of "value extraction" efforts. If the objective is the maximization of economic growth, this broad goal is unlikely to draw many detractors. The devil, however, is in the details. The major challenge for any fiscal manager is operating under institutional constructs that reflect in one way or another the will of the constituents, while also achieving the expected fiscal outcomes. This task is challenging because these concepts are not separable.

> "Once the fiscal policy objectives or targets are decided upon government tries to implement them by using policy parameters, such as tax rates, subsidies, transfers, purchases and other types of government expenditures over which it has conrol. These parameters are known as instruments. Policy targets and instruments belong to the same economic system. The former are endogenous and the latter are pre-determined. The values policy targets take depend on the type of instruments employed, and the relation between them will be determined by the structure of the economy."[91]

Among the multitude of policy innovations that have been advanced in service of increasing economic growth, institutional reforms that act on the property tax

base have materially altered local government finance for more than a century. As early as the 1880s, these reforms were dominated by efforts to target specific populations.[14] However, starting in large part with the Tax Revolt of the 1970s, more interest has taken root in implementing reforms that target the base in a general way: the tax and expenditure limitations discussed in the preceding sections. The impact of these and other measures has been noticeable. While property tax revenue remains fairly buoyant with respect to the economy, it has declined in importance from a proportional contribution perspective.

This paper is the first empirical section of the study. It seeks to evaluate the relationship between COTELs and homogeneity in revenue behavior across counties. In 1956, Tiebout suggested that choice among local jurisdictions was an efficiency enhancing characteristic of a federal system. Choices only exist to the extent that variety exists among the available alternatives. This paper intends to shed some light on whether or not COTELs affect the variety among the jurisdictional choices of local residents. A decrease in said variety will be referred to as "fiscal convergence". We will pursue this task by employing the operationalization of COTEL intensity discussed in Subsection 4.1.1. This concept is designed to capture the magnitude of the composite restriction of both TABOR and SLPTR. The impact of GA, by contrast, will enter the analysis as a standalone variable.

5.2 What is the Significance of Revenue Yield and Capacity?[1]

This study focuses on local revenue behavior, so perhaps it behooves us to ask whether or not local own-source revenues are really all that important. Why can local governments not rely on intergovernmental fiscal transfers from higher levels of government to satisfy their finance needs? Wallace Oates considers arguments for and against the importance of local revenue yield and capacity in some detail.[82]

For starters, from a Tiebout perspective, local revenue instruments are important because they act as prices for local constituents. They are the costs incurred by taxpayers in exchange for the consumption of local public services. Costs lead consumers to perform triage. Without costs, the strong monotonicity assumption is permitted to run wild. In other words, constituents would seek to consume without limit. It is the provision of local revenue by taxpayers that reveals opportunity cost and forces them to reveal their preferences. In so doing, they provide the information required by local fiscal managers to make smart choices in service of satisfying voter preferences.

[1] As used here, revenue yield signifies the actual, realized revenue collected by a given jurisdiction. Revenue capacity, by contrast, captures the economic potential of the tax base. We may think of this concept as the abstract revenue yield for a given county at some standard level of tax effort. If, for example, the property in county A is more expensive than the property in county B, county A can collect more revenue than county B with the same level of tax effort. In this example, county A has greater revenue capacity than county B.

As discussed in Subsection 2.1.1, local discretion over revenue sources is critical for local autonomy, an ideal that has been advocated on practical and theoretical grounds. Practical arguments extend back at least as far the debate over the crafting of the US Constitution. The so-called Anti-Federalists argued vociferously against the consolidation of power in central government. They believed that not only was this a sure path to a tyrannical regime, but also that it was remarkably impractical to try and govern so vast and diverse a country from a single location. Representatives sent to higher levels of government could not possibly reflect the rich diversity of interests and needs that would inevitably fall within their purview. From a theoretical perspective, local autonomy facilitates the pursuit of the marginal equivalence of costs and benefits, an efficiency enhancing feature that naturally seeks welfare maximization for society.

Detractors could feasibly argue that marginal equivalence is not actually possible because the costs of production are often uncoupled with the means of financing public goods. Furthermore, given disparities in resource endowments, there are limits to the volume and quality of services that can be provided for some local jurisdictions, no matter what their preferences are. For the sake of balance, we should also note that the Federalists were greatly concerned by the potential for material harm to minority "factions" if local autonomy was too strong. Their bias towards central provision was cultivated in part because they believed the multitude of opinions expressed at higher levels of government would lead to fairer outcomes, in this case fairer allocations of public resources. In the end, all that seems to be clear is that either extreme appears to be undesirable. Therefore, the role for local own-source revenue is an important one that is worthy of study.

5.3 What is the Expected Impact of TELs on Fiscal Convergence?

Fiscal convergence in our context carries a spatial dimension. When one considers the siting choice of a taxpayer, theoretically, the entire set of local jurisdictions in the country is available to him or her. In reality, however, the costs associated with all of these choices is far from equal even when staying inside Colorado. Leaving aside cost of living for the purposes of our analysis, the costs of mobilization are non-trivial. It is much more costly for a resident of the northeastern County of Logan to move to the southwestern County of Montezuma, than it would be to move to the neighboring County of Morgan. Thus, convergence in fiscal outcomes does not have to be uniform across the entire state to have a significant impact. The activity that occurs in the local neighborhood, the collection of counties that are "close" to the county of interest, is the driving factor. For this reason, we are concerned with the *clustering of fiscal behavior within the local neighborhood.*

From a theoretical standpoint, there are two main features of COTELs that would promote fiscal clustering among low-capacity jurisdictions in particular.

First, COTELs impose asymmetric pressure on revenue yields over time. The rate of increase is limited by an explicit growth limit, but decreasing yields are not so constrained. Furthermore, once a drop in revenue has been experienced in one year, the baseline is "ratcheted" down. The allowable revenue in the current year is measured against only the previous year's revenue, and not the long term trend. Low revenue years have a disproportionate impact on the long-term revenue capacity of the jurisdiction.

The second impact is related to the first. To the extent that COTELs bias revenue downward (in a manner quite uncoupled with demand projections), it becomes increasingly difficult for constrained jurisdictions to invest in the human and physical capital needed to support robust economic growth. The first effect impacts revenue generation, while the second impacts the capacity of the economic base itself.

A complicating factor is the existence of spillovers. Both the provision of public goods and the economic vitality of neighboring jurisdictions impact the fiscal and economic capacity of the primary jurisdiction. This externality network has the potential to dynamically reinforce economic growth behavior, whether it be a high or low growth regime. If COTELs exacerbate this effect, there could be undesirable long-term consequences for low capacity counties seeking to create the conditions for economic growth. Insofar as the relationship between COTEL intensity and spatial dependency is evaluated, this chapter explores this phenomenon directly.

5.4 How is Fiscal Clustering Measured?

Testing whether or not the constraints imposed by COTELs lead to fiscal convergence is difficult to achieve with the prevailing models in this area. Most of the empirical work attempts to study TELs across states, and as such, focuses on statewide definitions of TELs. This tends to cover up local variation, but perhaps more interestingly, this choice in geographic scope encourages certain kinds of questions. What is the impact of TELs on revenue volatility?[21] Do TELs constrain property taxes?[35] Do TELs constrain growth in public employment and wages?[86]

Comparatively little research examines the within state dynamic. Once one asks the question about local differences, modeling the parameter of interest is a different game altogether. In this case, the researcher must tease out variation among fiscal circumstances for which statewide policy is a common denominator. Once this issue comes to the fore, one is immediately confronted with the following question: if the statewide policy does not vary cross-sectionally, do we expect uniform impact across all jurisdictions at time t? Fiscal behavior is a function of economic circumstance, and given the variation in economic bases across a given state, one would expect COTELs to have different impacts in different jurisdictions.

A second, and related, question is whether or not we expect a temporal element in the impact of COTELs. Does the constraint placed on a county

increase with the amount of time the county has spent operating under the COTEL? Furthermore, given the fact that the COTEL environment is composed of overlapping policies, do we expect interaction effects to play a role? To shed light on such questions, this study employs spatial techniques to examine a panel dataset of county-level fiscal and economic data in Colorado over the 1987-2009 time period (econometric exploration begins in 1995). First, we establish the existence of temporal variation in fiscal clustering, and then we employ econometric techniques to uncover the impact of COTEL intensity and the Gallagher Ratio.

5.4.1 Does Fiscal Clustering Occur and Does it Change Over Time?

The hypothesis rests on the idea that not only does spatial clustering of fiscal behavior occur, the nature of the clustering must vary over time. Without both of these conditions, there is no basis for measuring the impact of COTELs on fiscal convergence. To determine whether or not these conditions are met, we will take snapshots of fiscal and economic hotspots[2] every five years, starting with 1987. Fiscal hotspots are evaluated via measurement of revenue yield per capita. Economic hotspots are evaluated via annual payroll per capita.

One might reasonably ask why annual payroll is being used. It does not correspond to a specific tax base levied by Colorado counties, and in general, per capita income is usually the preferred measure. There are three reasons for this choice. First, a measure of the tax base is already established with per capita revenue. We seek to get at the total economic resources available in this case. Second, in comparing income and annual payroll, we see that income is tied to residents that live in the jurisdiction while payroll is tied to firms that are located in the jurisdiction. Since residents can earn income in jurisdictions other than the one in which they live, their income is more likely to reflect decisions made outside of the county. Annual payroll, on the other hand, is necessarily contained within the county. This is useful insofar as it directly speaks to the economic activity influenced by the decisions of policymakers within the county. Third, annual payroll is readily available by county throughout the study period, thanks to the rather detailed Quarterly Census of Employment and Wages.

The hotspots are identified with Local Indicators of Spatial Autocorrelation (LISAs) developed initially by Getis & Ord[46], with subsequent development by Anselin.[2] The measures are Getis & Ord's G* (GOG) and Local Moran's I (LMI), respectively. To evaluate clustering, LISAs require a definition of the linkages of importance between jurisdictions. Said differently, they require an explicitly defined local neighborhood. Spatial analysis is generally sensitive to the choice of weight matrices (which define the local neighborhood), so we test multiple neighborhood criteria. Corroboration across tests lends support to the findings.

[2]"Hotspots" are pockets of similar values.

5.4.1.1 Weight Matrices

Weight matrices, in an abstract sense, define "closeness". The definition of proximity can vary quite dramatically by application. The most natural interpretation, the one employed in this study, is based upon spatial proximity. However, it is quite plausible to use other distance measures. For example, one might define neighbors as those counties with similar demographics, industrial bases, or any other characteristic of interest. Since the focus of this study is on siting choice given the cost of mobility, spatial proximity is a natural choice.

Taking spatial proximity as the weight basis, there are a number of ways to define the neighborhood. This study employs two common approaches: contiguity and distance. As one might expect, contiguity requires contact to be considered a neighbor. Contact with the primary jurisdiction is not strictly required. A second order contiguous neighborhood, for example, would include neighbors that contacted a jurisdiction in contact with the primary jurisdiction. Distance, by contrast, includes as neighbors all jurisdictions within some distance of the primary jurisdiction.

Within the contiguity and distance classes of weight matrices, there are several variations on the theme. Figure 5.1 shows two types of contiguous neighborhood definitions in the first two panels: rook and queen. As can be seen, these definitions are taken directly from the rules of chess. The third panel provides a generic view of a neighborhood defined via a distance metric. In this instance, distance is measured from the primary jurisdictions centroid, but one could envision distance from the closest border or the population's center of gravity being relevant metrics as well.

As depicted in Figure 5.1, all of the weights for each neighborhood are binary. Blue squares indicate weight values of 1, so those jurisdictions are "all in", so to speak. Binary classification of neighbors is in no way a requirement. The strength of the weight may vary with proximity, and there are a number of decay functions in common use. This study employs three kinds: binary, inverse distance, and Gaussian. Generic examples of these are depicted in Figure 5.2.

Given this information, the neighborhoods used to identify hotspots are defined by the following metrics:

- Rook Contiguity (w_rook)
- Queen Contiguity (w_queen)
- Distance Band - Binary (w_db_b)
- Distance Band - Continuous (Inverse Distance Decay;w_db_c)
- Kernel (Gaussian Decay;w_kern)

Each choice features differing county-specific neighbor counts for each weight matrix. For example, for rook contiguity (w_rook), five is the most frequent neighborhood size. This is in sharp contrast to the kernel matrix (w_kern), which hase only six counties with a neighborhood of size five. The inconsistent

Model 5 Weak and Strong Monotonicity

WEAK MONOTONICITY: *If* $x \geq y$ *then* $x \succeq y$.
STRONG MONOTONICITY:*If* $x \geq y$ *and* $x \neq y$, *then* $x \succ y$.

"Weak monotonicity says that 'at least as much of everything is at least as good'. If the consumer can costlessly dispose of unwanted goods, this assumption is trivial. Strong monotonicity says that at least as much of every good, and strictly more of some good, is better. This is simply assuming that goods are good."[111]

Figure 5.1: Differing Weight Matrix Definitions

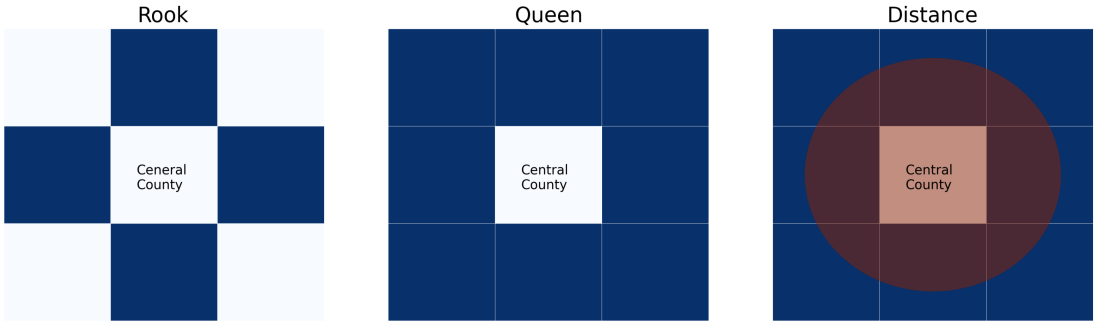
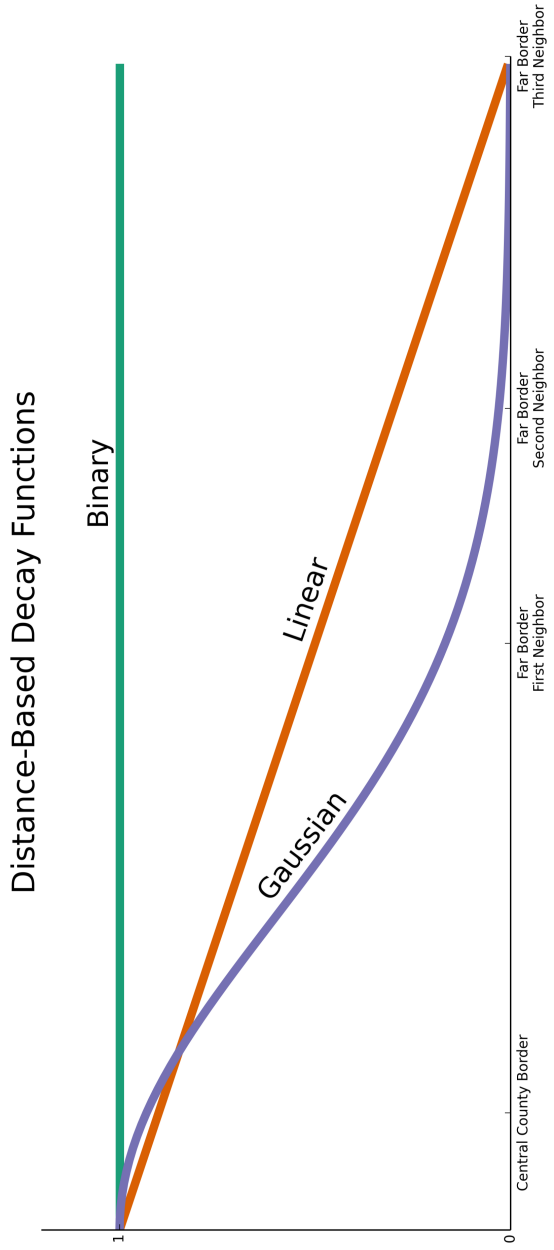


Figure 5.2: Variance in Weight as a Function of Distance



neighborhood size distributions demonstrates the substantive variation in the definitions employed by each weight matrix and the reason for sensitivity to neighborhood definition.

5.4.1.2 Local Indicators of Spatial Autocorrelation

There are two primary measures used to establish spatial clustering for each weigh matrix/year combination. LMI measures the global spatial autocorrelation in an attribute y over a given neighborhood. Equation 6 is calculated for each county, i. LMI permits a kind of topological view of autocorrelation. Just as providing a single moment of a vector of values masks other distributional characteristics of the data, providing only a single global parameter for spatial association masks regional dynamics. LMI reveals these dynamics by providing values for each spatial observation (e.g. county), thereby enabling the analyst to take note of patterns (e.g. fiscal clusters). LMI returns high values for a county when it is surrounded by *similar* values, and it returns low values when it is surrounded by *disimilar* values (Figure 5.3).

As noted by Anselin[2], the interpretation of LMI is insufficient for a comprehensive knowledge of the clustering behavior of spatially related activities. It can provide an analyst with knowledge of the existence of clusters, but it does not provide information about the type of clustering. In this regard, GOG (Equation 7) is a natural complement. It is also calculated for each spatial feature (e.g. county). In contrast to LMI, GOG returns high values when *high* values are clustered and low values when *low* values are clustered (Figure 5.4).

If one were to rely solely on LMI, the clustering of low revenue capacity would be indistinguishable from the clustering of high revenue capacity. If one were to rely solely on GOG, it would not be possible to detect unusual patterns of discontinuity.[3] This would render the detection of local anomolies more difficult, and in turn, the identification of spatial non-stationarity.[4] Therefore, to gain a

[3]Unusual patterns would be those discontinuities that were beyond those which would occur with a random shuffling of values. In other words, they would be systemic patterns of disimilarity, also known as negative spatial autocorrelation.

[4]Stationarity is the same concept in a spatial context as it is the more widespread temporal context. In time series, the joint distribution of observations must be invariant to a time shift to be considered strictly stationary.

> "A time series r_t is said to be *strictly stationary* if the joint distribution of $(r_{t_1}, ..., r_{t_k})$ is identical to that of $(r_{t_1+t}, ..., r_{t_k+t})$ for all t, where k is an arbitrary positive integer and $(t_1, ..., t_k)$ is a collection of k positive integers."

Weak stationarity just requires that the mean of the reference observation and the covariance between the reference and a lag of arbitrary size must be invariant to a time shift. In effect, the observations share a common mean, and there is some fixed amount of noise.

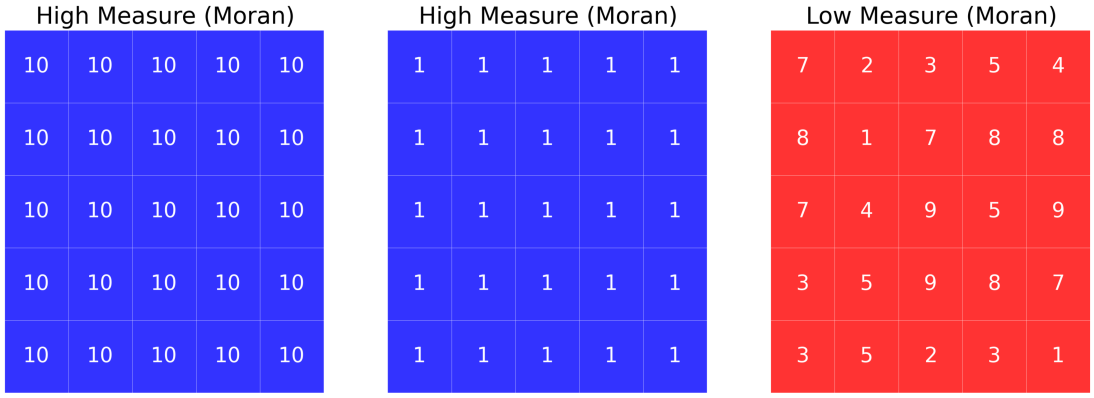
> "A time series r_t is *weakly stationary* if (a) $E(r_t) = \mu$, which is a constant, and (b) $\text{Cov}(r_t, r_{t-l}) = \gamma_l$, which only depends on l."[110]

One may think of spatial stationarity in the same way, accept that lags are not uni-directional as in the time series case. Rather, lags extend in all directions. In a time series, the observation in the preceding time period is a first order temporal lag. In a neighborhood defined by queen contiguity (see Subsection 5.4.1.1), all of the jurisdictions that touch the primary jurisdiction are first order spatial lags.

Model 6 Local Moran's I (LMI)

$$I_i = \frac{\sum_j z_i w_{i,j} z_j}{\sum_i z_i^2} = \frac{\sum_j (y_i - \bar{y}) w_{i,j} (y_j - \bar{y})}{\sum_i (y_i - \bar{y})^2}$$

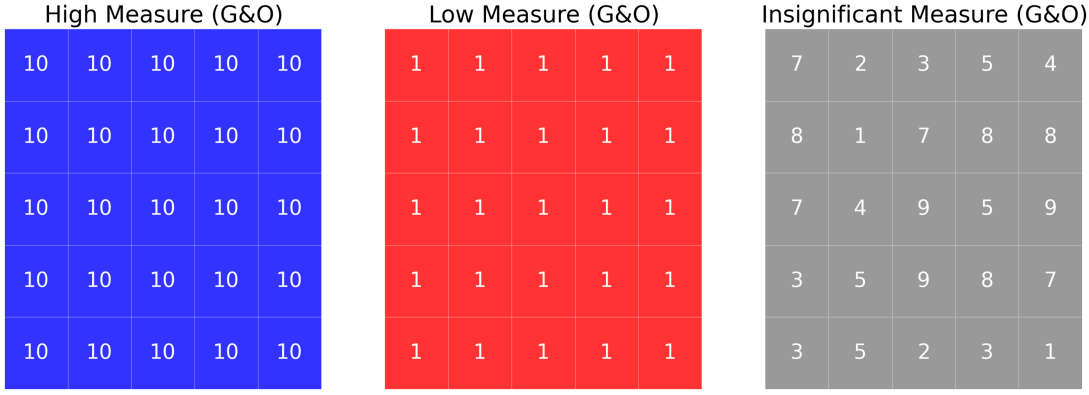
Figure 5.3: Interpretation of Local Moran's I Values



Model 7 Getis & Ord's G* (GOG)

$$G_i(d) = \frac{\sum_j w_{i,j}(d) y_j - W_i \bar{y}(i)}{s(i)\{[(n-1)S_{1i} - W_i^2]/(n-2)\}^{(1/2)}}, j \neq i$$

Figure 5.4: Interpretation of Getis & Ord's G* Values



complete picture of spatial patterns in revenue yield and capacity, we must use both LMI and GOG.

The spatio-temporal plots below display spatial clustering activity over time for each weight matrix. The first collection (Figure 5.5) features clustering as a measured by LMI while the second (Figure 5.6) features GOG. In both collections, the first plot matrix displays clustering of revenue yield (per capita revenue) and revenue capacity (per capita annual payroll). While the intensity of clustering does vary to some extent across different weight matrices (as indicated by varying color intensity), the general patterns persist.

Not only does revenue yield clustering occur, the extent of the clustering changes over time. Furthermore, upon closer examination of the data, three main properties stand out:

1. Variation is substantially higher in GOG, which indicates relative consistency in clustering activity, with larger variation in the magnitude of clustering values. This could mean correlated revenue capacity shifts across multiple counties within given neighborhoods.

2. Variation is generally more substantial in the higher values for both statistics. For LMI, this indicates varying intensity of spatial association amongst similar values. For GOG, this indicates low capacity counties are more tightly coupled than high capacity counties.

3. Central tendency generally leans right of zero for LMI, and left of zero for GOG. This suggests a tendency towards the existence of spatial clustering, but this clustering occurs more often among low capacity jurisdictions.

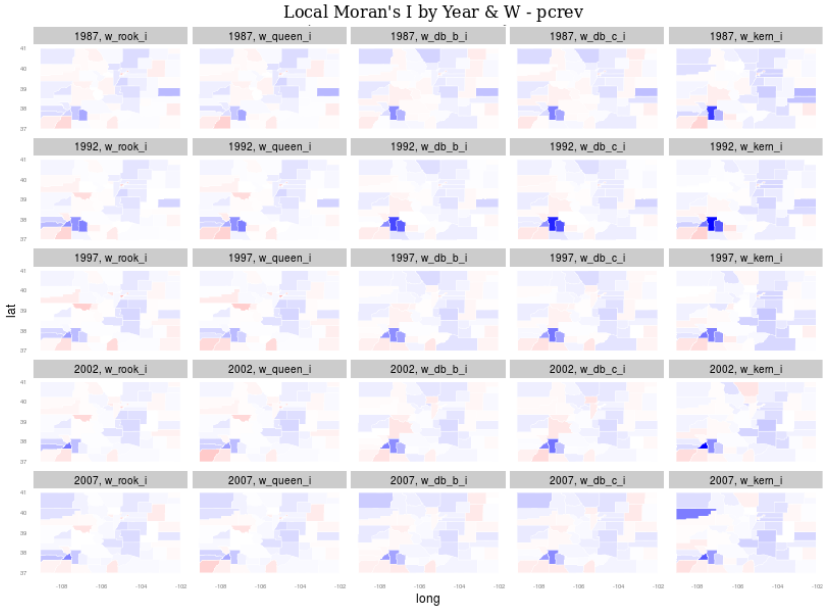
5.5 Do TELs Depress Revenue Yield and Capacity?

Globally consistent trends in clustering are far from clear in the figures above, but it is clear that there exists variation in the intensity of clustering as time passes. Extracting the marginal effect of COTEL intensity requires econometric exploration. In this analysis, we employ three approaches to explore this impact on measures of both revenue yield (per capita revenue; *pcrev*) and fiscal capacity (per capita annual payroll; *pcap*).

5.5.1 Modeling Approaches

Pooled Ordinary Least Squares estimation serves as the baseline specification. It is primarily an exploratory modeling exercise to place the integration of spatial and temporal dependency in context. Two models, with per capita revenue and per capita annual payroll, the primary dependents, are evaluated. Furthermore, given the absence of an explicitly modeled spatial dependency structure, the pooled OLS approach facilitates the exploration of COTEL intensity impact on the LISAs defined above. The

Figure 5.5: Spatio-Temporal Plots - Local Moran's I



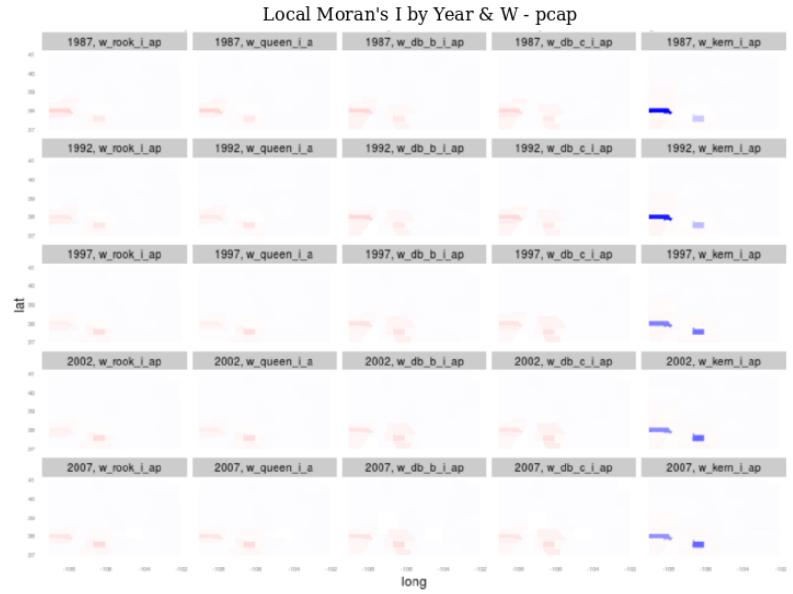
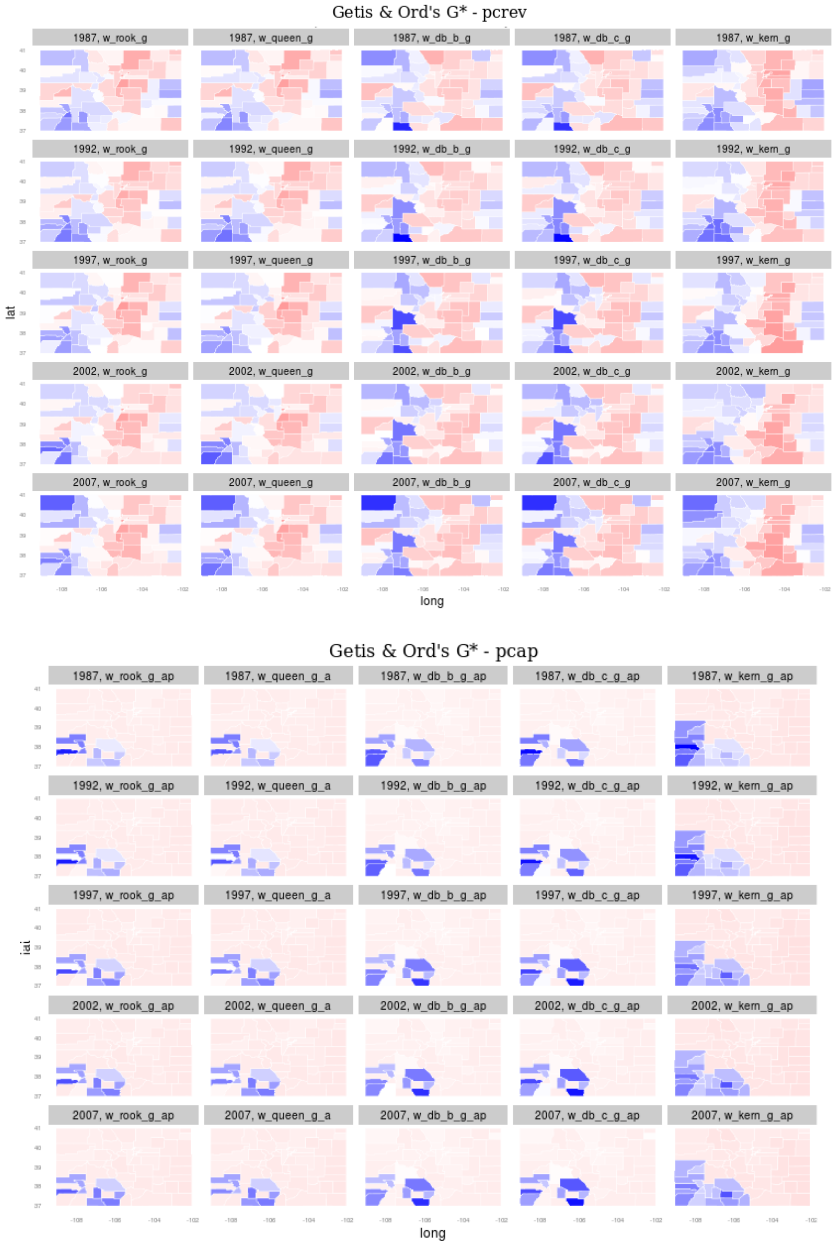


Figure 5.6: Spatio-Temporal Plots - Getis & Ord's G*



LISA subset of models use each combination of LISA measure, fiscal indicator, and weight matrix as the dependent variable. For example, one dependent (w_rook_i) will be the LMI score for per capita revenue, as calculated with rook contiguity. Dependents capturing annual payroll include an extension:$\_ap$. The sister dependent variable to w_rook_i is $w\_rook\_i\_ap$. There are two LISAs (LMI and GOG), two fiscal indicators (per capita revenue and per capita annual payroll), and five weight matrix definitions (see Subsection 5.4.1.1). Therefore, there are 20 LISA models.

Repeated Cross-Sectional Spatial Lag estimation provides year-specific assessments of COTEL intensity impact while incorporating the fiscal behavior of the local neighborhood. All of these models are evaluated with the rook contiguity weight matrix (w_rook). The decision to select one weight matrix for presentation is a function of two factors. First, the trends revealed by the analysis are generally insensitive to the choice of weight matrix. Second, presentation of all weight matrices is likely to suffer from diminishing returns while simultaneously inhibiting the central message. In general, this series of models provides some sense of temporal variation over time. There are two fiscal indicators (per capita revenue and per capita annual payroll) and 17 years (1993-2009), leading to a total of 34 models.

Fixed Effect Panel estimation does not contain a spatial component, but it does enable us to incorporate county-level unobservable characteristics (albeit suboptimally). This basically trades one specification element, spatial autoregression, for another, capture of county-specific factors that do not explicitly enter the model. The approach provides a cleaner view of TEL impacts than cross-sectional analysis because the fixed effects shift the focus to within county deviations. Two of these models are run, one for each dependent: *pcrev* and *pcap*. A Hausman test was used to select fixed as opposed to random effects.

5.5.1.1 Econometrics as Observation

In total, there are 58 models that will be presented. One would be well within the bounds of reasonableness to ask why an analyst would even bother to attempt presentations of so many. The answer is that this inquiry seeks to partially address a certain type of estimating uncertainty. When estimating the parameters of an economic process, the precise nature of what we are estimating is somewhat unclear.

> "Haavelmo distinguishes between *autonomous* relations, which are invariant to a wide range of interventions, and [...] *confluent* relations, which are the result of (complex) interactions of autonomous relations. Confluent relations may appear stable until subjected to interventions."[58]

We may think of the autonomous relations as those which bind the components of the true, underlying data generating process. We know that, for example, the volume of a gas is proportional to its temperature, which is just a measure of the kinetic energy in the gas. This is a natural linkage, in the sense that it is always true, everywhere. This is an autonomous relation. When we seek to measure such a phenomenon, however, one must worry about confluent relations. For example, we will not observe the natural linkage between temperature and volume if the volume is somehow constrained by another variable in the system. This would produce variation in our estimates, even if no such variation exists in the underlying data generating process.

Since we have no validation mechanism that reveals the data generating process[5], we cannot know if we are actually observing an autonomous or confluent relation. Consequently, Hoover suggests that we must assume all of our observations are confluent interactions between the more conceptually atomistic autonomous relations. The question remains, what is the appropriate mitigation strategy?

First and foremost, we must recognize that each econometric strategy we may employ has its failings. For example, fixed effect estimation is useful for capturing the aggregate impact of group-specific characteristics, but by failing to identify the characteristics covered by the fixed effect explicitly it creates challenges in exploring the specific nature of these impacts. Just as a sample drawn from a population provides a specific view of the population that does not capture its full variety, the model an analyst chooses to employ captures a particular view of that sample. That view is a function of both the strengths and weaknesses of the modeling approach and the specification evaluated by the analyst.

> "Economists customarily speak of these [models] as 'good', 'bad', 'valid' and 'invalid'. Given the distinction between the data-generating process and confluent relations, it would be more to the point to *think of these econometric calculations themselves as observations of the confluent relations.* As such they may be illuminating or useful or neither, but not valid or invalid."[58] (emphasis added)

Conceiving of econometric calculations as observations of the underlying interplay between the components of the true data generating process shifts the focus away from the identification of precise estimation of an effect, *if one seeks to flesh out the dynamics needed to shape a paradigm of thinking about a given phenomenon.* To the extent that the analysis presented here is largely an effort to open the study of TELs to a broader array of potentially confounding elements, the analysis is more about the establishment of directional action.

In this light, an ensemble approach like that used here is useful. Instead of precision, we are concerned with agreement. The more observations (that is, econometric calculations) that support the direction of impact for a given

[5] If we did, of what value would estimation be?

variable, the higher the degree of confidence we can ascribe to the our proposed view of the world.

5.5.2 Members of the Regressor Set

The independent control variables seek to capture changing dynamics in the economic and demographic conditions by county. State level indicators are also included to provide macro-level context, as are our primary variables of interest (those capturing COTEL impact).

Gross State Product (*gsp*) provides a measure of statewide economic activity. It is intended to capture some measure of resources available to the state in a given year. It is omitted in the repeated cross-sectional models, because it does not vary across counties within a single year.

Lagged Population Growth (*lpop_growth*) provides a measure of public demand for services and housing. With respect to the former, demand for services (a.k.a. expenditure need) determines the level of revenue required in a given year. With respect to the latter, population growth drives the demand for housing, which in turn drives up prices and the overall value of the revenue base.

State Level Unemployment Rate (*st_unempr*) is a business cycle indicator. Economic downturns have dynamic consequences for jurisdictions subject to TABOR.[105] Specifically, downturns increase the likelihood of the revenue yield failing to reach the growth ceiling imposed by TABOR/SLPTR. The consequence is a permanently lowered revenue baseline in the absence of a local override.

Housing Permits per Unit Housing (*permit_rate*) is related to population growth, but it provides a more direct, concurrent measure for housing market pressures. More importantly, it captures the TABOR growth factor (new construction) in a straightforward way.

Vacancy Rate (*vac_rate*) is the most direct measure of housing demand. There are reasons for both the population growth and permit rate indicators to separate from stock utilization. For example, population growth may be accompanied by increases in household size and permit rates may increase due to developer forecasting assumptions. Neither separation is possible with the vacancy rate.

Total Revenue From All Governments (*all_gov_rev*) captures the cumulative receipts for all governments in the county. It is meant to give a sense of the total volume of public resources available in the county. (Recall that *pcrev* captures only county government receipts per capita.)

County Proportion of Total Revenue From All Governments (*cty_rev_prop*) captures the proportion of cumulative receipts for all governments in the

county that is collected by the county government. County governments are an unambiguously important component of fiscal operations, but the magnitude of that importance can vary across counties. This measure also speaks to the ability of other governmental entities to pick up the slack when counties are constrained.

5.5.2.1 Variable of Interest

Ratio of Residential to Non-Residential Assessment Value (*prop_ratio*) captures the county-specific value of the measurement used to set statewide assessment rates pursuant to the Gallagher Amendment. It is one of our primary variables of interest.

Cumulative Impact of TABOR and SLPTR (*intensity_stock*) is another primary variable of interest. It captures the extent to which TABOR and SLPTR limit the revenue yield for a county to reach its potential.

The fiscal yield models regress fiscal yield (*pcrev*) on all of the above regressors *and fiscal capacity* (*pcap*). The fiscal capacity models, on the other hand, only include the above regressors. Fiscal yield does not enter the fiscal capacity models. Note that all dollar amounts have been adjusted to reflect 2009$.

5.5.3 Results

Clearly, there are challenges associated with the presentation of 58 models. As mentioned above, however, our overarching concern is consistency. To what extent do the models tell the same story. With this in mind, we are afforded some flexibility in presentation. A graphical approach is taken here. Furthermore, a summary view of the LISA models is provided, each view of which shares averages of coefficient estimates, p-values, and model fit for all five weight matrices presented. In all of the visualizations that follow, three interpretations apply:

1. Coefficient estimates are represented by the y-axis value;
2. p-values are represented by color of the bubble[6]; and,
3. Model fit (R^2) is represented by the size of the bubble.

5.5.3.1 Baseline Estimation with Pooled Ordinary Least Squares

As will become apparent, the pooled OLS models provide a view of a counterintuitive, yet relatively consistent, narrative. While the COTEL intensity measure (*intensity_stock*) has the expected negative and statistically significant effect on revenue yield (*pcrev*), higher values of the intensity measure are consistently associated with higher levels of fiscal capacity (*pcap*). This is a curious result that directly challenges the notion that COTELs limit the fiscal capacity of a

[6] A diverging color scale is used.p-values below 0.1 are a shade of blue, while values above 0.1 are a shade of red.

given county. Furthermore, the same revenue yield relationship holds for the ratio of residential and non-residential property (*prop_ratio*) used to capture the impact of the Gallagher Amendment (the Gallagher Ratio). Again, higher relative amounts of residential property are associated with lower revenue yields. This accords with intuition to the extent that GA is designed to limit residential property tax liability. Fiscal capacity, on the other hand, is higher in counties which have higher relative levels of residential property in the assessment base.

Note also the large disparity in model fit across the two models. This is a persistent character of this analysis - all of the revenue yield models explain a larger portion of the variance than do their fiscal capacity counterparts. This is perhaps unsurprising. The impact of institutions and economic changes on revenue yield is much more direct than is the impact on fiscal capacity. Complete identification of this indirect linkage can be pursued in future research.

5.5.3.2 Evaluating the Impact on Fiscal Clustering with Local Indicators of Spatial Autocorrelation (LISAs)

Using the LISAs as dependents provides some notion of how the variables in the model impact spatial clustering of revenue yield and fiscal capacity. Counties experiencing higher levels of COTEL intensity are expected to converge in the revenue yield and fiscal capacity measures. In effect, the COTELs are expected to retard their revenue growth, which will create a wedge between constrained and unconstrained counties. It has already been shown that spatial clustering of fiscal behavior occurs, so this wedge is expected to be spatially relevant. The visualization of these results employs averages across the five weight matrices used in this analysis (see Subsecton 5.4.1.1). Again, this is to limit the sensitivity of interpretation to choice of the local neighborhood, W.

The results of the LISA models can be placed in context by getting a sense of the distribution of clustering values. Figure X shows the kernel densities of each LISA dependent variable. They are grouped by clustering concept (e.g. Local Moran's I, or LMI) and clustering value (e.g. per capita revenue, or *pcrev*). Within each group, the densities are shown for all five weight matrix definitions used in this analysis (see Subsection 5.4.1.1). Take note of the reported standard deviations. They range from $\sigma = 0.56$ to $\sigma = 2.47$, although the latter is a bit of an outlier. The median is $\sigma = 1.16$.

To reiterate, high values of LMI indicate the clustering of similar values, while low values indicate the clustering of disimilar values. In other words, high values of LMI can indicate the presence of a local neighborhood of counties characterized by either high revenue yield/fiscal capacity or low revenue yield/fiscal capacity. In contrast, high values of GOG indicate clustering of high values, while low values of GOG indicate clustering of low values. Thus, LMI reveals more about the strength of clustering while GOG reveals more about the type of clustering.

When controlling for other factors, COTEL intensity (*intensity_stock*) has very limited impact on the clustering of revenue yield (*pcrev*). Said differently, if a county is highly constrained, the constraint is not a significant driver of

the clustering that already exists. This is interesting because one could reasonably expect that the inflexibility of achievable expenditures in the constrained county would force convergence in fiscal behavior, thereby taking jurisdictional idiosyncrasies out of the siting equation and reinforcing similar revenue preferences in the local neighborhood. It is possible that collaborative efforts in the local neighborhood to provide wide area services free up enough revenue to still allow for some base level of distinction. Further, COTEL intensity has a rather ambivalent relationship with fiscal capacity (*pcap*) clustering values (GOG), which speaks little to the idea that higher levels of COTEL constraints are related to clustering of low values of fiscal capacity. In other words, this view provides no support for the hypothesis that COTELs ultimately limit fiscal capacity for low-income jurisdictions.

On the other hand, the Gallagher Ratio (*prop_ratio*) behaves precisely as we would expect from a revenue yield perspective. Insofar as it increases the strength of clustering (higher values of LMI) and decreases the values assoicated with said clustering (low values of GOG), the evidence suggests that the measure is a limiting factor on revenue yield in the local neighborhood. On the fiscal capacity side, the Gallagher Ratio is neither statistically or substantively relevant. In both the revenue yield and fiscal capacity models, the model fit is modest at best (particularly with respect to the latter) and categorically lower than the fit of any other model considered in this chapter.

5.5.3.3 Incorporating the Local Neighborhood with Spatial Lags

Repeated SLM analysis allows us to incorporate the local neighborhood explicitly because the spatial lag of the dependent variable is the weighted average of the dependent variable value in the neighboring jurisdictions. Evaluating annual cross-sections is useful insofar as it provides a view of the variation in regressor impact over time, both in magnitude and significance. The non-trivial downsides are two-fold:

1. Repeated cross-sections do not permit control of year-specific factors; and,
2. To the extent that deBrucing is an ongoing phenomenon, there is temporal variance in the sample properties. The characteristics of the counties, namely the capacity of COTELs to constrain a given jurisdiction, are changing over time.

As a consequence, the technique can only be useful in this context as a complementary component in a larger analysis.

With respect to revenue yield, both COTEL intensity (*intensity_stock*) and the Gallagher Ratio (*prop_ratio*) accord with the pooled OLS results. They both materially decrease the revenue per capita in the county, even after controlling for the revenue dynamics in the local neighborhood. In other words, these are reductions over and above the preferences that may be shared with neighboring jurisdictions.

The interesting dynamic revealed by the repeated cross-sectional approach is that COTEL intensity appears to get less significant over time, both in statistical

and substantive terms. In contrast, the Gallagher Ratio is doing precisely the opposite. This could indicate either a shift in the composition of counties subject to binding COTEL constraints or a shift in the composition of the property assessment base (or both).

Evaluating fiscal capacity with the repeated SLM approach reveals the tenuous nature of any direct connection between our COTEL variables and per capita annual payroll. COTEL intensity and the Gallagher Ratio are both statististically insignificant in every single year. For the most part, COTEL intensity is also substantively insignificant while the Gallagher Ratio demonstrates substantial variation in magnitude. With respect to the latter, it is also worth noting that the sign of the Gallagher Ratio estimate remains at least directionally consistent with the pooled OLS run. Even when controlling for the other factors, the underlying positive relationship between per capita annual payroll and the Gallagher Ratio.

5.5.3.4 Capturing Temporal Dependency with Fixed Effects

Pivoting from the modeling of spatial to temporal dependency, it is possible to control for county-specific unobservables that may obscure the mechanism by which changes in COTEL intensity (*intensity_stock*) and the Gallagher Ratio (*prop_ratio*) effect changes in revenue yield and fiscal capacity. The panel model results plot for revenue yield reveals a consistent theme for most variables, although the permitting rate (*permit_rate*) sign has switched from the OLS flight. Both COTEL intensity and the Gallagher Ratio are modestly depressing forces on revenue yield in a given county.

The raw coefficient estimates are provided in Tables5.1 and5.2 . If the estimates are standardized to reflect the impact sizes as a multiple of the standard deviation, a one standard deviation shift in COTEL intensity accounts for a shift in revenue yield of approximately 4% of one standard deviation in revenue yield (*pcrev*). The parallel impact for the Gallagher Ratio is 9%. These figures are roughly three times as large as those reported in the pooled OLS model, and twenty times as large as those reported in the spatial lag models (on average).[7]

The results of the panel analysis of fiscal capacity do little to sort out a pattern in the estimates reported in previous models. While COTEL intensity is still positive and significant once again, the Gallagher Ratio is now negative for fiscal capacity. The latter result contrasts sharply with the pooled OLS and SLM models. This may suggest that the other models were using the Gallagher Ratio as a proxy for some of the unobserved characteristics we are now capturing in the fixed effects.

[7] Note that this is the average response to a shift of a single standard deviation across the models for all years. Thus, this effect would not necessarily scale linearly,*even if the impact of a change in COTEL variables were consistent through the entire range of COTEL values.*

Figure 5.7: Kernel Density Estimates of Year-Specific LISA Values for Revenue Yield
These kernel density estimates capture the same information as the spatio-temporal plots in Figure5.5 and Figure5.6. Instead of displaying the values by county, however, the values for all counties for a given year are captured in each estimate. The plots in the left column (with the$_i$ suffix) capture LMI estimates while the plots in the right column (with the$_g$ suffix) capture GOG estimates. The weight matrices used are apparent from the labeling. For example, in the left plot in the first row, each kernel density estimate captures Local Moran's I values for revenue yield in each year captured (1987, 1992, 1997, 2002, 2007).

Table 5.1: Fixed Effect Estimation - Revenue Yield ($R^2 = .959$)

Variable	β	p-value	S.E.
Gross State Product (*gsp*)	0.001	5.888×10^{-03}	0.000
Lagged Population Growth (*lpop_growth*)	-29.018	6.007×10^{-01}	55.424
State Unemployment Rate (*st_unempr*)	17.772	1.310×10^{-04}	4.629
Housing Permits Rate (*permit_rate*)	2911.950	8.086×10^{-08}	538.725
Vacancy Rate (*vac_rate*)	3.969	2.701×10^{-02}	1.792
Fiscal Capacity (*pcap*)	0.033	3.097×10^{-19}	0.000
COTEL Intensity (*intensity_stock*)	-41.543	4.145×10^{-03}	14.457
Gallagher Ratio (*prop_ratio*)	-16.785	7.537×10^{-01}	53.489
County Govt. Revenue Proportion (*cty_rev_prop*)	2973.786	1.056×10^{-128}	105.799
Revenue from All Govt in County (*r_all_gov_rev*)	-0.000	1.046×10^{-02}	0.000

Table 5.2: Fixed Effect Estimation - Fiscal Capacity ($R^2 = .952$)

Variable	β	p-value	S.E.
Gross State Product (*gsp*)	0.024	5.753×10^{-58}	0.001
Lagged Population Growth (*lpop_growth*)	-535.619	2.690×10^{-01}	484.246
State Unemployment Rate (*st_unempr*)	-61.950	1.257×10^{-01}	40.419
Housing Permits Rate (*permit_rate*)	-2625.838	5.772×10^{-01}	4709.004
Vacancy Rate (*vac_rate*)	44.088	4.826×10^{-03}	15.608
COTEL Intensity (*intensity_stock*)	604.101	1.540×10^{-06}	124.945
Gallagher Ratio (*prop_ratio*)	-74.558	8.734×10^{-01}	467.619
County Govt. Revenue Proportion (*cty_rev_prop*)	4222.329	4.479×10^{-06}	915.293
Revenue from All Govt in County (*r_all_gov_rev*)	0.000	1.522×10^{-27}	0.000

Figure 5.8: Regressor Correlation Plot

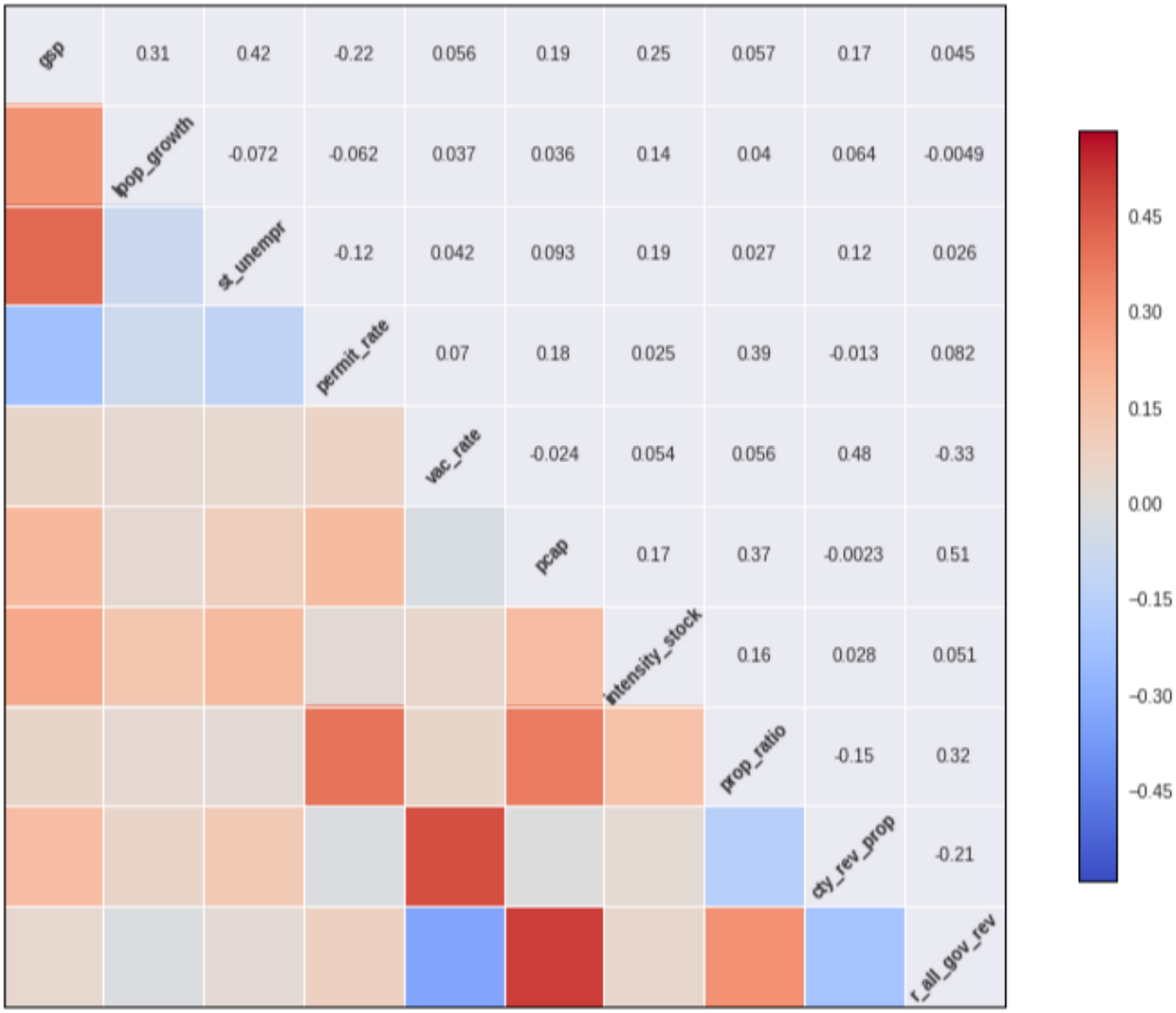


Figure 5.9: Pooled OLS Results - Fiscal Capacity (*left*) & Revenue Yield(*right*)

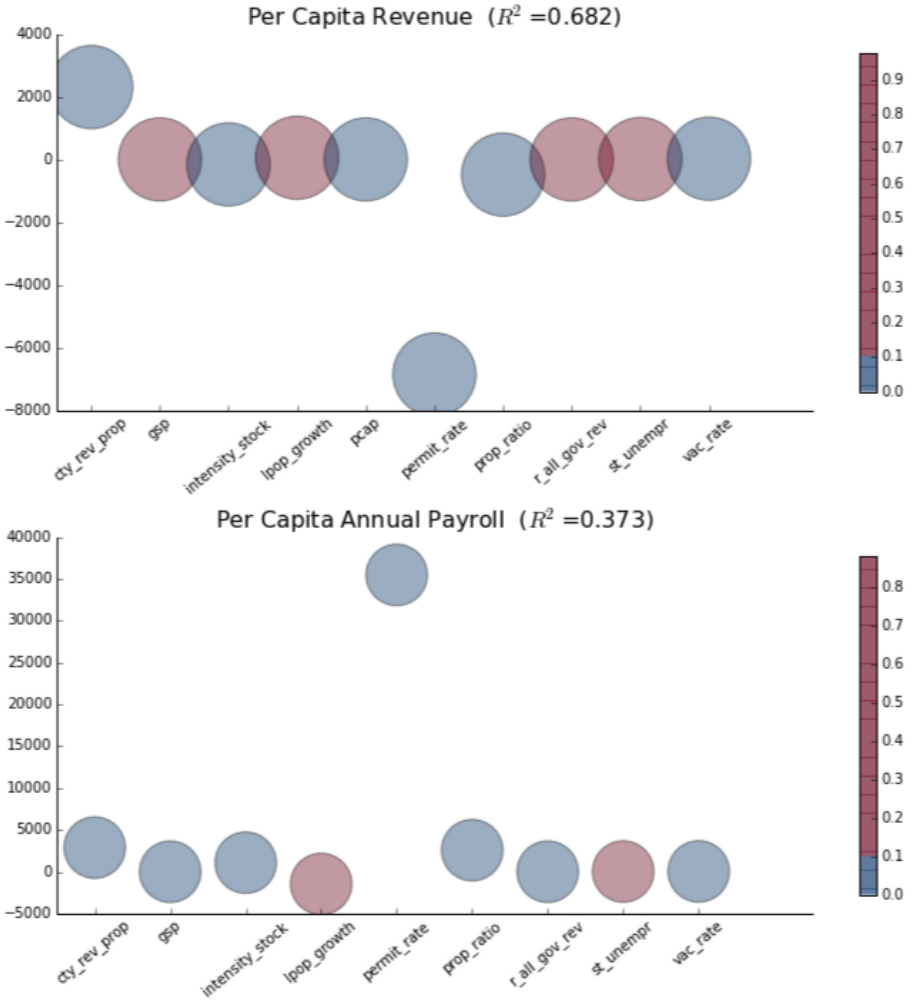
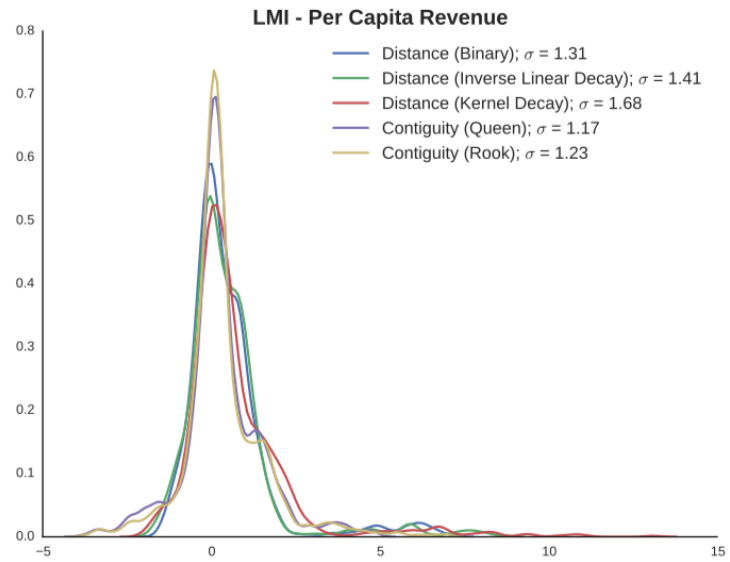
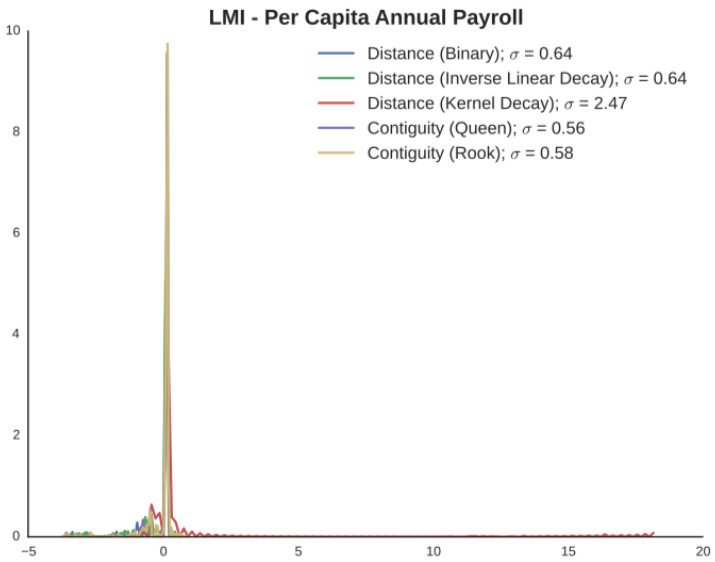
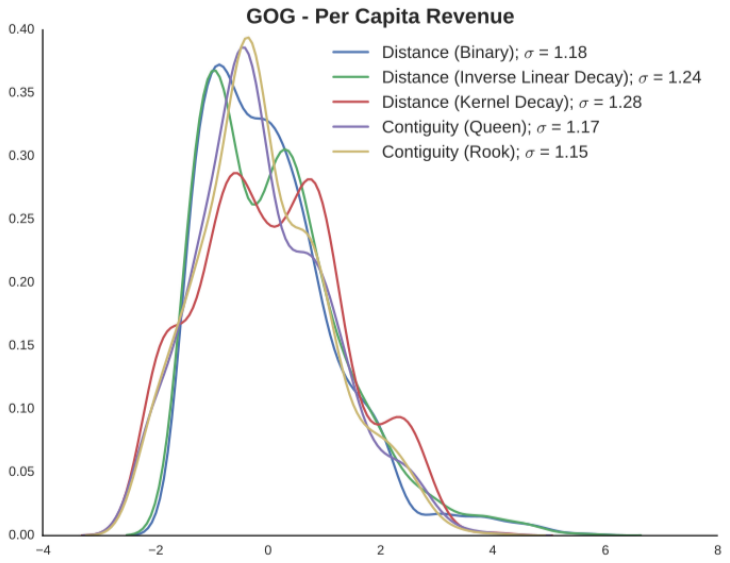


Figure 5.10: Distribution of Clustering Values







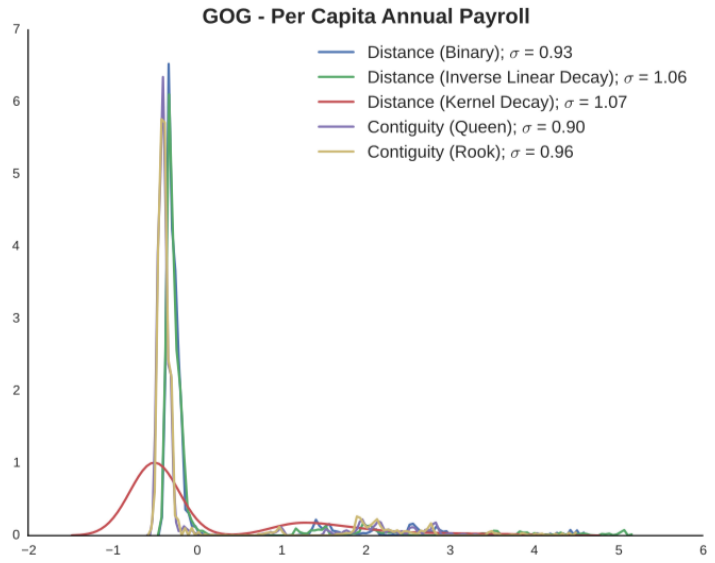


Figure 5.11: LISA Results - Revenue Yield (*left*) & Fiscal Capacity (*right*)

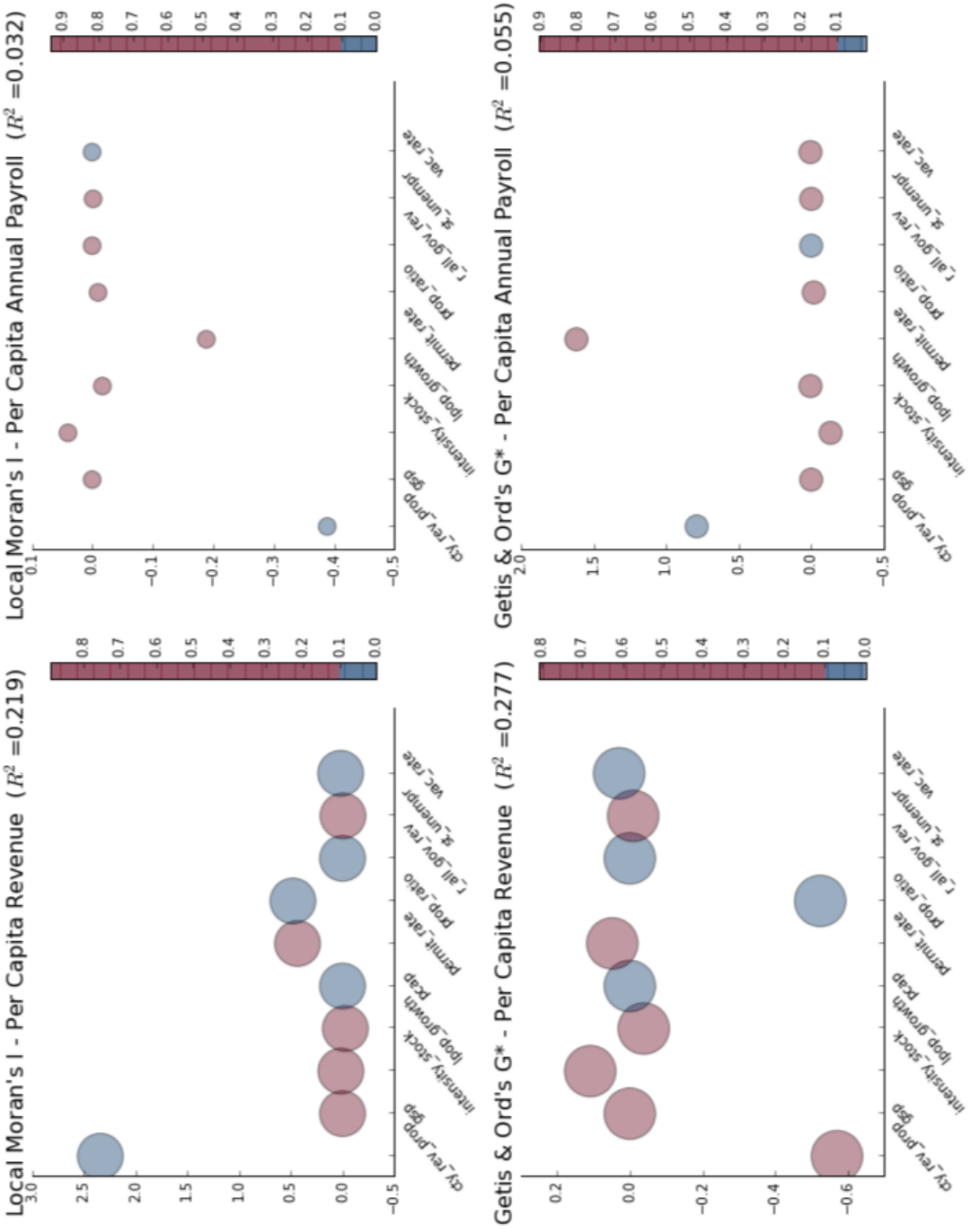
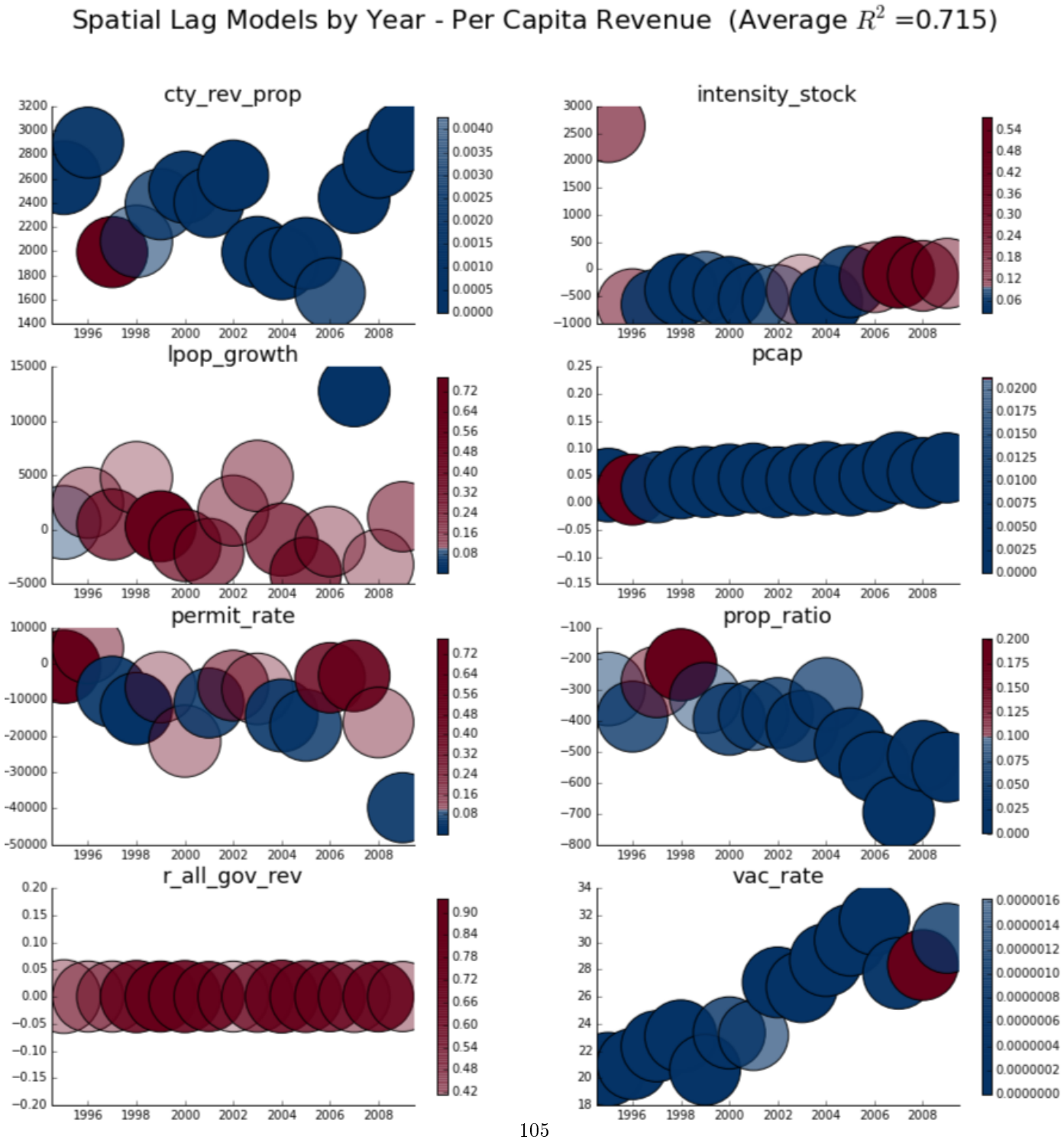


Figure 5.12: Spatial Lag Models by Year - Revenue Yield (*pcrev*)



Note: the single red data points in the *pcap*, *prop_ratio*, and *vac_rate* subplots are only artifacts of the plotting function. As can be seen in the color bar, the range of p-values for these variables is entirely below p=0.1. The final version of this graphic will remedy this issue with post-hoc adjsutment of the an SVG version of the plot.

Figure 5.13: Spatial Lag Models by Year - Fiscal Capacity

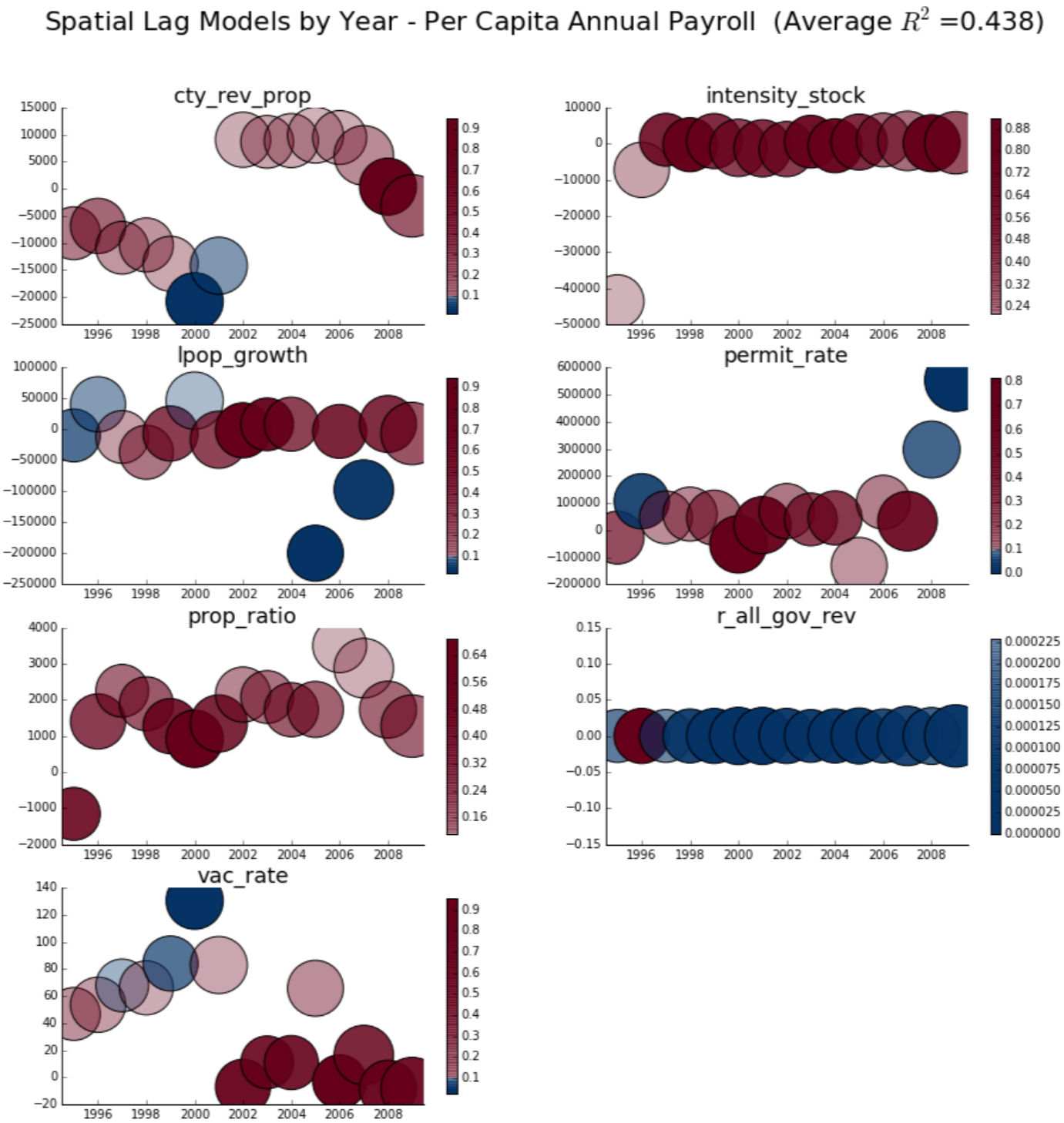
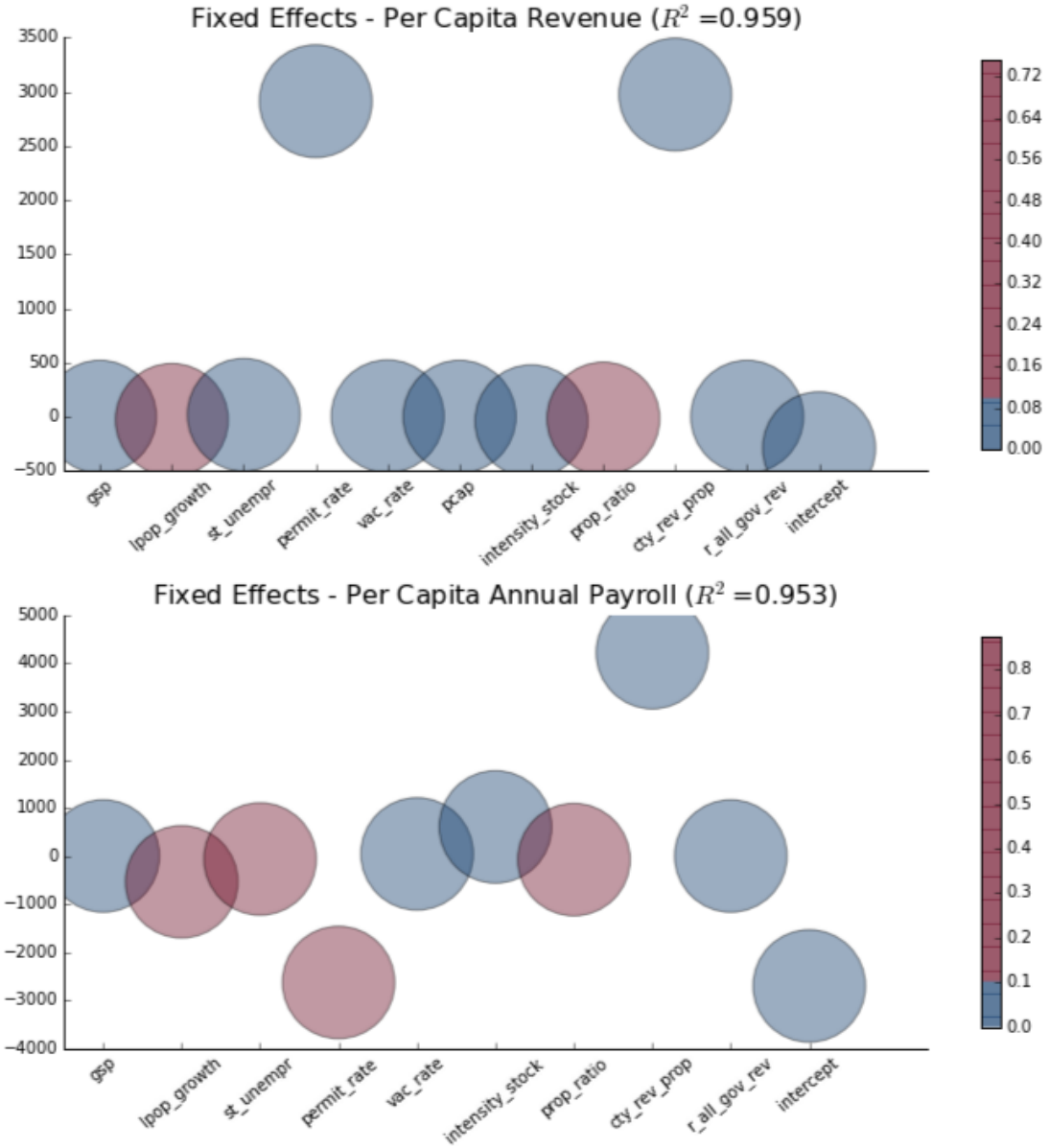


Figure 5.14: Fixed Effect Model Results - Revenue Yield (*left*) & Fiscal Capacity (*right*)



5.6 Summary of Findings and Conclusion

This analysis was designed to evaluate the impact of the cumulative, composite limit imposed by TABOR and the Statewide Limit on Property Tax Revenue (a.k.a. COTEL intensity), as well as the Gallagher Amendment, on two fiscal indicators: revenue yield (revenue per capita) and fiscal capacity (annual payroll per capita). To pursue this objective, the analysis employed pooled OLS, spatial lag models, and panel analysis to identify patterns in the COTEL impacts from a variety of perspectives. While there was non-trivial variation in the magnitude of impact, COTELs consistently depressed revenue yields. This accords with intuition, and empirical exploration has borne this out.

In constrast, the fiscal capacity models consistently explained less variation relative to revenue yield models, and the impacts of COTELs were inconclusive across models. The implication is that COTELs do not have direct impacts on fiscal capacity. Rather, the ultimate impact is likely a function of how individual counties respond to the constraints placed on them by statewide COTEL policies.

It should also be noted that the analysis in this paper makes clear that differential impacts across counties are non-trivial. These disparities in the impacts of COTELs are drive by dynamic economic characteristics of each county. Furthermore, the economic circumstances of counties display spatial dependency, and spatial clustering occurs more strongly among low revenue/capacity counties. Consequently, policies that depress revenue yield or fiscal capacity exacerbate this phenomenon. With respect to revenue yield, it is clear that COTELs do just that. The impact of COTELs on fiscal capacity, however, warrants greater study.

Chapter 6

Alteration of Expenditure Patterns

6.1 Introduction

In Chapter 5, the impact of COTELs on the revenue side of county finance in Colorado was explored. This chapter focuses on the other side of the equation: expenditure behavior. This shift in focus is designed to structurally capture the duality of public finance discussed in Subsection 2.1.1.3. While popular discourse tends to decouple the two, revenues and expenditures are instrinsically linked. Each unit of revenue collected by a government not used to cover the cost of labor is redeployed as some programmatic output designed to either increase the real income of constituents or increase their capacity to generate income elsewhere. Even though the topic of revenue could have consumed the entirety of this dissertation, recognition of fiscal duality demands some level of balance in topic selection.

Whereas Chapter 5 was concerned with the general capacity of a county to finance public services, this chapter begins to explore the specific expenditure choices made in the context of COTELs and fiscal clustering. In particular, it seeks to understand whether or not counties that face constraints under the TEL regime in Colorado make different choices about how to spend public funds than they otherwise would. Indeed, since we do not observe an alternative state of the world, such a question raises certain difficulties. The chief obstacle is the establishment of an artifical, yet defensible, counterfactual scenario. The analysis that follows leans on basic tools of machine learning to construct such a scenario. In so doing, this chapter serves two purposes. First and foremost, it sheds light on the expenditure side impact of COTELs. Second, it suggests that students of public finance can learn from the methods of others, which sometimes have favorable characteristics that help to mitigate deficiencies in more conventional methods. In general, we should seek to employ complementary (but not redundant) tools whenever possible, even if they are unconventional from the field's

perspective. As discussed in Subsection 5.5.1.1, consistent results from a variety of calculations lends credibility to the analysis.

6.2 Why does a Shift in Expenditure Patterns Matter?

In *The Pure Theory of Public Expenditure*[90], Paul Sameulson evaluated the implications of the joint consumption of public goods. This feature of public goods separates them from private goods along one very important dimension: the feasibility of preference revelation. Without the ability to determine what an individual would pay for the marginal unit of public good x, there is no natural way to determine the efficient volume of x that should be supplied to society. Tiebout, on the other hand, argued that a critical variable had been omitted from the analysis: mobility.

> "The consumer-voter may be viewed as picking that community which best satisfies his preference pattern for public goods. [...] The greater the number of communities and the greater the variance among them, the closer the consumer will come to fully realizing his preference position."[108]

In effect, Tiebout was suggesting that the Samuelson model only applies when only one supplier exists. However, if many suppliers exist, the consumer-voter is able to choose from among the set. This choice provides the avenue for revealed preference. That is, we can make claims about what consumers prefer based upon what they choose to consume. A mechanism similar to that at work in the private sector could therefore be applied to public spaces when mulitiple providers are present. It is clear that returns to scale and consistency make the multi-provider framework undesirable at the national level. In a federal system, however, multiple providers must exist in the subnational space, particularly at the local level.

To further the implication of Tiebout's insight, there are two dimensions along which the consumption evironment may provide the capacity for revealed preference. First, the ease with which preferences may be articulated increases with the volume of choices, or in this case, the number of local governments in the choice set. For our purposes, this number is basically fixed. While jurisdictions do come and go, over the study period (1993-2009) the movement is negligible. Second, for true options to exist, there must be differentiation across the available products. If one seeks something to eat and the choice is between an apple and ... an identical apple, no true choice exists. If a "consumer-voter" is to reveal his/her preference, there must be some distinction between community characteristics that can elicit different return values from his/her utility function. While it must be made clear that this chapter in no way seeks to evaluate mobility, this idea of differentiation is critical to this analysis. The motivational hypothesis behind it is the idea that differentiation across communities is non-trivially impacted by the imposition of COTELs.

This analysis seeks to complement the study of TEL impact on expenditure behavior conducted by Daniel Mullins.[73] He finds that TELs do not uniformly constrain the finances of all affected jurisdictions. Rather, governments serving less affluent communities are most adversely impacted by the limitation. A looming question is, what is the role of spatial externalities emanating from the local neighborhood? Spillovers can and do impact fiscal behavior at the local level. The question explored here is whether or not the variation in constraint observed in Mullins (2004) remains when spillovers are taken into account. That being said, the aim here is slightly different. To reiterate, we want to compare each county to a simulated version of itself to explore the impact of COTELs.

6.3 How are Shifts in Expenditure Patterns Measured?

To fulfill the research objective, there are two major questions that must be answered:

1. How can one tell if a county has deflected from its preferred expenditure portfolio?

2. How can one measure how much it has deflected?

In the past, there have been three broad approaches taken to address such problems. First, the use of broad classifications have provided summary views of shifts in behavior. For example, on the revenue side, one may split revenues into two groups: tax and non-tax. The revenues can then be characterized by a single proportional value and entered easily into a given model. This is a useful approach, but there is a threat that disimilar cases will be lumped together. If we have limited resolution (only two dimensions of comparison in the example), there is a limited ability to typify communities into distinct groups.

A second approach has been to highlight changes in a single function (e.g. changes in infrastructure expenditure), which improves on the resolution deficiency of the first approach. However, the number of comparisons required to fully specify a jurisdiction across all functions and compare it with other jurisdictions quickly grows unmanageable. The primary reason is that, in a set of n jurisdictions, each function of a given jurisdiction n_i must be compared with the corresponding function of the other $n-1$ jurisdictions. One approach to this problem has been to limit comparisons to an earlier version of the same jurisdiction, but this within-county scope strays from our concern regarding differentiation across jurisdictions.

A third approach is a regression decomposition framework, whereby the proportional contribution of each function is represented as a regressor in the model. This method is quite useful for uncovering the average effects of revenue or expenditure composition on other variables of interest, but movement in the expenditure profile is what we are pursuing in this case. This movement must be

the dependent variable, and we seek a measure that tells us about the movement at the individual county level.

The approach taken here is typification. In the absence of a counterfactual, we can instead ask how counties of a similar type respond to differing levels of COTEL constraint. In effect, we are asking whether or not jurisdictions with similar expenditure preferences at the outset still have similar behavior after COTELs have been imposed. If similar expenditure preferences persist, the interpretation is that COTELs have not led to a change in the expenditure preferences of the county in question.

6.3.1 Is It Reasonable to Construct Counterfactuals through Typification?

The implicit assumption that comes with the typification approach is that the same counties that share common preferences at time t will still share preferences at time $t + l$ where $l > 0$. Stated differently, the assumption is one of constant covariance in preferences across counties, over time. This is certainly not a trivial assumption. The relevant question is, what are the available alternatives?

One could compare each county at time t with itself at time $t + l$. This approach would have the virtue of avoiding the assumption of constant covariance in preferences. However, it does assume that preferences *within a county* do not change at all. Thus, the question becomes, which assumption is more offensive, constant covariance or static preferences? To the extent that we know the macro-enviroment is changing over time in Colorado, characterized at the very least by significant increases in income and population, constant preferences seems to fail the face validity test. Furthermore, as we learned in Chapter 5, while fiscal clustering changed in intensity over time, the broad patterns were fairly persistent. This observation lends at least some support for the idea that the constant covariance assumption does have some degree of merit. It should also be reiterated here that we are concerned also with differences across counties.

One could capture the evolution of preferences by comparing counties in Colorado with counties in other states that do not operate in the COTEL context. This capture, though, is just a repackaging of the constant covariance assumption. The comparison in this case is just a single county instead of a county type, which generally seems to be a riskier bet. The maximum gap between two members of a population will generally be larger than the maximum gap between a single member and some measure of the population's central tendency. To vary on this theme, given a population, the *expected* gap between member i and any member j (where $i \neq j$) *is the gap between member i and the population's measure of central tendency.* In a nutshell, the variance in the quality of the cross-state match over time seems to be generally wider than that which would be experienced via the within-state typification approach. This is not to mention that the cross-state match strategy would still have to clear the hurdle of accommodating state-specific unobservables, a hurdle that one need not grapple with when using the within-state typification approach.

The interval nature of the COTEL variables used in this study afford within-state matching, which would avoid the state-specific unobservable problem. Such an approach, however, would not escape the single county variance problem. In general, measures of central tendency are more stable than individual elements in a population, and thus are better suited to serve as reference points. In general, while constant covariance is a strong assumption, it does not appear that other approaches avoid potentially more damaging assumptions.

6.3.2 Operationalizing County Types

The challenge that arises when comparing jurisdictions to one another is how one may uncover a simple comparison while still incorporating all of the complexity of the entire expenditure function vector. To achieve this, some form of dimensionality reduction is required, as is some method of understanding which jurisdictions are similar and which ones are not. The approach taken here is to place the counties in "space" and evaluate the distances between them. Space, in this context, is the coordinate position in the n-dimensional field defined by an expenditure vector of length n (Figure 6.1). This coordinate position will henceforth be referred to as "fiscal position".

Counties that are "close" to each other in the expenditure space have similar proportional distributions of expenditure. We will capture county types as "natural" groupings of counties in this n-dimensional space. In this framework, deflection of a given county from the group's preferences will be identified by an increase in the distance between the county's fiscal position and the central tendency in the group's set of fiscal positions. To perform this task, two questions must be answered:

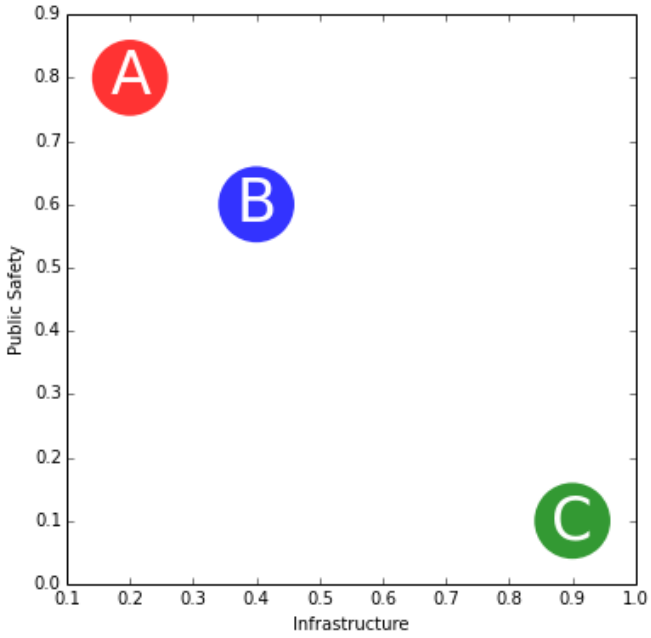
1. How is the space defined?
2. How are clusters identified?

6.3.2.1 Defining Fiscal Space

To define the space in which fiscal positions were mapped, there were actually two parallel tracks taken in the analysis. One track proceeded as described above, in the n-dimensional space defined by the full number of expenditure functions compared. While this approach facilitates interpretation of any single dimension, the high number of dimensions is 1) difficult to contemplate all at once, 2) impossible to visualize, and 3) vulnerable to sparsity in broad swaths of the expenditure space.[1]

[1] Recall that estimation generally attempts to get at some form of local averaging. To be efficient, that is, to minimize the variance in the estimate, it requires that a number of observations are close to the location being evaluated. There are only 64 counties evaluated in any given year. If they all varied in the dependent value and in only one independent dimension, we would likely be able to estimate with a high degree of precision. As soon as a second independent dimension is added, however, the area in which observations may reside increases dramatically. It becomes much less likely that observations are close enough together to provide the estimating precision experienced with only one independent dimension. This

Figure 6.1: Fiscal Position Concept



The figure demonstrates the concept of fiscal position in two dimensions. Suppose Counties A, B, and C all had only two expenditure functions: Infrastucture and Public Safety. We can relate their expenditure profiles to one another by placing the counties in space according to the proportion of expenditures allocated to each function. In the figure, County A is more similar to County B in expenditure preferences than County C. This concept is scaleable to, if not depictable in, an aribitrary number of dimensions.

One approach that mitigates these concerns is the dimension-reduction technique known as principal component analysis (PCA). This method enables one to leverage linear combinations of the original dimension set. It is used here to place counties in three dimensional space, albeit at a cost of a reduction in interpretability for each of the resulting dimensions. In other words, moving along a given dimension in the principal component space (e.g. $x_1 = 5d_1 + 3d_2 + 4d_3$ where d_* could represent public safety) is much more difficult to characterize than moving along a given dimension in the original n-dimensional space (e.g. $x_1 = d_1$). To the extent that our main concern is the magnitude of the distance between a county and its start group, we can still pull useful information out of this approach, even if it is difficult to explain precisely how a county is different. In any event, since one track's weakeness is the other's strength, the parallel tracks are complementary. If consistent results are seen across both, it adds strength to the findings. Henceforth, the n-dimensional track will be referred to as Track 1, while the PCA track will be referred to as Track 2. To complicate things just a little further, Track 1 also employs a limited dimensionality reduction protocol that will be known as Track 1a. The protocol in Track 1a first groups the original 16 expenditure functions into eight subgroups (Table 6.1).

The second step of this protocol leverages the fact that our primary concern is the impact of COTEL intensity on fiscal behavior. Consequently, only those dimensions that are actually affected by TEL imposition are retained. In other words, inclusion in the final model is determined by whether or not the expenditure category has a meaningful relationship with COTEL intensity, as indicated by a series of bivariate regressions. The procedure for selection of subgroups is discussed in Paragraph 6.3.2.1.

Selection of Expenditure Subgroups To select from the subgroups identified in Table 6.1, there are two properties that must be identified:

1. The extent of variation in each subgroup's proportional contribution to the entire expenditure portfolio.

2. The amount of each subgroup's variation *that can be associated with variance in COTEL intensity.*

The first conditions the findings of the second. Though in reality the impact of COTEL intensity has been evaluated for all subgroups, those subgroups that vary the least are not as desirable. The variation in subgroup contribution can be seen in Figure 6.2.

To associate movement in each subgroup as a function of COTEL intensity, a series of models have been run on two different COTEL intensity concepts:

Intensity flow is the gap between allowable revenue yield under TABOR/SLPTR and that which would be possible based upon economic conditions within a county.

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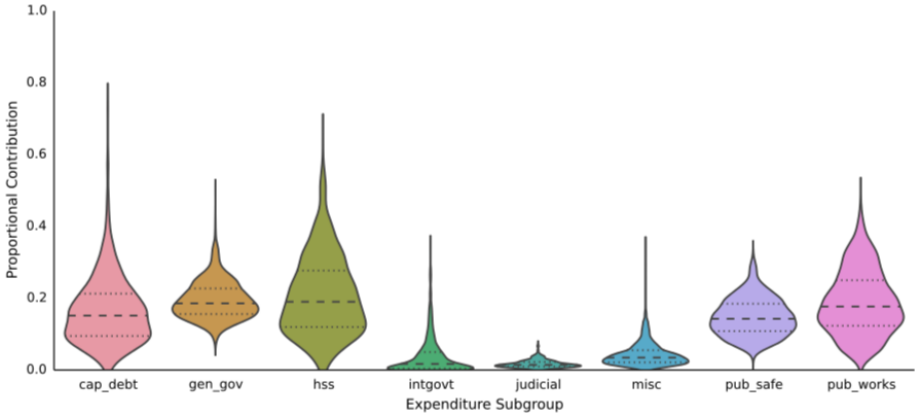
potential observation space increases yet again with a third dimension, and further still with a fourth. In general, each new dimension one adds to the model requires a substantial increase in the number of observations needed to maintain the same estimating precision.

Table 6.1: Subgroups for Track 1a

Subgroup	**Constituent Functions**
General Government	General Government
Judicial	Judicial
Public Safety	Police, Fire, Other Public Safety
Public Works	Street, Trash, Other Public Works
Health and Social Services	Health, Social Services
Captial Improvements and Debt Service	Capital Outlays, Principal Service, Interest Service
Intergovernmental	Outgoing Transfers
Miscellaneous	Recreation, Miscellaneous

Figure 6.2: Distribution of Subgroup Proportional Contribution to Total Expenditures



Intensity stock is the cumulative impact of intensity flow.

For each intensity concept, two sets of models tested association with transformed versions of the subgroup proportions. These transforms, demeaning and standardization, were employed to capture only within county variation due to COTEL intensity. As can be seen in Figure 6.3, both sets of models yielded similar results.

The coefficient estimates are captured as the y-axis position, the fit (R^2) by the size of the bubble, and the statistical significance by the color. As can be seen, intensity flow had negligible impacts on the expenditure subgroups. The intensity stock models identified three subgroups of interest: health and social services, public safety, and public works.

It is interesting to note that the two dimension reduction procedures (PCA and regression selection) highlight different aspects of the fiscal portfolio. The variation in public works-related expenditures is a common theme, as is health and social services. However, there is some disagreement in the public safety area. This underscores the need for three flights of models using the distances calculated via Track 1, Track 1a, and Track 2.

In all Tracks, the final component dimension is the proportion of all government expenditures in the county that are specifically attributed to the county government (*cty_exp_prop*). To the extent that counties may vary in their propensity to leverage municipalities or school districts for the delivery of services, this is a material dimension that will lead to differing behaviors across counties. As such, it is included in the type definition array.

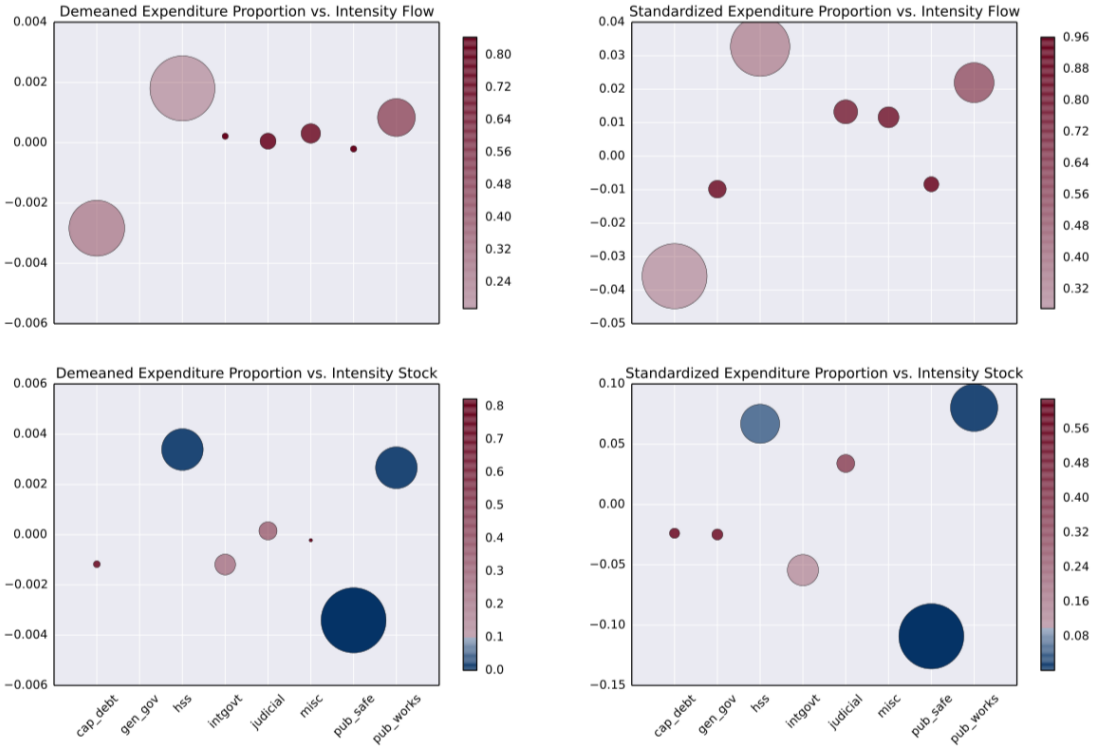
6.3.2.2 Identifying County Expenditure Types

A central pillar of this analysis involves the capacity to assign types to individual counties. Which rule should be used to group counties when no a priori classification information exists? What is required is a classification scheme that is emergent, conditional on the data. The approach employed here is *k-means clustering*. The technique, implemented via the expression in Algorithm 6.1, minimizes the total distance between members of the same cluster (within-group variance).

The definition of position is of central importance, and it varies with context. In the current case, each point (x_j) represents the fiscal position of a county in one of the fiscal spaces defined in Subsection 6.3.2.1. In a well behaved case, in which the clusters are reasonably well defined, the clustering algorithm returns groups as seen in Figure 6.4. Our fiscal position data is not nearly as well behaved, but k-means clustering still provides a framework for cluster selection.

From an operational perspective, the clustering analysis was performed based upon fiscal positions in the PCA space. The reasons for this are two-fold. First, the dimension reduction techniques (PCA and regression filtering) allow us to distill down to three dimensions, which facilitates visualization. As it turns out, visualization is a very useful way of checking the face validity of the algorithm's output. Second, PCA is preferable relative to the regression filtering approach

Figure 6.3: Impact of COTEL Intensity on Individual Expenditure Subgroups

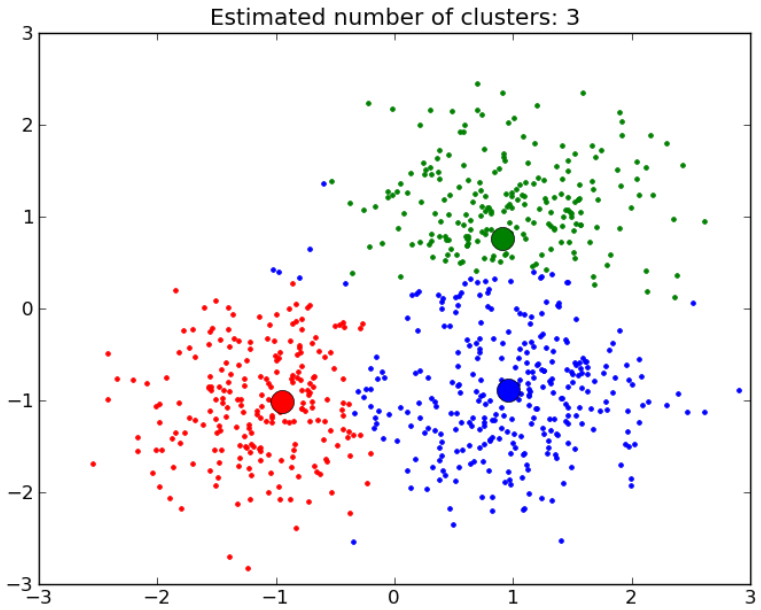


Algorithm 6.1 k-Means Clustering

$$\text{argmin}_S \sum_{i=1}^{k} \sum_{x_j \in S_i} \|x_j - \mu_i\|^2$$

The expression minimizes the sum of all distances between each point, x_j, and its associated centroid, μ_i, within each cluster, S_i. There are k clusters; k is given as a parametric input. The expression is referred to as the minimum sum of squared residuals (SSM). Insofar as this approach defines groups without pre-existing classification attributes, it is considered a member of the *unsupervised learning* class of estimators.

Figure 6.4: Well Behaved Clusters



Group membership is defined here by color. The centroids of each group, or cluster, are represented by the large markers of each group's color. Note that the centroid markers *do not represent observations.* Rather, they are calculated measures of within-cluster central tendency. The image is attributed to the documentation of the scikit-learn library.

because it retains nearly all of the information in the original set. This is because the new dimensions are just complex combinations of the old dimensions, and the first three components explain 75.3% of the variation in the data (Figure 6.5).

Recall that the major drawback of the PCA approach is the interpretation of movement along one of the compound dimensions that remain. However, if all that matters for this particular operation is the proximity of fiscal positions across counties, interpretation of the linear combinations of underlying dimensions is not the principal concern. Consequently, the space defined by PCA is unambiguously superior to the space defined by regression filtering for the purpose of identifying clusters of county fiscal preferences.

Choosing the Appropriate Number of Clusters k It is important to reiterate that the use of k-means clustering requires the number of groups, k, to be a parametric input. Therefore, there is a certain amount of subjectivity involved, because the optimal value of k is unknown.[2] This subjectivity is particularly prominent when group boundaries are not clean. The fiscal positions of Colorado counties in 1975 are displayed in Figure 6.6.

To lessen the influence of the subjectivity in selecting the number of groups, this analysis tested a range of values for k. This allows one to evaluate the impact on SSM of additional clusters. That being said, variance in group count, k, is a useful but insufficient means for identifying the correct clustering profile. On the one hand, SSM is*always* a non-increasing function of the number of groups k. On the other hand, it is simply desirable to minimize the number of required groups because evaluating the dynamics of a group is less than useful if it has only a few members. To mitigate the tension between these two desirable properties and determine the number of clusters to be used for econometric analysis, three tests augmented visual inspection of clustering:

1. The first method evaluates the marginal contribution to *between-cluster variation* of each cluster. The technique seeks to understand movement in the ratio of between-cluster variation to total variation in the sample. The desirable number of groups is then the value,k, at which the ratio increase over the interval $[k-1, k]$ is significantly higher than the ratio increase over the interval $[k, k+1]$.

2. The second method evaluates the marginal contribution to *within-cluster variation* of each cluster. As previously indicated, this function decreases with increases in the number of groups k. When intersected with the first method, the result is a balancing of separation across clusters and similarity within clusters.

3. The third method is a popular selection mechanism known as the "silhouette score". In this case, the number of clusters is identified by maximizing

[2] If, for example, one were to choose k such that the aggregate distance between points within each cluster was minimized, one would find that $k \to n$ where n is the number of observations. In other words, each cluster would shrink to contain only a single observation.

Figure 6.5: Variation in Principal Components of the Expenditure Portfolio

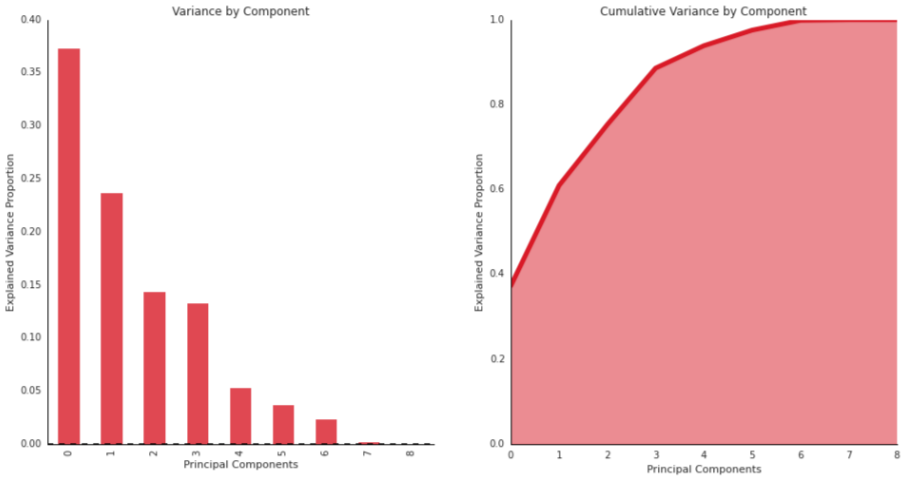
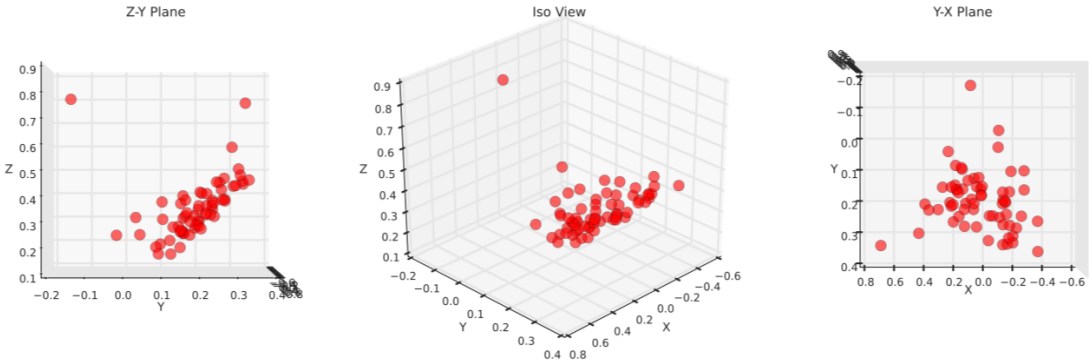


Figure 6.6: Fiscal Positions of Counties in Colorado in 1975



Note that the fiscal positions are not as well-behaved as the ideal case above.

the aggregate distances of observations in cluster i from the centroid of all groups j (where $i \neq j$), *relative to the points' distance from their own centroid in group i.*

The test ensemble suggested that the optimal cluster count, k, lies on the interval $[5, 8]$. Within these bounds, selection proceeded via visual inspection of the clustering outcomes at each value of k. Ultimately, five clusters were found to provide the cleanest separation of groups.

Do Distances to Cluster Centroids Vary? Just as it was necessary to establish variation in fiscal clustering in Chapter 5, the existence of meaningful variation in the distances between individual counties and their cluster's centroid must be established here. Without said variation, we would be unable to associate variation in COTEL intensity with variation in the distance of each county from its centroid.[3] In Figure 6.8 we see violinplots of cluster distances within each group, as well as the coefficient of variation for county distances for each group.

It is interesting to note differing variation profiles within each group, which supports the idea that they are rightfully distinct in this analysis. As can be seen in Figure 6.9, the overall distance to cluster increases modestly over time. In other words, there is some evidence of the variety in expenditure profiles across all counties increasing over time.

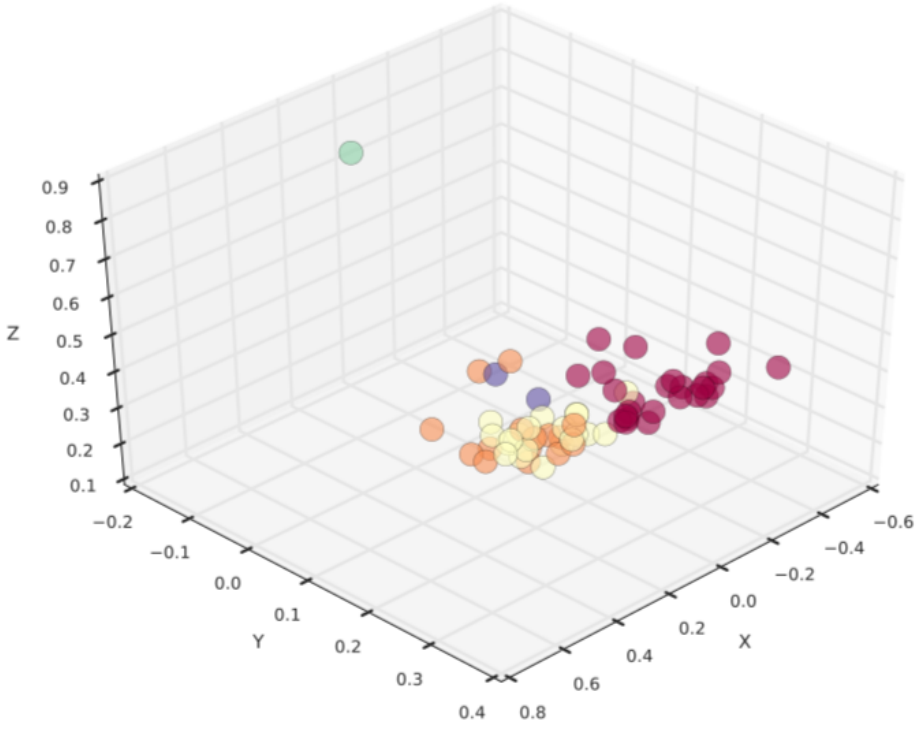
Caveat Emptor The last view considered prior to modeling is the *within-county* variation in distance to the associated centroid. In Figure 6.10, the distribution of cluster distances across years is displayed by county. On the positive side, it reinforces the idea that counties within a cluster can behave quite differently over time. The analysis seeks to leverage this variation in behavior to understand the impact of COTELs.

However, this view does some violence to the idea of constant covariance in within-cluster expenditure preferences. First, while we seek to identify within-cluster differences associated with COTELs, other differences capture inherent disimilarity as well. Second, there is an assumption that counties do not change types, but it is plausible that the variation seen in Figure 6.10 would lead to different types at different times. Again, if this is due to COTELs, this is a useful finding. If it is due to other factors, it again highlights inherent disimilarity.

Thus, some weaknesses of the constant covariance approach certainly exist, but as discussed in Subsection 6.3.1, it is likely to be a less costly assumption than alternative assumptions that can be made. In general, *there does not exist a unique approach that may reveal the fundamental nature of the phenomenon in isolation.* Hoover reflects usefully on the general selection of an estimation approach:

[3] Recall that distances to cluster centroids are how we measure wedges between an individual county and the prevalent expenditure preference schedule of similar counties.

Figure 6.7: Fiscal Clusters$k = 5$



Visual identification of clusters in 3-dimensional space is difficult with static views. The selection process leveraged animated rotation of several plots to facilitate cluster count choice.

Figure 6.8: Within-Cluster Variation

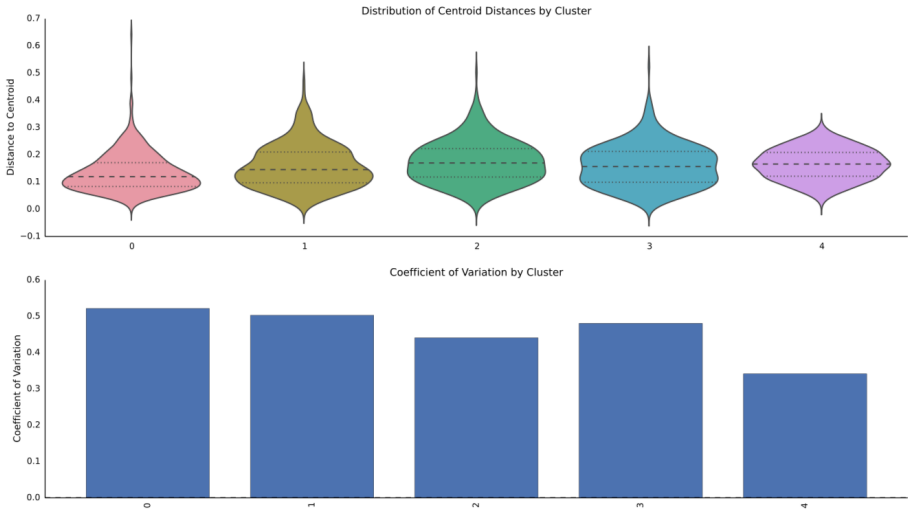


Figure 6.9: Within-Cluster Variation by Year

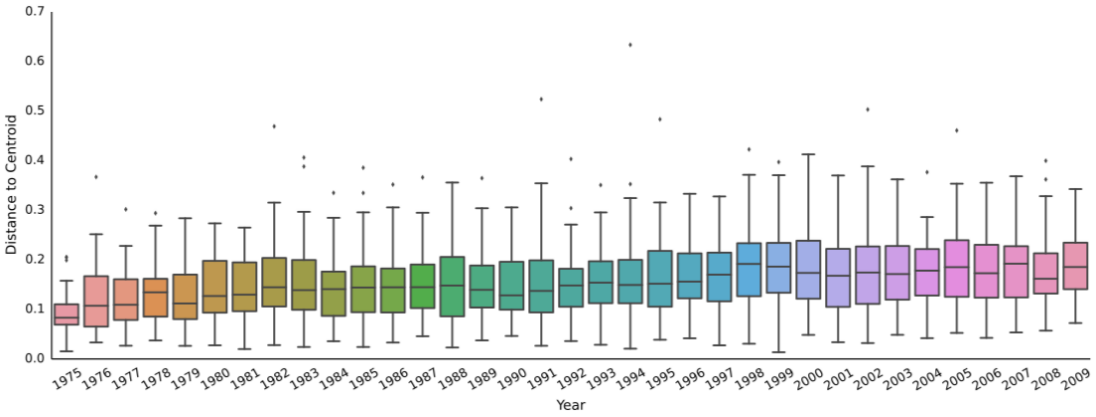
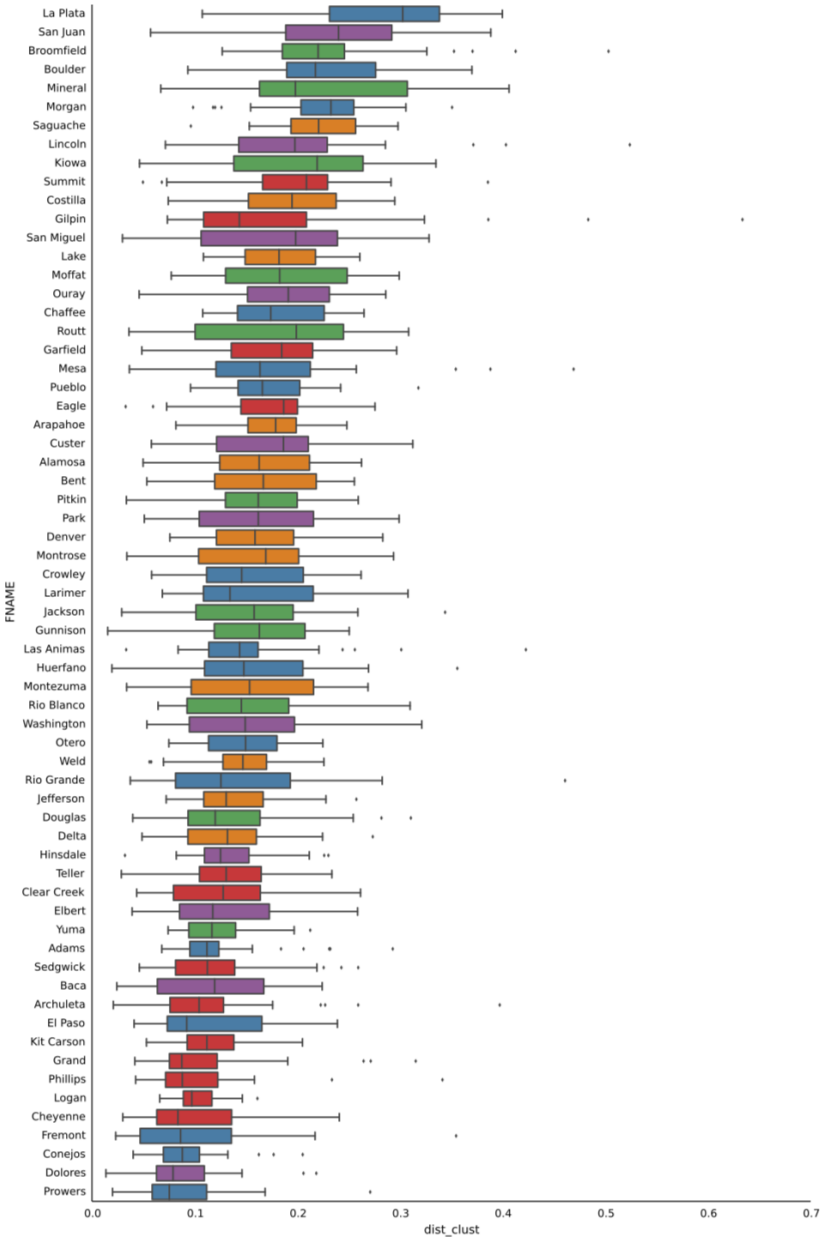


Figure 6.10: Within-County Variation of Distance to Cluster



The counties are colored by type. Note that these distances are not measured from the same location, but rather the location of the centroid of each county's associated type.

> "[T]he thorough-going optimization implicit in new classicism suggests that everything depends on everything else, not just in theory, but in practice. [...] Thus, theory presents us with some a priori (in the sense of not *currently* questioned) restrictions on empirical investigation; while the empirical results help us generate beliefs (or new theories) which are prior to further investigations."[58]

In other words, we restrict the lens through which we view the observable implications of some unseen phenomenon. While the lens may be defensible, each choice suffers from the weakness of our a priori belief about how said lens ought to be defined. No single view should be evaluated as having incorporated the full complexity of the system under study. Rather, we take simplified cuts at the data generating process, and converge on "reality", with confidence increasing in the number of supporting analytic outcomes.

Given the basic establishment of statistical identification, it is important to consider the impact of the boundaries imposed by a given method (e.g. constant covariance). The concern, from a utility standpoint, is whether or not the boundaries are responsible for driving measurement outcomes, as opposed to the underlying data generating process. Indeed, it was with this liability in mind that the decision was made to leverage data driven classification in the first place. k-means clustering does take a single parameter, k, but it does not otherwise impose any distributional assumptions.

In the end, the approach taken here must not be viewed as a substitute for the views that would be revealed by other approaches, inclusive of those considered in Subsection 6.3.1. Rather, this approach, unique to the best of the author's knowledge, provides an important view of the underlying data that should be considered in a comprehensive assessment.

6.4 What is the Expected Impact of TELs?

The frame for this analysis is the "expenditure wedge". Do constrained jurisdictions deflect from their preferred expenditure bundles? It is hypothesized that any such deflection would be in the direction of providing a minimum bundle of services, and it is expected that the minimum bundle reflects a fairly consistent set of needs for any general purpose jurisdiction (Model 8). Therefore, paring down to the minimum bundle would limit the capacity of a given jurisdiction to distinguish itself from other jurisdictions. It is further expected that the impact of this convergence will be strongest in low-income jurisdictions, where resources are already constrained. The work of Mullins and Joyce[61] has revealed that binding TELs are associated with shifts of expenditure responsibility to the state level, which also promotes uniformity in service delivery (or at least in the resources allocated). This study evaluates what counties in Colorado do with the remaining resources. What does their expenditure profile look like when TELs have taken effect?

If expenditure behavior shifts, a wedge is thrown between the realized and preferred tax-expenditure bundle for a given county. For prospective residents,

the choice set is more limited, and the properties that may have drawn them to a particular county are less of a factor. For existing residents, an artificial difference has been created between the initial, expected utility that factored into the decision to site in the county and the realized utility after the expenditure shift has occurred. In practice, this may or may not lead to a reshuffling for those residents that can afford to move. Those that cannot simply experience a loss in utility. Furthermore, if the choices in close proximity lose some of their differentiation, the cost of relocating to a more "desirable" county increases. In any event, understanding the impact of loss in differentiation is important for a comprehensive view of COTEL impact.

6.5 Do TELs Shift Patterns of Expenditure?

Our primary inquiry centers on whether or not the distance of a given county from the average preference position of counties of that type can be explained to some meaningful degree by the intensity of the COTEL constraint acting on said county. In measuring this, it is important to control for confounding economic processes that may impact cluster distance. These economic processes may occur in both the current observation's county, and the adjoining counties that may share bases of economic activity. In other words, the model must account for both the primary county, and the counties in the local neighborhood. Model 9 captures this process in a general way.[4]

In practice, Model 9 is captured in two separate model classes. The first is the spatially autoregressive, cross-sectional model:

$$y_i = W y_{i\_} \Gamma + Z\beta + \epsilon$$

The second is a conventional temporally autoregressive model; it is generally known as an AR(1) model:

$$y_{i,t} = y_{i,t-1}\Gamma + Z_{i,t}\beta + \epsilon_{i,t}$$

This split is largely due to the relative lack of spatial panel estimators at the time of analysis.

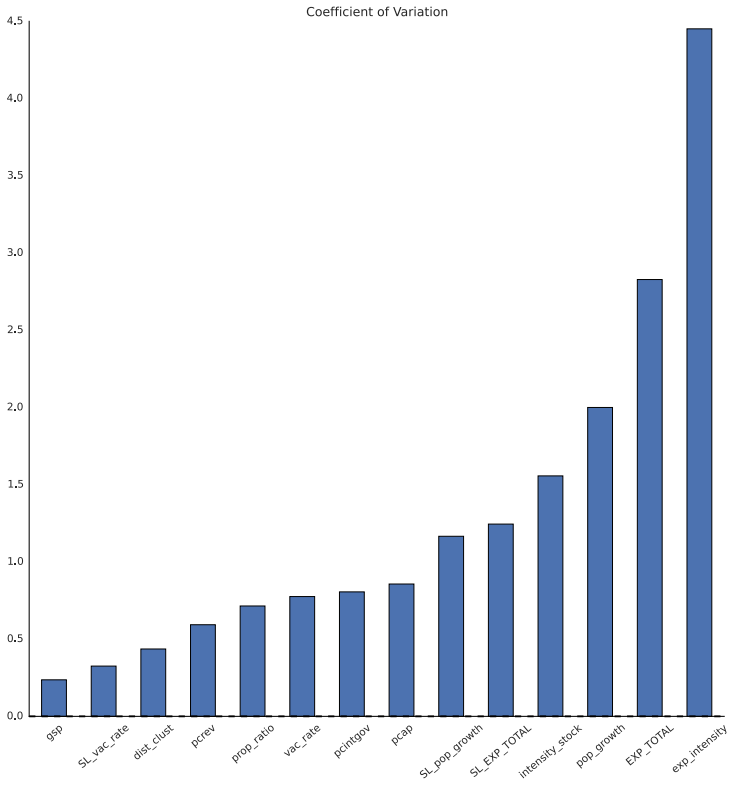
6.5.1 Variable Properties

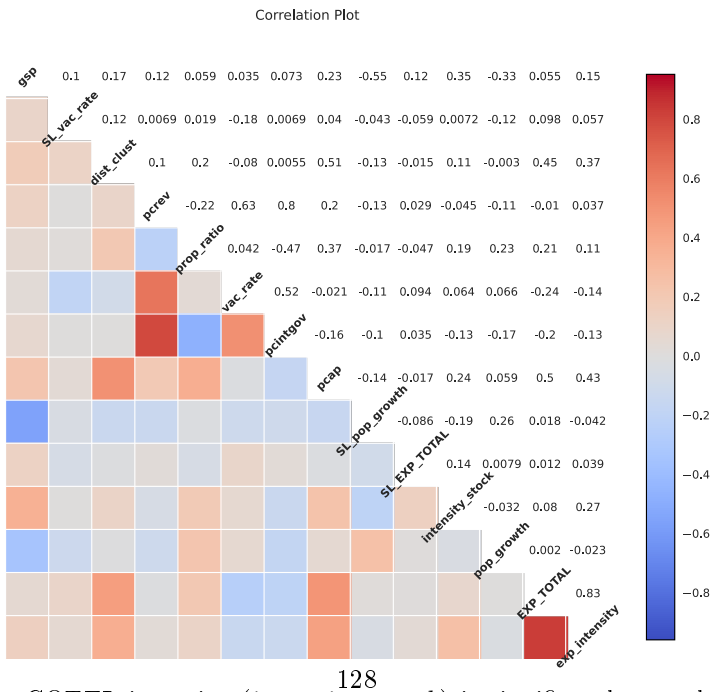
As can be seen in Figure 6.11, the model terms have very different variation profiles. While cluster distance (*dist_clust*) does vary, the normalized view offered by the coefficient of variation indicates that cluster distance does not vary nearly as much as the other variables included in the analysis.[5]

Our measure of similarity, or disimilarity as the case may be, is *clust_dist*. It proves to be useful, but it would be more so if it varied over a greater range.

[4] Recall that the proportion of expenditures from all governments in the county that are undertaken by the county government (*cty_exp_prop*) is included to speak the scope of county government application, but it is modeled as part of the definition of county positions used to measure cluster distance. To include it here as a regressor would be to capture the equation

Figure 6.11: Variation in Model Variables - Full Expenditure Portfolio Distance





Note that COTEL intensity (*intensity_stock*) is significantly correlated only with the Gallagher ratio (*prop_ratio*) and economic capacity (as measured by annual payroll per capita;*pcap*).

Marginal impacts of regressors are easier to identify when they are associated with larger absolute spans in the range of dependent values. If a given dependent variable takes one of only two values, the contributions of each regressor is more difficult to distinguish relative to the case in which a dependent variable *with the same support* (that is, the same range of feasible values) takes any one of 100 values.

It would be interesting to know if the correlation dynamics shift based upon the definition of cluster distance (Figure 6.12). Recall that while all three distances are ℓ^2 norms (a.k.a. Euclidean distance), the dimensionality of the space in which these distances are calculated varies in number and concept. For example, the full expenditure portfolio set has 16 dimensions, one for each expenditure concept. In the PCA set, there are three dimensions, and each is a linear combination of some subset of the original 16.

While the statistical significance of association between cluster distance and the COTEL variables does not meaningfully change, the magnitude of association increased in both cases. Note that differences in association strength imply different variation profiles. One way to get a sense of how distance behavior varies across the three frames is to observe the distribution of distance values by county and basis for distance calculation.

The boxplot in Figure 6.13 is certainly a busy visual display of variation in cluster distances. The takeway, however, is not a precise estimate of variation. Rather, this chart shows that the distribution of values differs markedly by calculation method. To the extent that these distributions neither perfectly overlap nor exhibit fixed relationships observed in all counties, it can be inferred that the results of this analysis may be sensitive to calculation methods. That being said, consistent findings from these models in spite of this variation would be strong evidence in support of a real relationship existing in the underlying data generating process (see Subsection 5.5.1.1).

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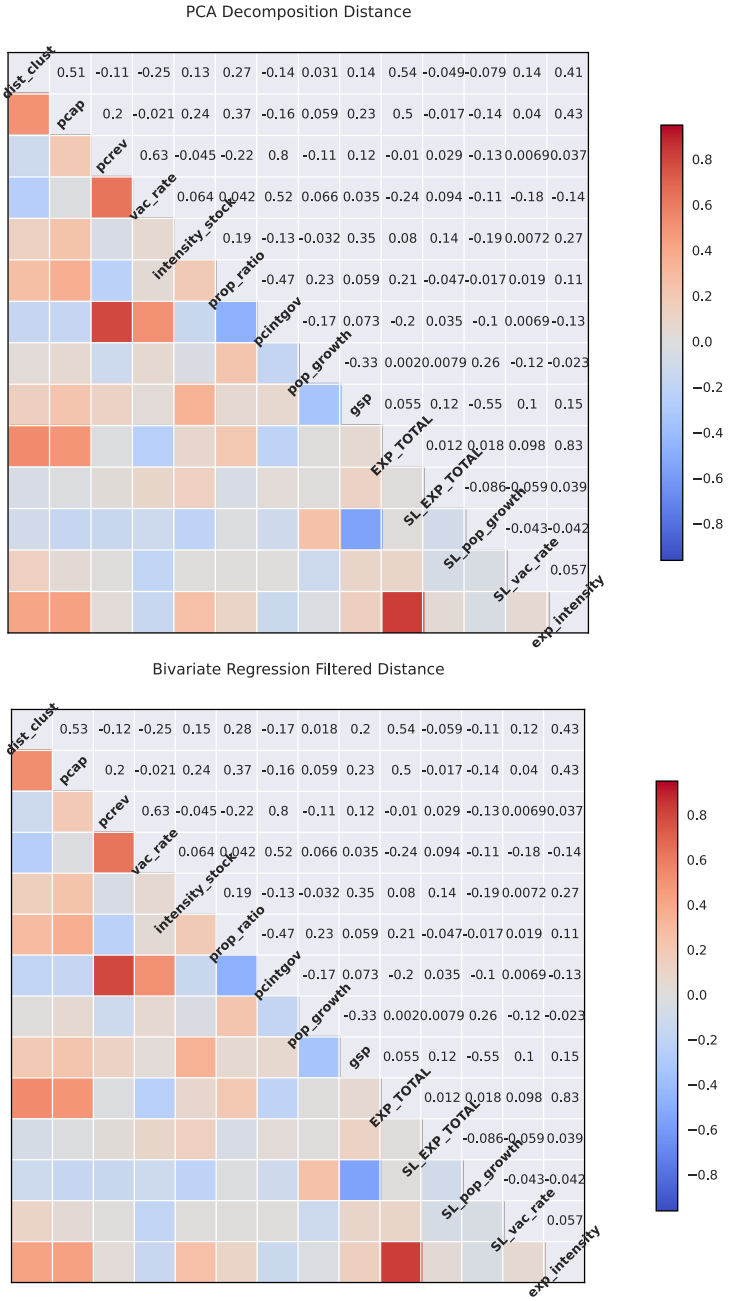
in both the dependent and independent sides of the specification.

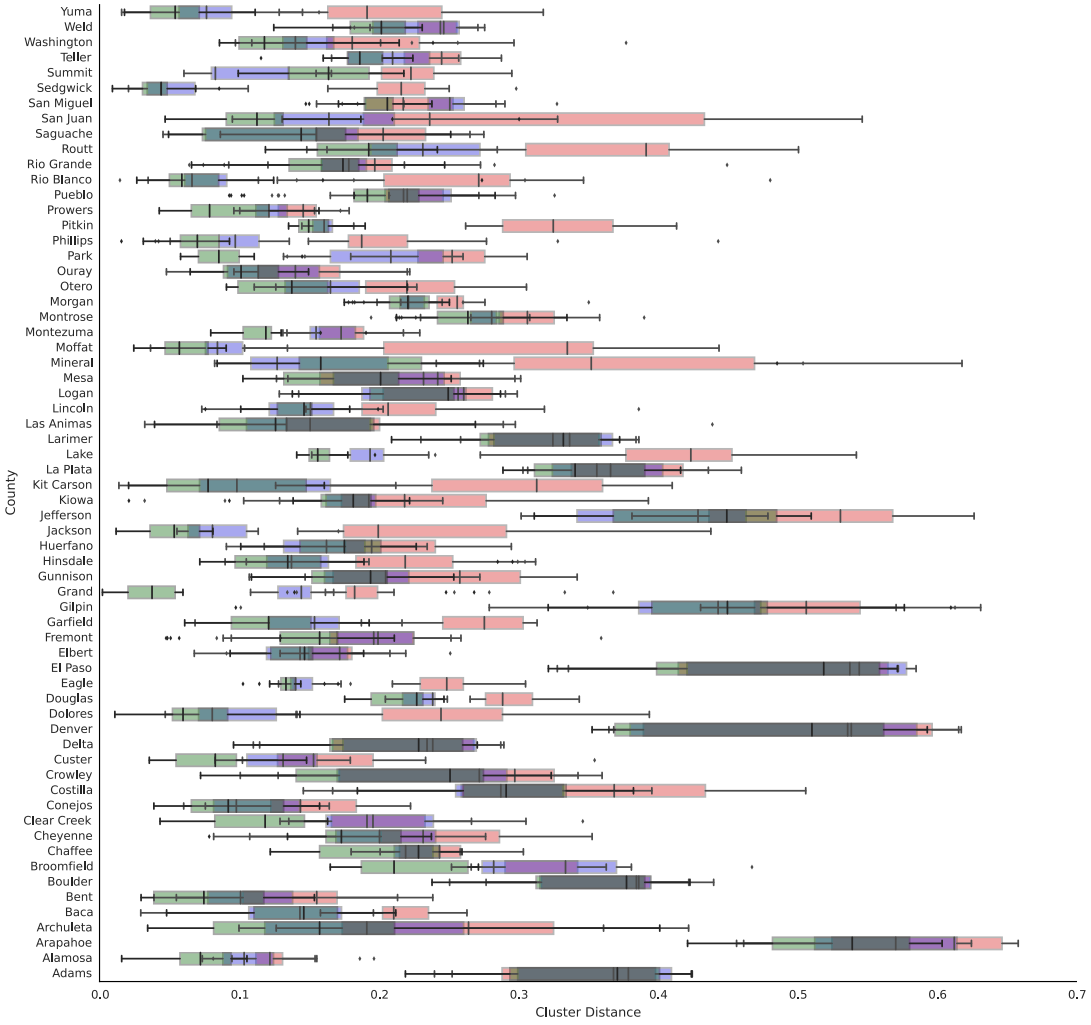
[5]Note that any of the variables names preceded by $SL\_$ indicate spatial lag versions of the base variable. That is, the value captures the weighted average of all values in the local neighborhood as defined by weight matrix W, except for the primary county i.

Figure 6.12: Variation in Model Variables - Alternative Distance Measures



The significance of assosciation between cluster distance (*dist_clust*) and all other variables changes notably when distance is measured in the reduced dimensionality space. With respect to the regression filtered space, the relationship between cluster distance and COTEL intensity (*intensity_stock*) is quite similar to full portfolio case. Furthermore, the relationship between cluster distance and the Gallagher ratio (*prop_ratio*) is similar. This suggests that the three dimensions that remain were driving association in the full portfolio case anyway.

Figure 6.13: Cluster Distance by Calculation Method by County



The space in which cluster distance was measured is indicated by color. The red boxplots indicate the distance was calculated across the entire expenditure portfolio. The bivariate regression filtering space is show in blue, and the PCA is shown in green.

Model 8 What is the Nature of COTEL Impact on Expenditure Behavior?

Expenditure Differentiation $=f$(Resources to Cover the Minimum Service Bundle, Excess Resources)

where

Resources to Cover the Minimum Service Bundle $=f$(Demographic Factors, Geographic Environment)

Excess Resources $=f$(Revenue Base Dynamics, Institutional Restrictions on Revenue)

In effect, the model in this study suggests that institutional restrictions on revenue (e.g. tax and expenditure limitations) restrict the resources available to cover services that would allow a given jurisdiction to differentiate itself from others. In reality, this is a gross simplification. There is no natural boundary between revenues used to cover basic services and those used to cover the additional services preferred by constituents. In general, this model suggests convergence in expenditure behavior would stem from the imposition of COTELs.

Model 9 Modeling Determinants of Cluster Distance

$$y_{it} = \underbrace{W y_{i\_,t} \Gamma_1}_{(1)} + \underbrace{\sum_{l=1}^{L} y_{i,t-l} \Gamma_2}_{(2)} + \underbrace{Z_{i,t}\beta}_{(3)} + \epsilon_{i,t}$$

where

$$Z_{i,t}\beta = \underbrace{W X_{i\_,t} \beta_1}_{(3a)} + \underbrace{X_{i,t}\beta_2}_{(3b)} + \underbrace{X_t \beta_3}_{(3c)}$$

$y_{i,t}$ is the dependent variable (*clust_dist*), the distance of county i at time t from the centroid of its cluster (a.k.a. cluster distance). Note that $y_{i\_,t}$ denotes the cluster distance of each county j at time t where $i \neq j$.

W is the weight matrix that defines the "local neighborhood".

Γ represents the coefficients of autoregressive terms. Γ_1 is for the spatially autoregressive effect, while Γ_2 is for the temporally autoregressive effect.

$Z_{i,t}$ is a vector of regressors that includes the primary variables of interest, *intensity_stock* and *prop_ratio*. These include factors from the local neighborhood, county-specific factors, and statewide factors.

$\epsilon_{i,t}$ is the error term.

The model can be broken down into components, each of which are numbered above. The top line equation captures spatial autoregression in cluster distance (1), temporal autoregression in cluster distance (2), and forces acting on the primary county at time t (3). The second equation unpacks term 3. It captures select properties of counties in the local neighborhood (3a), county-specific properties (3b), and statewide variables (3c). The breakdown of variables in term 3 are as follows:

Term 3a includes total expenditures (EXP_TOTAL), population growth in the preceding year (*pop_growth*), and the ratio of vacant housing units to total housing units (*vac_rate*).

Term 3b includes total expenditures (EXP_TOTAL), population growth in the preceding year (*pop_growth*), intergovernmental revenue per capita (*pcintgov*), total revenue per capita (*pcrev*), annual payroll per capita (*pcap*), COTEL intensity (*intensity_stock*), and the Gallagher ratio (*prop_ratio*). The term also includes an interaction between COTEL intensity and total expenditures (*exp_intensity*) to capture variance in intensity impact along the fiscal resources dimension.

Term 3c includes a single variable, gross state product in the previous year (*gsp.L*).

6.5.2 Cross-Sectional Models

Model 9 presents a view of the world that represents the a priori belief of the author with respect to cross-sectional action in county fiscal behavior. Given that county groups are not defined spatially, and thus members are often not close to each other, it seems quite plausible that the factors that may lead a county to part ways with group behavior are spatial factors which would not be shared across all members of the group. Thus, it is expected that spatial dependency, either through lags or errors, would need to be integrated into the analysis. The abstract and operational versions of this view are provided in Model 10.

To check the face validity of the spatial assumption, one can use a global version of the Moran's I calculation defined in Algorithm 6. While the global calculation does not permit the identification of hot spots, or clusters, within the state, it does have the advantage of providing a single statistic that captures the existence of clustering somewhere within the state. As such, we can evaluate clustering over time more easily. Figure 6.14 displays clustering activity in Colorado over time, faceted by six distance dimensions. The first three (Full Portfolio, Regression Filtered, and Principal Components) correspond with the distance measures calculated in the spaces defined in Subsection 6.3.2.1. The second three are transformations of the first three. They are change measures that capture the difference in cluster differences between the current year (year t) and the next year (year $t+1$).

There are three properties of the Figure 6.14 that are of particular interest. First, the identification of spatial clustering varies dramatically across different measures of distance. Second, leading change measures are generally less spatially coherent than current year absolute measures. Third, the current year full portfolio distance measure is the only one that seems to exhibit spatial clustering over most of the period, *and that clustering intensity declines over time.* In short, while it seems as though regional dynamics could play an outsized role in causing counties to stray from the behavior of their initial types, the data seem to suggest that this expectation is overstated.

For the purposes of thoroughness, spatial models were estimated for all three distance measures for each year between 1993 and 2009.[6] As can be seen in Figure 6.16, these models did not provide consistently clear impacts from the institutional variables of interest: COTEL intensity (*intensity_stock*) and the Gallagher ratio (*prop_ratio*). In most years, they could not be meaningfully separated from zero.

These results clearly lead one to question whether or not the specification was appropriate. To reiterate, the model sought to capture economic dynamics, tax burden, and the impact of activities in the local neighborhood. Variations on these themes resulted in similar results to those seen in Figure 6.16. In light of these findings, an alternative approach was pursued: LASSO regression.

[6] Note that cross-sectional spatial models do not easily permit pooled estimation. There must be a single value for each variable in each spatial feature.

Model 10 Cross-Sectional Estimation of Expenditure Divergence

$$y_i = \underbrace{Wy_{i\_}\Gamma}_{(1)} + \underbrace{Z\beta}_{(3)} + \epsilon$$

where

$$Z\beta = \underbrace{WX_{i\_}\beta_1}_{(3a)} + \underbrace{X_i\beta_2}_{(3b)}$$

In terms of the variables, the model is as follows:

$$dist\_clust_i = \underbrace{W \times (dist\_clust \; \forall \; j)}_{(1)} +$$

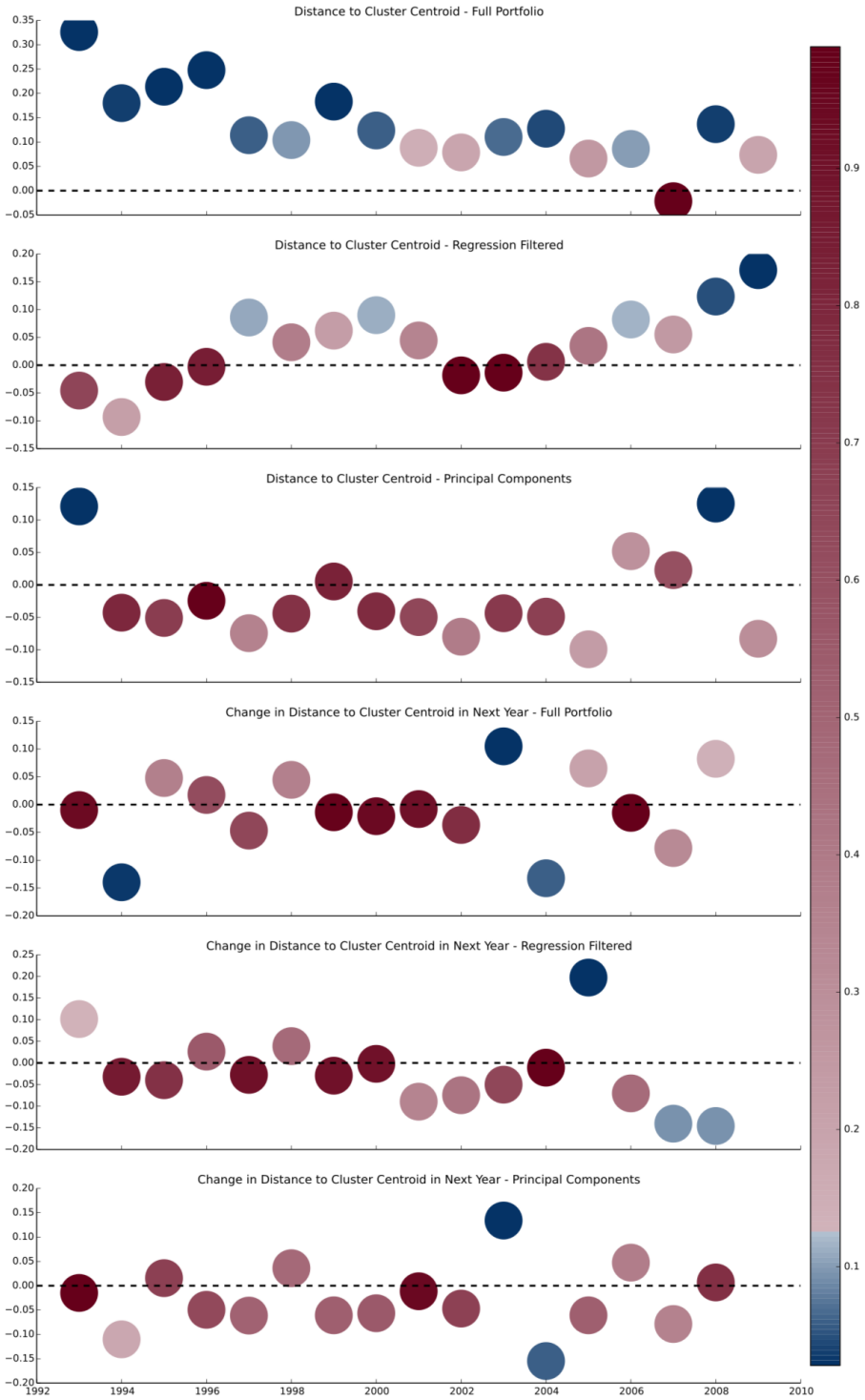
$$\underbrace{SL\_EXP\_TOTAL + SL\_pop\_growth + SL\_vac\_rate}_{(3a)} +$$

$$\underbrace{EXP\_TOTAL + pop\_growth + pcintgov + pcrev + pcap +}_{(3b)}$$

$$\underbrace{prop\_ratio + intensity\_stock + EXP\_TOTAL * intensity\_stock}_{(3b)}$$

where $i \neq j \; \forall \; i \in S$ and the $SL\_$ prefix indicates the spatial lag (the average value in the local neighborhood, S).

Figure 6.14: Moran's I - Cluster Distance by Year



The figure depicts the value of Moran's I for each distance measure by year. Higher values indicate clustering of similar values while lower values indicate clustering of disimilar values. A value of zero should be interpreted as the absence of clustering. In other words, the distribution of cluster distances is relatively random across counties. The color of each observation captures the statistical clarity of the clustering behavior (i.e. p-value).

Figure 6.15: Distribution of Distance Measures

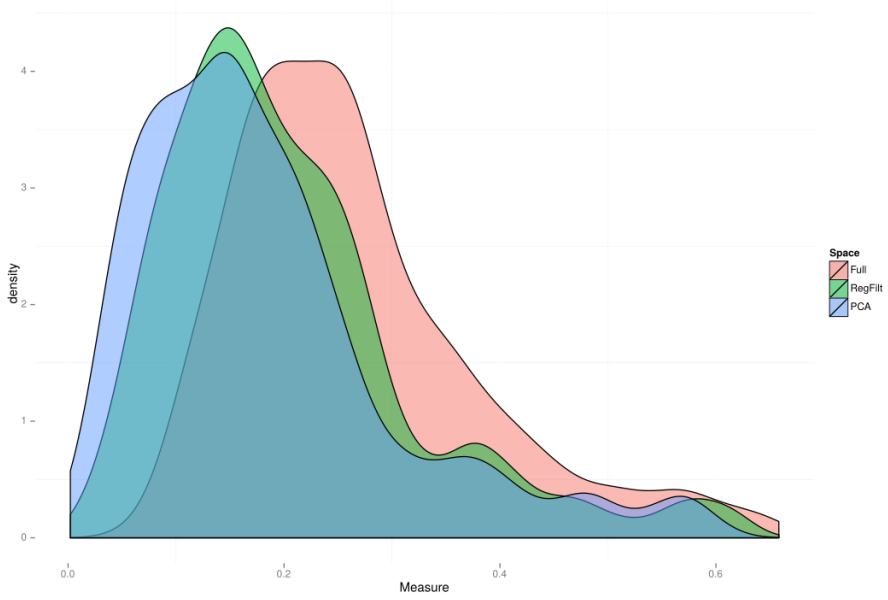
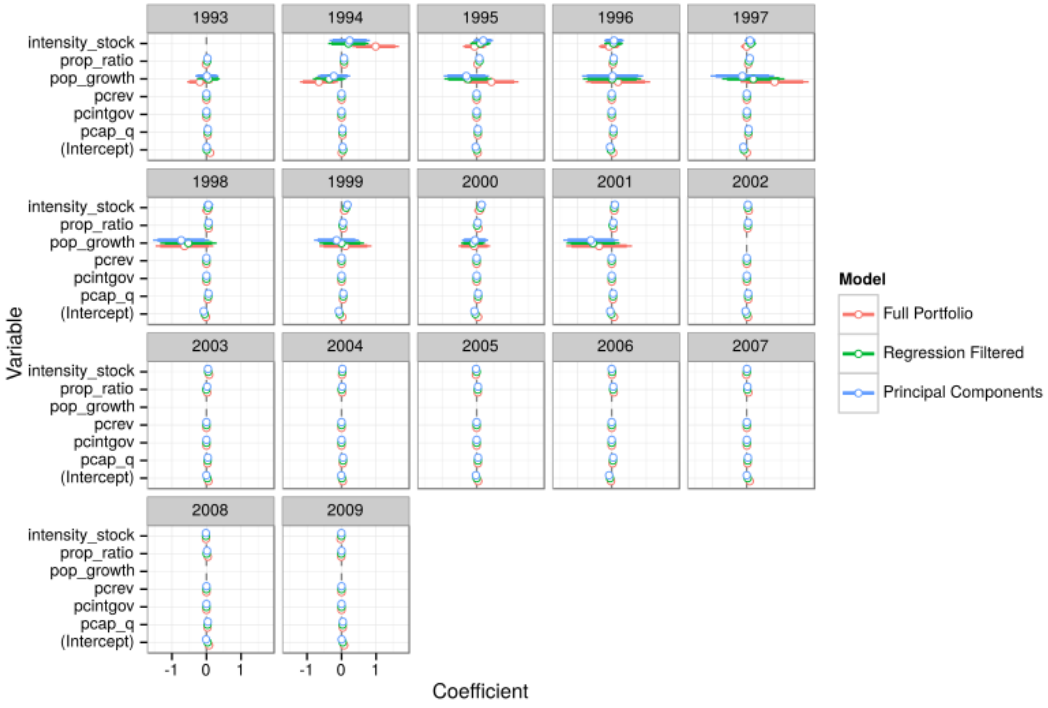


Figure 6.16: Spatial Lag Model Results by Year



6.5.2.1 LASSO Regression

> "It has been again and again demonstrated, that those who are accused of despising facts and disregarding experience build and profess to build wholly upon facts and experience; while those who disavow theory cannot make one step without theorizing."[71]

Mill hints at the natural tension between those at either end of the inquiry spectrum, while simultanesouly recognizing that the differences between the poles are matters of degree, not concept. This is, in fact, an instructive point for the current situation. The a priori theoretical relationships hypothesized at the top of this section must be converted in an operational specification, which involves the selection and form of the variables used to represent said relationships. Ultimately, however, transformations can only make so much of a difference. In this case, the low explanatory power of the model presented was reasonably robust to an array of transformations of the variables presented. One must consider the implication: important elements are missing from the specification.

Fortunately, the context of this analysis is conducive to alternative methods of model selection. Specifically, a class of estimators has been developed to deal specifically with the problem of dealing with a model that contains a number of regressors , p, that greatly exceeds the number of observations, n. These approaches are referred to as shrinkage, or regularization, methods (Algorithm 6.2). Their utility extends beyond the specific use case for which they were designed. In general, they are useful for identifying the components of a dataset that are the best predictors. In contrast to filtering based on pairwise correlation or stepwise variable selection, they avoid the primary deficiency with discrete subset selection methods: comparatively high variance in predictive accuracy. Shrinkage methods rely instead on a continuous process for subset selection. In a nutshell, they penalize the sizes of the coefficient estimates. Since the loss function must now account for this penalty, the effect is to "shrink" the estimates down until many of them are no longer meaningfully distinguished from zero. Those that remain yield effects in spite of the penalty interacted with the impacts of all other variables.

In this analysis, following the theoretical specification above with LASSO regression provides information that we may use to update the model. Furthermore, this approach lessens the chance of omitted variable bias (assuming our initial dataset contains a sufficient amount of information). Finally, if the institutional variables remain significant, it lends support to the main theoretical thrust of this inquiry.

6.5.2.2 LASSO Results

LASSO estimators can only be run on complete cases. Rather than drop the observations for which missing values exist in a few variables, the analysis relied

on multiple imputation based upon a multivariate normal prior.[7] Figure 6.17 depicts the impacts of each variable on cluster distance in the full portfolio space, averaged across all imputation sets. As can be seen, the institutonal variables (*intensity_stock* and *prop_ratio*) still appear to be among the most important drivers of changing fiscal behaviors, as measured by distance to the average position of similar counties. In fact, most of the theoretical model is contained as a subset of the variables identified by the LASSO procedure.

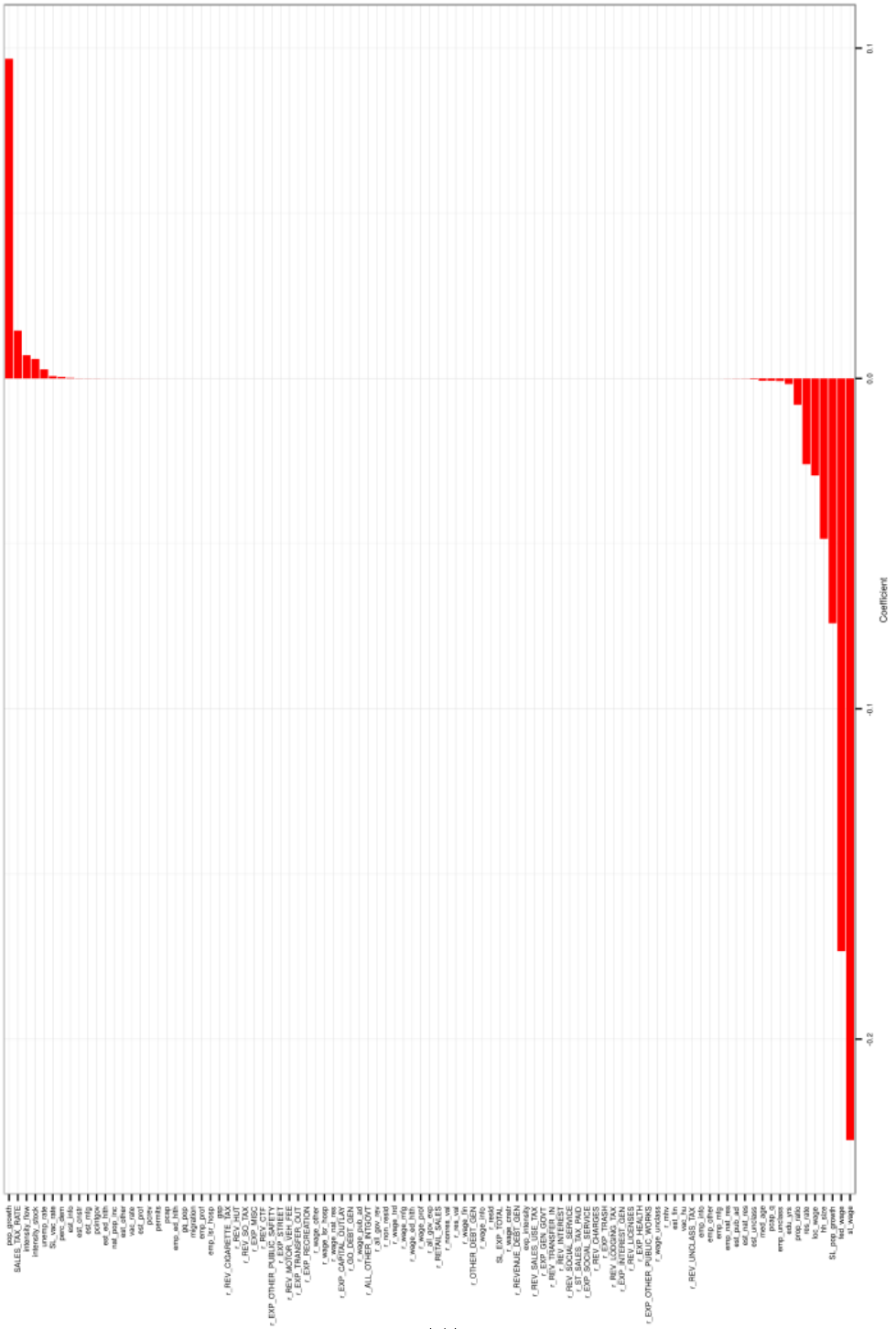
There are, however, significant departures from the initial model, most notably the impact of the size of government employment. Government employment is captured by the proportion of annual payroll in a county allocated to the federal (*fed_wage*), state (*st_wage*), and local (*loc_wage*) employees. It should also be noted that socioeconomic factors like household size (*hh_size*), educational achievement (*edu_yrs*), and current year population growth (*pop_growth*) played meaningful roles as well.

The inclusion of the missing elements in the model had a tremendous impact on explained variation. Figure 6.18 shows the explained variation for current level and future change versions of the distance measures created in each space (full expenditure set, regression filtered, and principal components). Providing the scores for each of the five imputed sets provides some notion of sensitivity to imputation. In general, however, even though the leading indicators remain difficult to evaluate, the current levels all increased by an order of magnitude.

One might reasonably ask whether or not the distance measures are in agreement about which factors matter the most. As previously argued, agreement across different implementations of fiscal behavior lends support to valid inference about the true drivers of fiscal behavior. Figure 6.19 directly compares the estimates from both versions (leading change and current level) of all three distance measures (full portfolio, regression filtered, and PCA). Estimates on the zero line have been virtually eliminated in the shrinkage process, and may thus be interpreted as immaterial predictors. Agreement across models is captured by estimates appearing on the same side of the zero line. Clearly, the closer the estimates are to each other, the stronger the agreement. If estimates fall on both sides of the line, as is the case for the level of state employment (*st_wage*), support as a credible driver of fiscal behavior is reduced. Note that while the impacts are modest relative to federal employment (*fed_wage*) and population growth (*pop_growth* in the county and *SL_pop_growth* in the local neighborhood), the estimates of the COTEL intensity (*intensity_stock* and *intensity_flow*) point consistently in the same direction across models. In general, they are associated with larger distances between a county and the centroid of its type, though the magnitude of the effect is not as substantial as other model components. In other words, they are associated with deviations in the expenditure trajectory of a given county. The Gallagher Ratio, on the other hand, seems to be more sensitive to distance measure.

[7] The joint distribution of all variables was assumed to be normal, and the parameters were estimated based upon observed cases. The missing values are imputed as draws from this distribution. It is for this reason that five imputations were generated. Estimates presented here are averages of the estimates across all five imputations.

Figure 6.17: Average LASSO Estimated Effects - Full Expenditure Portfolio



Algorithm 6.2 Shrinkage Methods

$$\text{ShrinkageEstimator} = \text{argmin}_{\hat{\Theta}}\{L(\Theta, \hat{\Theta}) + \lambda f(\hat{\Theta})\}$$

LASSO Implementation

$$\hat{\beta}^{\text{LASSO}} = \text{argmin}_{\beta}\{\frac{1}{2}\sum_{i=1}^{N}(y_i - \beta_0 - \sum_{j=1}^{p} x_{i,j}\beta_j)^2 + \lambda\sum_{j=1}^{p} \mid \beta_j \mid\}$$

As can be seen, the loss function ($L(\Theta, \hat{\Theta})$) in the LASSO estimator is just ordinary least squares. The innovation is in the second term, a penalty that scales with λ.

Figure 6.18: LASSO Scores by Distance Measure

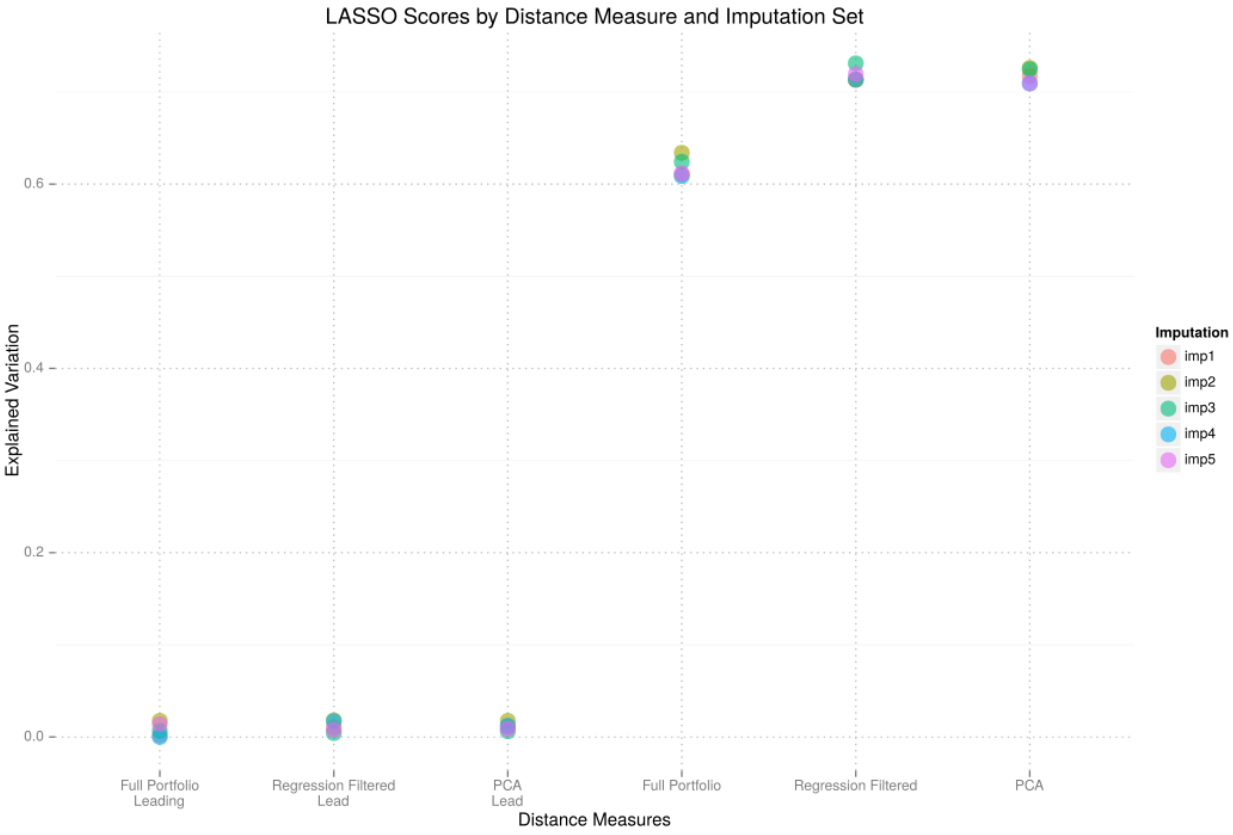
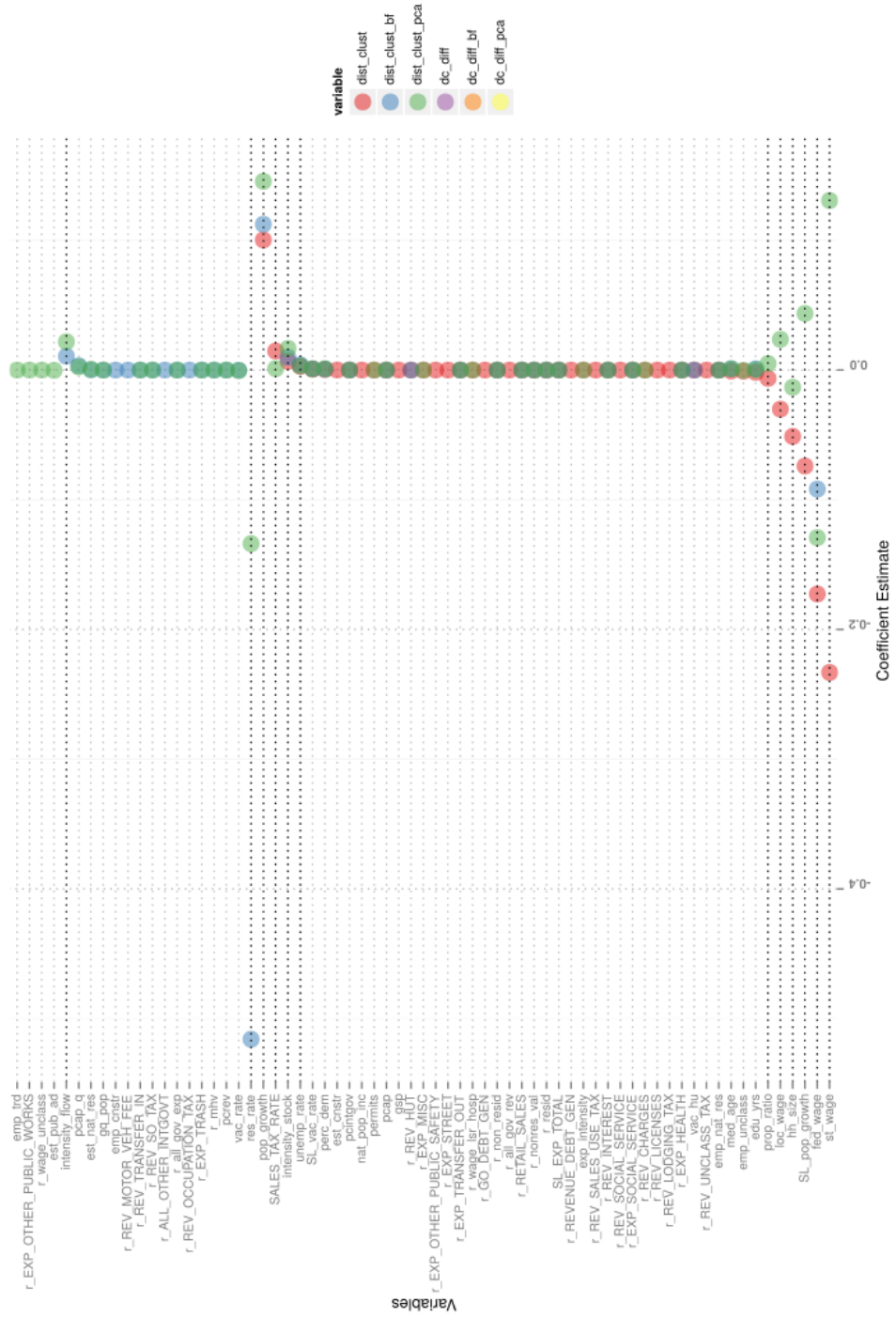


Figure 6.19: LASSO Estimates by Distance Measure



6.5.3 Panel Analysis

While Subsection 6.5.2 has provided useful information regarding plausible drivers of fiscal behavior, it is generally advisable to use panel data when possible. The increase in the number of observations can increase precision (i.e. reduce estimate variance), while leveraging variation across time and space can improve accuracy (i.e. reduce estimate bias). The drawback is that the enhancement techniques leveraged in Subsection 6.5.2 are not yet generally available to the best of the author's knowledge.[8] Furthermore, as will become apparent, the fixed effect techniques used here substantially diminish the explained variation in fiscal behavior over the pooled case.

To establish why simple reliance on the pooled case may be problematic, one can evaluate the behavior of the residuals. Figure 6.20 compares the distribution of residual values for pooled and fixed effect models. The separation of central tendency from the zero line in the pooled case is a measurement of the bias in the estimates. Note that this bias is markedly reduced in the fixed effect case, and variance is reduced as well. Figure 6.21 depicts the distributions of residuals by county. The implication is that unobserved county-specific effects are distorting the estimates from the pooled model. In effect, the aspects we do not measure may interact with those that we do measure in unexpected ways.[9]

Despite the problems with pooled analysis, OLS is often a useful starting point for building a narrative. In Table 6.2, it can be seen that the Gallagher Ratio (*prop_ratio*) is really the only consistent driver of increases in cluster distance across models. The sign of the COTEL intensity (*intensity_stock*) estimates suggest that it is also associated with larger cluster distances, although not with the same magnitude or precision as the Gallagher Ratio. These results, even if only weakly supported in the COTEL intensity case, suggest that COTELs are associated with forcing counties to make different decisions.

To mitigate the heteroskedastic factors discussed above, two flights of fixed effect models have also been evaluated. The first incorporates county fixed effects (Table 6.3) and the second incoroporates both county and year fixed effects (Table 6.4). These flights paint a very different story for COTELs. In the county fixed effect model, neither COTEL intensity nor the Gallagher Ratio is a meaningful predictor of cluster distance. In the two-way model, both measures go negative! The effect can dissipate when utilizing fixed effects for at least two reasons. The first is that COTELs do not actually lead to changes in expenditure behavior. Rather, they are correlated in the pooled case because of action in a third variable. For example, counties that capture a higher proportion of all government expenditure may simply be more likely to be constrained by COTELs because these jurisdictions are, in fact, trying to do more at the county level. Expenditure proportion is the only component of our fiscal

[8] Developing reliable estimators of the shrinkage type is a task that just might exceed the capability of the author. Indirect approaches involving the transformation of input data are more achievable, but this effort has not been pursued in the context of this inquiry.

[9] Note that there is also a gradual upward trend in the residuals, but the year effect is not nearly as siginificant as the county-specific factors.

Figure 6.20: Comparison of Residual Distributions - Pooled vs. Fixed Effects

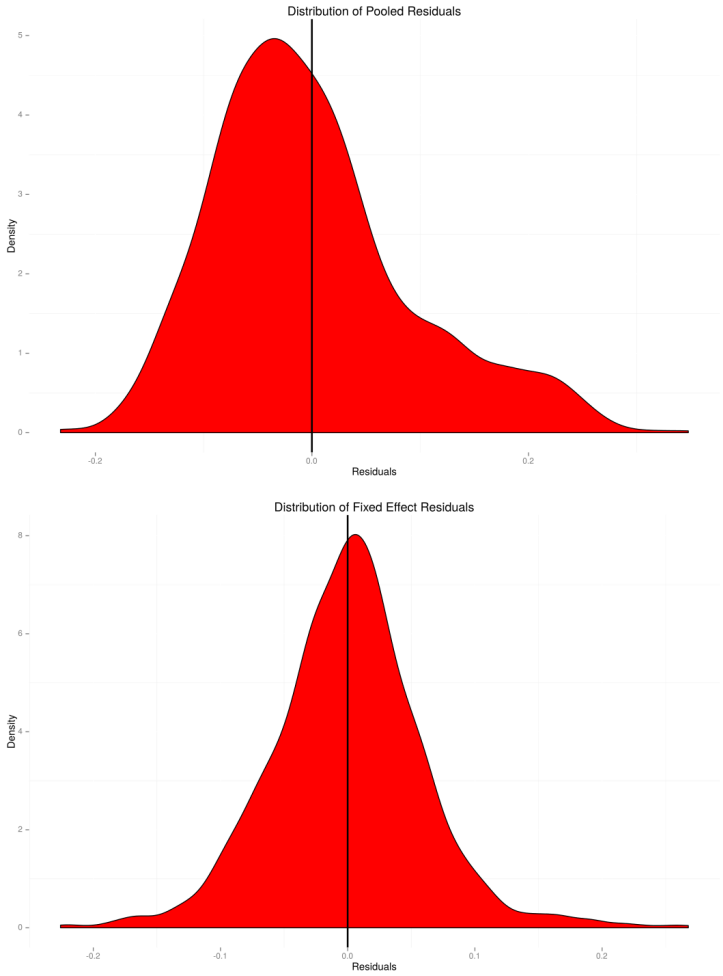


Figure 6.21: Pooled Residuals by County

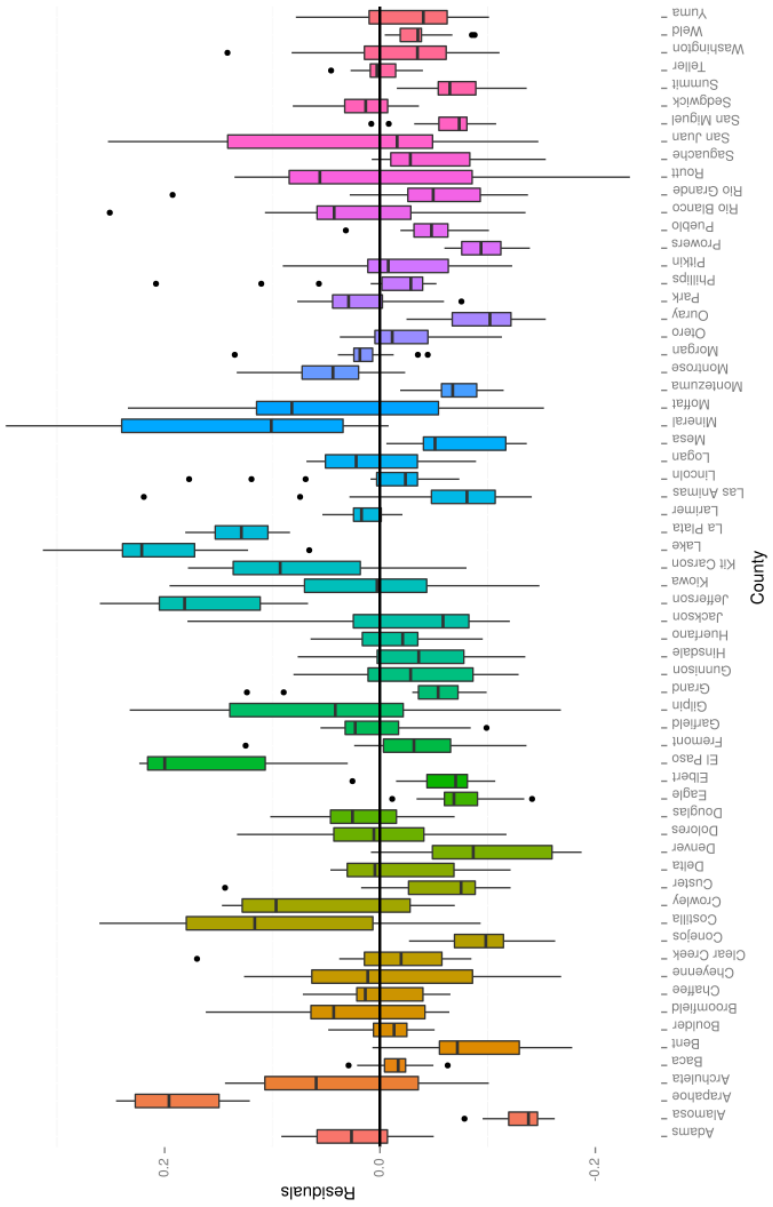


Table 6.2: Pooled OLS Results

	Dependent variable:		
	dist_clust	dist_clust_bf	dist_clust_pca
	(1)	(2)	(3)
exp_total	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)
pop_growth	−0.050	−0.053	0.0004
	(0.078)	(0.072)	(0.074)
pcintgov	0.0001***	0.0001***	0.0001***
	(0.00001)	(0.00001)	(0.00001)
pcrev	−0.00004***	−0.0001***	−0.0001***
	(0.00001)	(0.00001)	(0.00001)
pcap	0.00001***	0.00001***	0.00001***
	(0.00000)	(0.00000)	(0.00000)
prop_ratio	0.028***	0.034***	0.038***
	(0.008)	(0.007)	(0.008)
intensity_stock	0.002	0.017*	0.014
	(0.011)	(0.010)	(0.011)
exp_intensity	−0.000	−0.000**	−0.000***
	(0.000)	(0.000)	(0.000)
Constant	0.173***	0.140***	0.112***
	(0.008)	(0.008)	(0.008)
Observations	1,088	1,088	1,088
R^2	0.357	0.481	0.482
Adjusted R^2	0.354	0.477	0.478
F Statistic (df = 8; 1079)	74.858***	124.849***	125.352***
Note:			*p<0.1; **p<0.05; ***p<0.01

space definition that does not speak to expenditure patterns, and most counties exhibit a relatively narrow range of variation in this proportion. Fixed effects wash out consistent differences across units, so we may have washed out the impact of expenditure proportion to a large extent, which would drop the amount of variation COTELs can explain. For this to hold, however, a strong level of association between county expenditure proportions and COTEL measures. Figure 6.22 demonstrates that the association between these concepts is quite unremarkable.

Alternatively, fixed effects may be washing out too much variation in general across counties. This lack of variation would increase the difficulty in measuring the significance of any model component. Indeed, we see that the model fit has dropped dramatically, as has the impact of nearly all independent variables. This is, however, tough to square with the clarity of signal for our COTEL variables in the two-way model, which explains even less total variation in cluster distance than the county fixed effect model. In the two-way model, COTELs are consistently a driver of smaller cluster differences.

The author posits that these findings reflect a mechanism that violates the original hypothesis. COTELs may well force counties to change expenditures in a way that conflicts with underlying preferences, but this change may actually mean that counties are not free to differentiate themselves as they otherwise would. Said differently, COTELs push counties that want to change types to stay put. How is it then, that the OLS model showed a positive relationship? This is likely due to the fact that both the median cluster distance and COTEL values are increasing over time, although the increase in the former is modest.

6.6 Conclusion

No single element of any of the specifications used in this analysis displayed fully consistent impacts across all models. Given that over 60 models have been presented in the chapter, and given the discussion of ensemble approaches in Subsection 5.5.1.1, perhaps this is not so problematic. There do seem to be, for our purposes, some general trends of note.

First, and foremost, the positive relationship between COTEL intensity (*intensity_stock*) and our measures of changes in expenditure behavior, cluster distance ($dist_clust*$) was a fairly consistent phenomenon until time was addressed. This accords with intuition. It makes theoretical sense that jurisdictions that experience greater constraints on the ability to raise revenue will be forced to modify the menu of services they can feasibly finance, and that the cumulative effect over time would make this more acute.

The relationship to the Gallagher ratio, however, is a bit more murky in both theoretical and empirical contexts. From a theoretical standpoint, it is difficult to parse the residential share of the property tax burden from a prevailing preference for or against expenditure decisions. One could posit that counties with higher residential shares are more likely to behave similarly at the outset. Changing that share may not alter that preferential correlation. Sure enough,

Figure 6.22: County Fiscal Proportion Association With COTELs

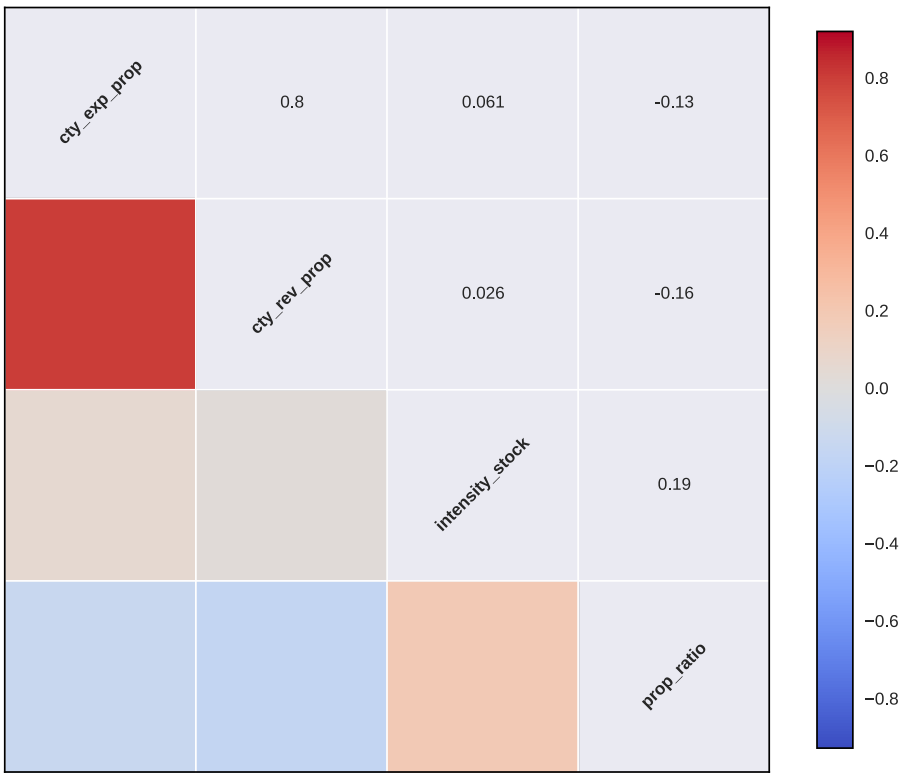


Table 6.3: Fixed Effect Results - County

	Dependent variable:		
	dist_clust	dist_clust_bf	dist_clust_pca
	(1)	(2)	(3)
exp_total	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)
pop_growth	−0.064	−0.136***	−0.027
	(0.061)	(0.047)	(0.047)
pcintgov	−0.00002	−0.00003**	−0.00002
	(0.00002)	(0.00001)	(0.00001)
pcrev	0.00002**	0.00003***	0.00003***
	(0.00001)	(0.00001)	(0.00001)
pcap	0.00000**	0.00000***	0.00000***
	(0.00000)	(0.00000)	(0.00000)
prop_ratio	−0.010	0.016	−0.010
	(0.017)	(0.013)	(0.013)
intensity_stock	0.002	0.003	−0.005
	(0.011)	(0.008)	(0.008)
exp_intensity	0.000	0.000**	0.000
	(0.000)	(0.000)	(0.000)
Observations	1,088	1,088	1,088
R^2	0.090	0.175	0.138
Adjusted R^2	0.084	0.163	0.129
F Statistic (df = 8; 1016)	12.522***	26.893***	20.356***
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 6.4: Fixed Effect Results - County & Year

	Dependent variable:		
	dist_clust	dist_clust_bf	dist_clust_pca
	(1)	(2)	(3)
exp_total	0.000	0.000	0.000**
	(0.000)	(0.000)	(0.000)
pop_growth	0.100	0.011	0.079*
	(0.062)	(0.047)	(0.048)
pcintgov	−0.00003*	−0.00004***	−0.00003**
	(0.00002)	(0.00001)	(0.00001)
pcrev	0.00001	0.00002***	0.00002***
	(0.00001)	(0.00001)	(0.00001)
pcap	−0.00000	0.00000	0.00000
	(0.00000)	(0.00000)	(0.00000)
prop_ratio	−0.048***	−0.018	−0.034**
	(0.017)	(0.013)	(0.014)
intensity_stock	−0.034***	−0.031***	−0.030***
	(0.011)	(0.008)	(0.009)
exp_intensity	0.000**	0.000***	0.000**
	(0.000)	(0.000)	(0.000)
Observations	1,088	1,088	1,088
R^2	0.052	0.071	0.083
Adjusted R^2	0.048	0.065	0.076
F Statistic (df = 8; 1000)	6.926***	9.543***	11.265***
Note:			*p<0.1; **p<0.05; ***p<0.01

the empirical analysis did little to sort this out. *prop_ratio* estimates were decidely more mixed than those associated with *intensity_stock*.

While it is also true that there are a number of other, often more important, factors that drive changes in expenditure patterns, a central message can be gleaned from the analysis. In all likelihood, institutional restrictions matter for local fiscal choices. Policy officials must, and measurably do, adapt to these constraints.

Chapter 7

Partial Revelation of Preferences via Local Overrides ("De-Brucing")

7.1 Introduction

It is clear that COTELs have changed the operating space for local fiscal managers in Colorado. The designers did, however, leave room for local autonomy. Local jurisdictions retained the right to exempt themselves from limitation, making room for a useful social inquiry. If local jurisdictions had the freedom to opt out, was the imposition of COTELs actually a means to better align constituent preferences and fiscal outcomes? Had the absence of COTELs enabled a disconnect between constituent desires and the actions of local public finance officials?

These motivating questions harken back to the discussion of TELs as instruments of democracy in Subsection 1.0.6. TELs are generally blunt objects, but they may serve as an attractive way to circumvent regular order, which may suffer from perceived deficiencies. As such, they may very well push fiscal outcomes towards accordance with constituent preferences. The question is whether or not the cure is worse than the disease. Chapters 5 and 6 explored limited aspects of this question.

This chapter partially explores the same question from a different angle. Before one can compare the "cure" and "disease", one must understand the extent to which the disease is a problem. In other words, we must identify voter preferences before we know if COTELs lead fiscal outcomes to converge on them. Since we do not directly observe voter preferences, identifying them is no small ask. It requires assumptions about how to synthesize the events that we can observe, and even then it is a multi-stage research program. This chapter takes only the first step. It explores whether or not the outcomes of local overrides,

or "deBrucing" attempts, can be anticipated based upon county conditions and ballot design.

7.2 How Can Voter Preferences be Revealed?

Since we cannot observe the preference schedules of constituents, we are compelled to rely on phenomenon that we can observe. This study assumes that ballot outcomes are valid observations of the utility mechanism that underlies political expression in a county, and the preference schedules of all its residents. This is, to be sure, a strong assumption if for no other reason than voting participation rates being nowhere near 100%. These initiatives, however, do provide our best information. They can be made to perform some work with some additional assumptions about the structural properties of the preferences that serve as inputs into voting outcomes. Given this framework, the path forward is understanding the drivers of ballot outcomes.

Anticipation of ballot outcomes is a composite inquiry because there are two components to a county's decision to exempt itself from TABOR and/or SLPTR. First, what is the baseline propensity to exempt? That counties differ in their desire to raise and spend public funds is a natural corollary to Tiebout's hypothesis.[108] To extend this view by positing that this preference differential could be manifested in differing baseline propensities to exempt is not an unreasonable prior belief. This study chapter seeks to update this prior belief with empirical observation of the actual outcomes of exemption votes.

Second, given an estimated baseline propensity to exempt, to what extent does the construction of the exemption impact the likelihood of success? It turns out that exemptions are far from identical. Each of them is uniquely constructed – each is a function of both the needs of the jurisdiction and the designer's estimated chances of successful passage. To state the question differently, given the county's political environment, which aspects of the ballot are likely to garner sufficient support? Which aspects are most problematic?

To understand whether or not exemption votes can be anticipated, this study takes a two part estimation approach. It does so in an effort to provide actionable intelligence for local policymakers. In this light, the sole objective of the establishment of a baseline propensity to exempt is to determine whether or not it can be identified from practically intrinsic features of the county. Characteristics of a constituent population do not change rapidly. From the perspective of a local official, policy options take the current population's sentiment as a given property. From a methodological perspective, this is constraining and liberating at the same time. It is constraining insofar as we cannot use policy actions (like previous votes, or lack thereof) as regressors in the prediction of future vote outcomes. To do so would conflate underlying constituent preferences with the design elements in the proposals tested in previous votes. On the other hand, it is liberating insofar as policymakers can focus on ballot design. Thus, as researchers, we can focus on predictive accuracy. Among other things, this facilitates the use of a larger suite of predictive tools, including those that

operate well in high-dimensional space.[1]

In the second stage, we can use the first stage result to condition the analysis of ballot design. In traditional policy literature, this is done by inserting the result of a probit model as a regressor in the second stage equation. We will parallel this approach by including a probability estimate of support vector classification in the second stage.

7.2.1 The Revealed Preference Construct

To use historical ballot initiative outcomes as the basis for understanding the preferences of voters, one must grapple with the nature of choice. Without some minimal structure, the past choices of individuals or groups is quickly rendered meaningless for the purpose of predicting future choices. Consider a scenario in which an individual must select from a set of three choices, $S = \{A, B, C\}$. In the absence of any other information, we must assign equal probabilities to the choice among items A, B and C. That is, in predicting the individual's choice or understanding the individual's expected utility form among the options, we can do no better than apply a uniform prior belief. Suppose now that the individual selected item B, and is tasked with selecting from the original set, $S = \{A, B, C\}$, a second time. We now have a situation in which we have knowledge of the set and additional information which may be used to affect our prior belief about the individual's bias towards a particular item. The question is, to what extent do we allow the supplementary information to affect our anticipation of the impending choice and our understanding of the individual's preference schedule.

One might reasonably inquire into the value of taking pains to precisely define the relationship between historical information and the current choice. Is it not obvious that a reasonable person would expect the consistent selection of B given the same set? In fact, that a prior choice controls is a nontrivial assumption. There are any number of reasons that that choices may be inconsistent. For a truly random number generator, it is not desirable to have a consistent choice of an item from a set. For an offensive coordinator on a football team's coaching staff, the element of surprise is actually an asset. Alternatively, in choosing the policies under which a voter must live, consistency seems to be more of a virtue, insofar as it confers benefits in siting and investment decisions. It is, however, important to 1) be explicit about the assumption, 2) be cognizant of the manner in which it can affect interpretation, and 3) be cautious about the results one obtains by way of the assumption. Furthermore, being precise about this relationship allows for clearer analysis of more complicated scenarios.

With this in mind, the analysis here leans on Samuelson's rather famous weak axiom of revealed preference (Algorithm7.1). In effect, the axiom says

[1] In addition to superior performance in high-dimensional regressor space, it ultimately became apparent that votes on the "wrong" side of the decision boundary also had to be accommodated. In this regard, not all classification approaches are created equal. The details of decisions made on this front will be elaborated on in Subsection 7.2.2.

that past choices do control when one seeks to construct a preference schedule. Said differently, the preferences of an individual do not change as a consequence of the available choices or the number of selections that may be made.

The consequence of permitting this kind of learning is that repeated observations of choice with varying compositions of the choice set can be related to one another to build an arbitrarily complex system of preferences. The property of revealed preference that allows this construction is called *transitive closure.*[111] Suppose we have two sets, $S_1 = \{x, y\}$ and $S_2 = \{y, z\}$, from which two choices have been made, $C(S_1) = x$ and $C(S_2) = y$. It can be seen that $x \succeq y$ and $y \succeq z$. Transitive closure allows us to then assert that $x \succeq z$. In this way, choices can be linked together and a preference schedule constructed.

7.2.2 Ballot Initiatives as Observations of Choice

In the context of deBrucing efforts in Colorado, Ω is the space that captures the full range of values along every dimension that may be included in a ballot initiative. These dimensions may be categorical (e.g. the target of expenditure) or continuous (e.g. the size of the requested increase in a given levy). S may be conceived of as each ballot initiative, which contains two choices, x and y. For purposes of demonstration, assume that x is always the status quo, and y is the proposed change. A complicating factor is that the status quo does not remain constant, insofar as environmental factors that are not on the ballot play a role in valuation of the status quo. Nevertheless, we may say that given two sets, $S_1 = \{x_1, y_1\}$ and $S_2 = \{x_2, y_2\}$, so long as the distance between x_1 and x_2 can be evaluated, $C(S_1)$ and $C(S_2)$ can identify the preference relation between y_1 and y_2. In other words, as long as we know how the status quo for the first vote is different from the status quo in the second vote, we can construct a preference schedule of arbitrary complexity by relating votes through transitive closure.

This is surely great news if the representative county voter is choosing between eating an apple or eating an orange. The analysis of deBrucing efforts, however, is complicated significantly by two factors. First, establishment of the representative voter is far from a simple task. Much of voting literature is built upon the concept of the median voter. [33] Reversing the dimensionality reduction required to make this approach tractable has proven remarkably difficult. Even if a voter's preferences can be placed in space, strong assumptions about the way that space is constructed across voters are required to develop a distribution of positions for a given population. This, of course, assumes that we can observe all of the relevant dimensions.

The second complication concerns not the dimensionality of the voter's preferences, but rather the dimensionality of the choices $x, y \in S$. Figure 7.1 depicts hypothetical utility functions for an individual's consumption of goods A and B, both of which can vary in value along dimension x. The choice an individual makes between the two goods in $S = \{A, B\}$ depends on the utility provided at a given value of x in this very basic example.

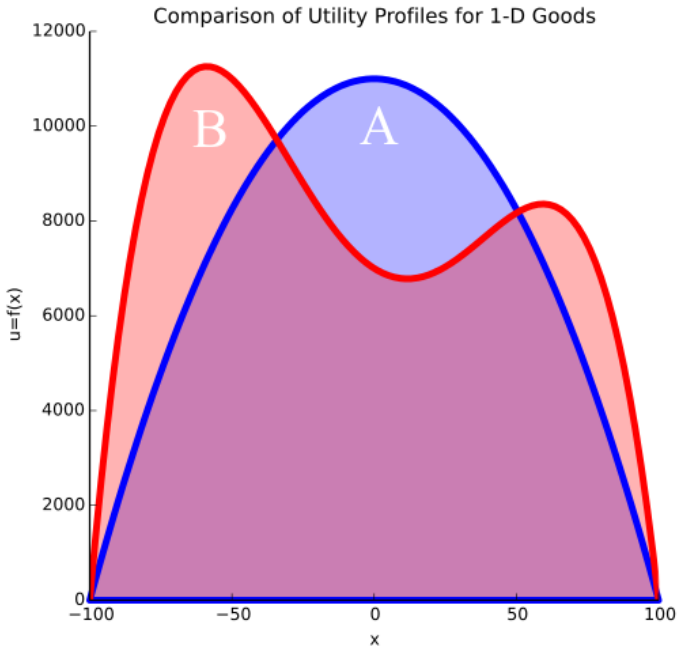
As can be seen in Figure 7.2, adding even a single dimension to this case complicates the intersection of the utility functions for these goods. There are

Algorithm 7.1 Weak Axiom of Revealed Preference

The choice structure $(\Omega, C(\cdot))$ satisfies the weak axiom of revealed preference if the following property holds:
If for some $S \in \Omega$ with $x, y \in S$ we have $x \in C(S)$, then for any $S' \in \Omega$ with $x, y \in S'$ and $y \in C(S')$, we must also have $x \in C(S')$.

In words, the weak axiom says that if x is ever chosen when y is available, then there can be no budget set containing both alternatives for which y is chosen and x is not. [69] In this case, we say that $x \succeq y$.

Figure 7.1: 1-D Utility Functions



In the graphic above, there are two single dimensional utility profiles ($u = f(x)$). The composite hull (the path of maximum utility across both goods) controls the decision. In the context of the graphic above, an individual would choose Item A if consuming a volume x contained approximately in the interval [-34,50].

over 30 dimensions in the operationalized form of the ballot initiatives used in this analysis. From a theoretical standpoint, no attempt to define the functional relationship between dimensions of alternatives is made. Furthermore, from an estimation standpoint, assumptions must be made to deal with the curse of dimensionality.[2][52] Indeed, accuracy in high dimensions is the motivating factor behind the use of support vector machines in this chapter.

These complications represent obstacles to a fuller articulation of preferences. Instead, we seek only to estimate the likelihood of prediction with the greatest achievable accuracy. It is for this reason that the introduction to this chapter claims to only scratch the surface in the effort to identify voter preferences.

7.2.3 Methodological Approach and Data

This chapter seeks to explore exemption behavior from the perspective of ballot design. For local policymakers, it asks which components should a ballot include to increase the probability of successful passage? In practice, this is a composite inquiry. To understand the marginal impact of ballot components, one must first understand how likely a given community is to pass *any* ballot.

Consequently, the analysis employs a two-stage estimation routine, a common approach when dealing with latent factors. In the first stage, we will seek to establish a baseline propensity to pass exemptions for each county in Colorado. This baseline propensity is necessarily separated from elements of ballot design. It is a function of only socioeconomic indicators. Once this baseline propensity is established for each county, it serves as an instrument in the second stage equation, which evaluates the marginal impact of ballot components (e.g. an increase in the property tax rate) on successful passage.

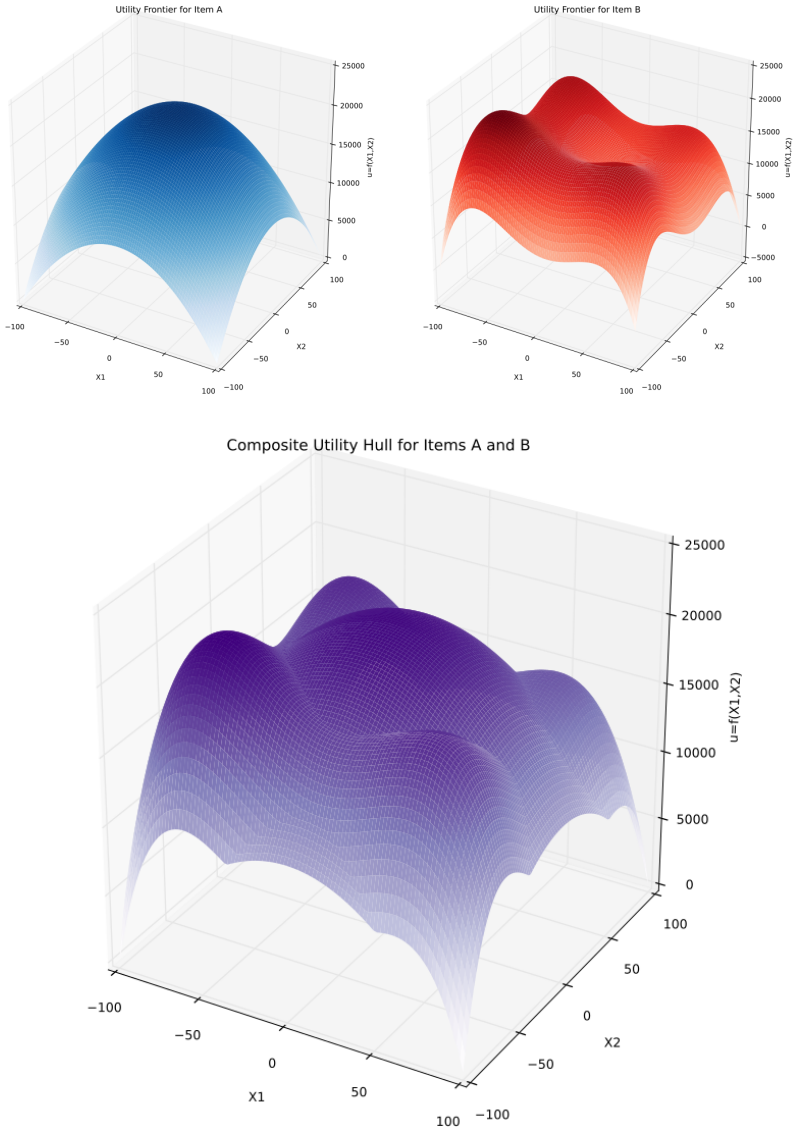
The time period considered covers all counties in Colorado between 1993 and 2009. This time period primarily reflects the scope of available exemption vote data compiled by Colorado Counties, Inc.. These data capture the contents of each exemption vote proposal and the vote outcome. The socioeconomic data are taken from the USA Counties database.[3] They cover a wide variety of indicators, collected from the following US agencies and departments:

- Census Bureau
- Bureau of Economic Analysis
- Bureau of Labor Statistics

[2]The curse of dimensionality refers to the idea that observations tend to get further away from the point being estimated in high dimensions. For example, consider a unit square that contains observations that are uniformly distributed. Suppose one is concerned with only a single dimension, $X1$. Essentially, everything in the square is projected down to the $X1$ axis. In this case, 10% of the observations may be identified by capturing the values within 10% of the range of $X1$. Call this range interval r_1. If 10% of the observations must be captured in the two dimensions ($X1$ and $X2$) of the original unit square, the radius of the circle required to do so (r_2) will generally be larger thanr_1. To state the same phenomenon from a different perspective, to keep the same level of estimating precision, the number of observations required jumps significantly with each additional dimension.

[3]This database is no longer maintained, but the available data do cover the study window.

Figure 7.2: 2-D Utility Functions



These graphics use the same hypothetical utility functions used in Figure 7.1, but they are projected in two directions instead of one. In the case of two dimensional utility profiles, the composite hull still controls, but the information required for estimation jumps dramatically.

- Department of Education
- Federal Bureau of Investigation
- Federal Deposit Insurance Corporation
- Internal Revenue Service
- Social Security Administration
- Geological Survey

Over the 17 years in question, counties in Colorado held 527 votes, 305 (57.9%) of which were passed. Every county had at least one vote, and the average for all counties was 8.23 votes. The single vote county was Gilpin. The most active county, with 35 votes, was Boulder. As can be seen in Figure 7.3, the vote data provides a view into the wide variation in exemption activity.

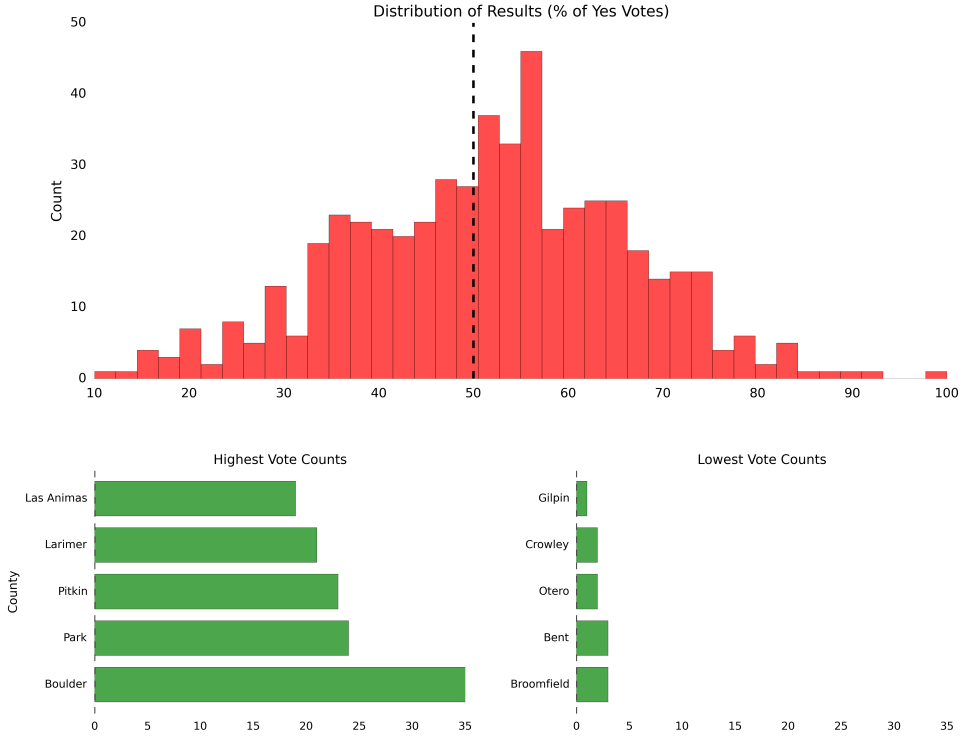
7.3 What is the Expected Impact of COTELs?

This chapter uses the same property tax-centric construction of COTELs presented in Subsection 4.1: the composite limit imposed by TABOR/SLPTR (*intensity_stock*) and the Gallagher Ratio (*prop_ratio*). Both measures are therefore capturing some element of the resource scarcity that can occur as a consequence of the intersection between COTELs and the prevailing economic activity in a given county. However, fiscal stress is a function of both revenue supply and expenditure need. *intensity_stock* only partially captures expenditure need, insofar as the allowable growth in revenues is in part determined by the construction of new housing units. Furthermore, the constraint component of the variable captures growth in the value of housing stock, which can partially serve as a proxy for a more robust concept of economic growth. If public services are generally normal goods, we expect constituents to demand more of them with increasing resources. Consequently, an additional component of expenditure need is captured in part by *intensity_stock*. By contrast, *prop_ratio* does not include any components related to economic growth. It captures only the mix of stock in the property tax base.

Since these measures only partially capture indirect measures of expenditure need, the analysis employs controls based on additional proxies. The first stage equation uses a diverse range of socioeconomic indicators that can account for demand side factors. The second stage, however, is focused entirely on ballot design. It incorporates demand factors indirectly via the "baseline propensity to exempt" variable estimated in the first stage equation. Thus, the entire analysis hinges on capturing demand characteristics in the socioeconomic indicators used in the first stage.

The implicit assumption in this construction is that these votes are very much a function of fiscal stress. One can reasonably posit that counties experiencing fiscal stress are generally more likely to make additional requests for

Figure 7.3: DeBrucing Votes (1993-2009)



more resources by way of deBrucing votes. Furthermore, one would expect that if the constituents feel sufficient pain from underprovided services, they would be more likely to accept the proposed exemption. There are three issues that complicate this linkage:

1. The decision to accept or reject a deBrucing proposal is likely to depend on both fiscal stress *and voter preferences*. If voters find the prospect of increased collections as too painful, they may be willing to absorb the costs associated with underprovision. This preference is expected to vary across counties, and it is exactly this phenomenon that estimating baseline propensity to exempt seeks to accommodate.

2. Preferences aside, voters may actually be taxed at a high rate. In other words, increasing revenue collection from the base is generally more feasible if the starting level of tax effort is relatively low, and vice versa. Thus, one would expect counties with fewer economic resources to have a more difficult time accepting deBrucing proposals. Differential endowments are captured in the socioeconomic indicators employed in the first stage equation.

3. Not all deBrucing proposals are created equal. Some proposals ask for more revenue than others. Furthermore, the type and scope of revenue can elicit different responses from the voters, *even if the overall level of revenue is held constant*. The design elements of ballots captured in the second stage equation are intended to account for these effects.

If expenditure need, preferences, and resource endowments are accommodated, it is hypothesized that the voting outcomes are a function of revenue supply. Revenue supply, in turn, is captured by the institutional variables discussed above. *Ceterus paribus, institutional constraints on revenue supply are expected to decouple revenue growth from expenditure need and create fiscal stress. This fiscal stress is expected to lead to higher rates of deBrucing vote passage.* The only situation in which this relationship ought to break down is when the deBrucing effort seeks to raise property taxes. To the extent that higher Gallagher ratios mean that residential voters would bear a higher proportion of such an increase, we would expect an inverse relationship between vote passage and *prop_ratio*. In practice, of course, the level of variation in votes that can be explained is limited by the indirect nature of the linkage, measurement error in the dependent and controls, and a limited number of observations in high dimensional space.

7.4 What is the Estimated Propensity to Override?

> "The consumer-voter may be viewed as picking that community which best satisfies his preference pattern for public goods. [...] At

> the central level the preferences of the consumer-voter are given, and the government tries to adjust to the pattern of these preferences, whereas at the local level various governments have their revenue and expenditure patterns more or less set. Given these revenue and expenditure patterns, the consumer-voter moves to that community whose local government best satisfies his set of preferences."[108]

Since Tiebout's hypothesis was first published, an enormous amount of literature has examined the veracity of this proposal. An exhaustive review of the literature is outside of the scope of this inquiry, but in general the prevailing wisdom suggests that sorting of this nature is only one piece of the puzzle. Nevertheless, it is an important piece, insofar as we do see heterogeneity in the preference patterns of local governments.

This variation in preferences is reflected not only in the policies that individual constituencies demand, but also in the operating contexts of each jurisdiction. Counties in Colorado, for example, vary dramatically in age profiles, industrial bases, political disposition, crime rates, and desire to consume public services among other things. For example, the median count of residents employed by either state or local government was 1,060 in 2007. The county with the least employees in subnational government (San Juan), however, had only 69. The county with the most (Denver) had 58,252. This variation suggests that counties will differ in their attitudes towards tax and expenditure limitations.

The goal of this component of the chapter is to identify a latent property of each county that taps into this preference variation. Since we cannot observe it directly, we rely on the intersection of characteristics we can observe to construct a proxy.

7.4.1 The Problem Set Up

In effect, this is a classification problem.[4] The response variable is a binary indicator of successful exemption. If the vote passed, it is coded as one; votes that fail to pass are coded as zero. The design matrix (i.e. regressor set) is comprised of 521 variables taken from the USA Counties database.

To be sure, there are many more variables in the database. The USA Counties data, however, present a challenge. All of the data are pulled from a broad mix of agencies and programs, each with its own reporting frequency. In their raw state, the data are quite sparse. A full discussion of the deliberation surrounding considered imputation approaches is beyond the scope of this chapter, but in the end, the approach taken sought to use the information in the data, and make no further distributional assumptions.[5] In practice, this was interpreted as applying a uniform prior to the unknown annual *changes*. This was

[4] Classification is characterized by a binary response, while regression is characterized by a continuous response.

[5] An alternative approach involved applying a multivariate normal prior. This approach resulted in a number of infeasible values and did not improve the separability of vote coutcomes. In other words, it did not perform better than the chosen approach from the perspective of prediction.

operationalized as linear interpolation between observed data points within each county, and extrapolation of the long-term trend (that which was implied by all observed data points) outside of the interpolation support.

7.4.2 Selection of a Classifier

Once complete cases had been constructed, a suitable classifier had to be chosen. To understand the rationale for this choice, observe Figure 7.4. To visualize the spread of voting outcomes, principal component analysis was performed on the USA Counties data. In the rotated basis, over 96% of the variation was explained by the first two principal components. Therefore, plotting in the plane formed by these two principal components provides a useful view of vote spread.

The typical candidate for estimating the probability of an outcome is the probit regression model, particularly when the estimate is to be used in a second stage equation. In this case, however, the probit estimater has a number of drawbacks. First, link function estimators of this type[6] impose distributional assumptions on the data, which is unnecessary for this task. Second, probit models rely on linear separating hyperplanes.[7][51] Therefore, a probit model would implicitly assume that the boundary between our "pass" and "fail" vote observations is straight. Third, the probit estimator is not the best tool for dealing with groups that overlap with each other. As can be seen in Figure 7.4, plenty of overlap exists.

Support Vector Machines (SVM)[8] represent a class of estimators that are well suited to remedy these issues. Effectively, they employ kernels to project the data into a higher-dimensional space that permits linear separability. To provide a very simplified example, if one were to imagine the subplots in Figure 7.4 actually depended on only two dimensions, linear separability would not be strictly possible. SVM could, however, project the two-dimensional data into three dimensions and find that linear separability is possible in the third dimension. This projection capacity means that SVM can create highly non-linear separating hyperplanes in the original data space.[52] *In a nutshell, this feature provides more flexibility in separating groups than is provided by the probit model.* Finally, SVM was designed with group overlap in mind. Available implementations of the estimator class allow for the input of a parameter that penalizes the existence of responses on the "wrong" side of the decision boundary (i.e. the separating hyperplane).

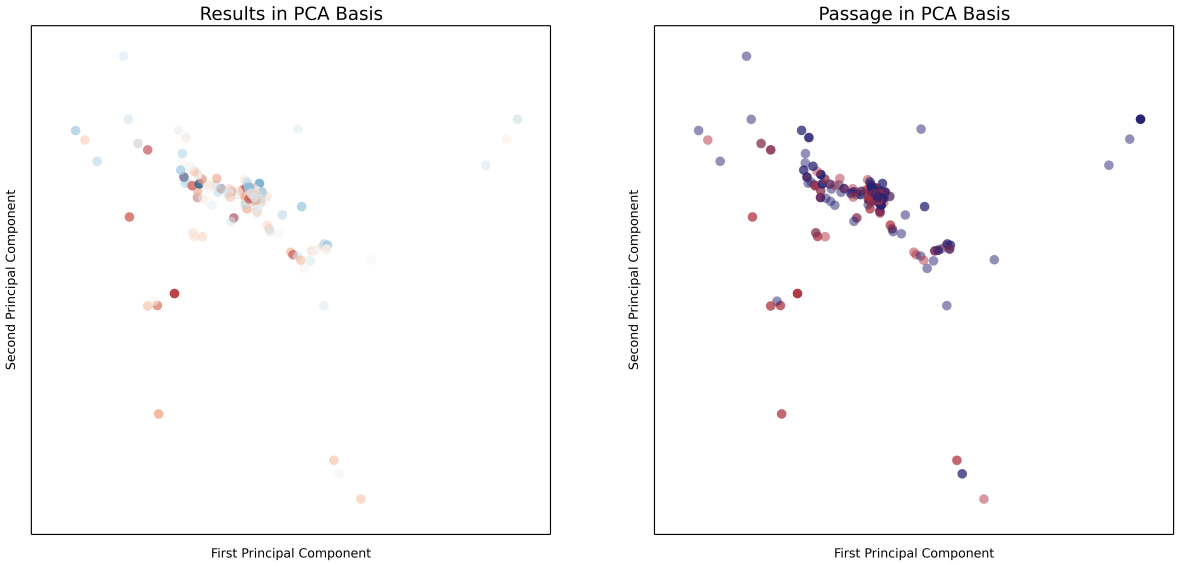
The drawbacks of the approach involve probability interpretations of the results and the difficulty with which the impact of each dimension can be interpreted. Both tasks involve post hoc manipulation of the estimator output, as opposed to directly falling out the typical estimator output as they would

[6] The logit estimator is another example.

[7] If we were operating in two-dimensional space, as depicted in the principal component plots of Figure 7.4, a hyperplane is just a simple line.

[8] SVM emerged as the best classifier for this purpose. Other estimators in the competition for binary classification included the following: logistic regression, k-nearest neighbor, and random forests. The probit estimator was also evaluated for the estimation of probabilities.

Figure 7.4: Voting Outcomes in a Rotated Basis



Voting outcomes in both subplots are indicated by color. In the left panel, observations are colored by the percentage of "yes" votes. The colors vary continuously, with the lowest value corresponding to deep red, and the highest value corresponding to deep blue. In the right panel, observations are colored by a binary passage indicator. Red corresponds to vote failure, while blue corresponds to vote passage.

with a probit model. With respect to the former, a little extra work (via Platt Scaling) returns the probability of successful passage for our purposes. With respect to the latter, interpretation of all 521 variables in the model is not our primary goal (as stated in the beginning of the chapter). The goal is accurate prediction, and a viable second stage instrument.

7.4.3 Usefulness of Prediction

The parameters of the classifier were identified by way of a grid search algorithm, which selects the intersection of input parameter values that maximizes a cross-validated accuracy score. Once the optimal estimator was identified, the outcomes of each vote were predicted based upon county characteristics from the USA Counties data. Keeping in mind that SVM provided the most accurate prediction of all tested classifiers, we predicted the vote outcomes accurately 58.3% of the time. *This outcome suggests that socioeconomic characteristics of a given county are not dominant drivers of vote outcomes.* This finding lends support to Cutler et al.'s finding that proxies for voter attitudes were difficult to identify. Furthermore, they could not "find evidence that people's views of local spending are affected by the demographic heterogeneity of their communities."[28]

Neverthelss, the probability of successful passage for each vote was still recoverable. As can be seen in Figure 7.5, most of these probabilities fell just under 60%. The proximity of these expected probabilities to 50% (i.e. zero information in a binary context) sheds light on the poor predictive accuracy. In almost all cases, there was an appreciative chance the vote would go the other way. As we will see, however, these probabilities still proved meaningful in the second stage equation.

7.5 What is the Impact of Ballot Design?

With the baseline propensity to pass an exemption established for each county, focus can be centered on the actual elements of the ballot. Out of all 527 votes, no two ballot initiatives were exactly the same. They differ in revenue source, expenditure targets, and timeframes.

7.5.1 Operationalizing Ballot Elements

Standardizing votes for use with any estimator involves judgments about the important elements of the ballot. Ultimately, the information in each ballot record was coerced into a schema characterized by three groups: revenue source, expenditure target, and scope of the change. The first two groups house binary concepts (Tables 7.1 and 7.2), while change variables (Table 7.3) report the actual proposal amount or rate. The binary indicators were coded as one if they were explicitly mentioned in the ballot record as the source of funds or spending target. The remaining variables are the propensity to exempt (*prob_exmpt*)

and the institutional variables: COTEL intensity (*intensity_stock*) and the Gallagher ratio (*prop_ratio*).

7.5.2 Measuring the Impact of Ballot Design

To measure the impact of design, this chapter employs three different classes of estimators for two different response variables: binary passage and continuous percentage of "yes" votes. The binary response warranted a classifier, and for this purpose both logistic and probit regression have been evaluated. Unlike the previous prediction effort, interpretation of individual factors is a higher priority. Both the logistic and probit classifier outputs are closer to that which is typical of regression estimators. This property facilitates comparison to the third model, ordinary least squares regression for the continuous response.

OLS regression is not strictly optimal for proportional responses, because it does not bound the predicted values in the [0,100] interval. Furthermore, the estimates can generally be biased. However, our purpose is to identify the most consistent design elements across specifications. If a consistent ranking is prevalent, one could capture even more relevant information. From the perspective of a policy official, the precise estimate is of less concern than the general direction and some notion of magnitude. It should also be noted that even though OLS (in this case, a linear probability model) does not share the same asymptotic properties as the logit or probit, marginal effects can be extracted if the model is well behaved. As it turns out, in this case, the error behavior does in fact suggest that the model is well behaved.

We are concerned with the intersection of significant values across models. Note that significance, in this case, includes both substantive and statistical concepts. Table 7.4 shows the results from all three models. There is notable consistency regarding the directional impact of each component.

The first aspect to note is the fit of the three models. The classifiers perform better than the zero information case; both accurately predict about 69% of the time. The OLS model explains only approximately 18% of variation[9] in the proportion of "yes" votes. These metrics suggest that the combination of the baseline propensity and ballot design (as operationalized) do not fully explain outcomes. Parsing out the remaining sources of explanation, such as fiscal indicators, is a subject for future inquiry.

Next, it can be seen that the most consistent factor in successful outcomes in all three runs is the baseline propensity to exempt (*prob_exmpt*). It is both substantively and statistically significant in all three models. In fact, there is no other model component that clearly increases probability of passage by such a magnitude. There are, however, multiple components that substantially drop the probability of passage. Most notably, voters seem to strongly dislike proposals for administrative tasks and unspecified choices.

On the other hand, the classifiers do not yield significant results for the cumulative impact of TABOR and SLPTR (*intensity_stock*). Furthermore,

[9] This value reflects the adjusted R^2, the base value is 23%.

Figure 7.5: Probability of Successful Passage for All Votes (1993-2009)

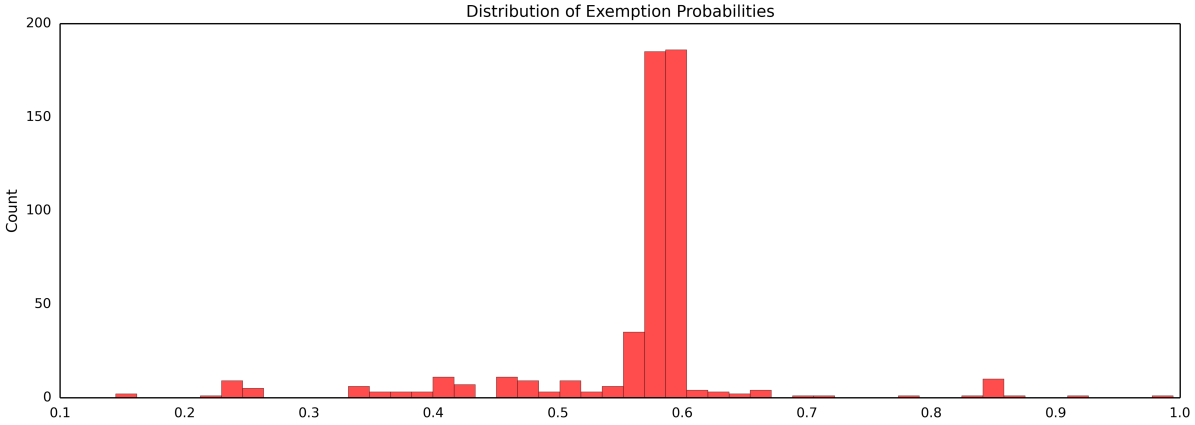


Table 7.1: Revenue Source Variables

Revenue Source	**Variable**
Sales Tax	ss_sales
Property Tax	$ss\_property$
Non-Tax Revenue	ss_nontax
Intergovernmental Transfer Revenue	$ss\_transfer$
Any Non-Property Tax Source	$ss\_nonproperty$
Tourism Revenue	$ss\_tourism$
Gaming Revenue	ss_gaming
Library Fees	$ss\_library$
Miscellaneous Revenue	$ss\_unknown$
No Restriction on Source Identified	ss_open

Note that ss_open means only that no explicit revenue source was provided in the ballot record.

Table 7.2: Spending Target Variables

Spending Target	**Variable**
Transportation Infrastructure Water Treatment Capital Improvement Projects Waste Disposal	*infrastructure*
Police Fire Services Emergency Services	*public_safety*
Economic Development Funds	*economic_development*
Water Conservation Open Space Parks Recycling	*environment*
Human Services Housing Animal Services Hopsital Improvement	*hss*
Schools Adult Education Library Facilities	*education*
Tourism	*tourism*
Commissions Studies Public Sector Labor Force Regulatory Development	*administrative*
Agricultural Land Preservation Farm Equipment	*agriculture*
No Spending Waiver Authorization	*no_waiver*
No Spending Target Identified	*open*

Note that *no_waiver* indicates that no *increase* in expenditure was authorized. Rather, the ballot sought to reprogram expenditure funds.

Table 7.3: "Scope of Change" Variables

Proposed Change	**Variable**
Spending Change Duration (years)	*s_time*
Revenue Change Duraction (years)	*rev_time*
Sales Tax Rate Change (decimal)	*sales_change*
Property Tax Rate Change (decimal)	*property_change*
Property Tax Levy Change ($)	*prop_levy_change*
Incurrence of Debt ($)	*debt_change*

Table 7.4: Ballot Design

	Dependent variable:		
	pass		results
	logistic	*probit*	*OLS*
	(1)	(2)	(3)
prob_exmpt	4.243*** (1.434)	2.567*** (0.841)	27.992*** (7.877)
s_time	0.002 (0.005)	0.001 (0.003)	−0.0001 (0.032)
sales_change	−0.461** (0.181)	−0.269** (0.107)	−3.246*** (1.053)
prop_change	−0.166** (0.082)	−0.100** (0.049)	−1.547*** (0.483)
prop_levy_change	−0.00000 (0.00000)	−0.00000 (0.00000)	−0.00000** (0.00000)
debt_change	−0.000 (0.000)	−0.000 (0.000)	0.00000 (0.00000)
rev_time	0.004 (0.003)	0.003 (0.002)	0.023 (0.018)
ss_open	−2.998* (1.816)	−1.727 (1.078)	−14.611 (9.765)
ss_sales	−1.058 (1.748)	−0.739 (1.053)	−8.550 (9.846)
ss_property	−2.065 (1.758)	−1.175 (1.051)	−15.561 (9.804)
ss_nontax	−3.649* (1.934)	−2.117* (1.151)	−17.659* (10.569)
ss_value	−2.620 (1.752)	−1.507 (1.048)	−8.957 (9.256)
ss_transfer	−2.875 (1.799)	−1.621 (1.063)	−8.888 (9.780)
ss_nonproperty	−2.478* (1.276)	−1.484** (0.750)	−1.681 (7.320)
ss_tourism	13.595 (1,103.388)	3.721 (172.650)	−9.354 (11.945)
ss_unknown	−20.509 (2,399.545)	−7.489 (376.755)	−21.384 (16.708)
ss_library	12.468 (2,399.545)	2.834 (376.755)	−10.496 (16.688)
ss_gaming	14.109 (1,395.266)	4.148 (214.962)	6.990 (11.591)
infrastructure	−0.851*** (0.303)	−0.497*** (0.182)	−3.542* (1.832)
open	−1.794*** (0.618)	−1.047*** (0.353)	−7.537** (3.124)
public.safety	−0.652* (0.339)	−0.372* (0.205)	−4.604** (2.053)
economic.development	−2.324 (1.462)	−1.413* (0.825)	−6.404 (7.039)
unspecified	−0.731 (0.485)	−0.448 (0.294)	−2.660 (2.945)
environment	0.418 (0.396)	0.257 (0.235)	0.754 (2.289)
hss	−0.426 (0.364)	−0.259 (0.220)	−4.668** (2.218)
education	−0.509 (0.477)	−0.298 (0.290)	−4.013 (2.956)
tourism	1.239 (0.885)	0.749 (0.503)	1.388 (4.535)
no.waiver	−4.338** (1.845)	−2.527** (1.092)	−20.917** (9.801)
administrative	−2.937*** (1.093)	−1.613*** (0.551)	−24.235*** (4.637)
limited	−16.217 (2,399.545)	−5.006 (376.754)	−8.405 (13.849)
agriculture	−1.437 (1.246)	−0.875 (0.761)	−7.892 (7.852)
unknown	−16.401 (2,399.545)	−5.106 (376.754)	−28.806** (14.120)
choice			
intensity_stock	−0.334 (0.331)	−0.207 (0.200)	−5.225*** (2.003)
prop_ratio	0.456* (0.247)	0.273* (0.149)	3.996*** (1.493)
cty_rev_prop	1.716 (1.083)	1.115* (0.644)	16.704*** (6.100)
Constant	1.965 (2.014)	1.060 (1.192)	53.197*** (10.909)
Observations	526	526	526
R^2			0.232
Adjusted R^2			0.177
	170		
Log Likelihood	−303.567	−304.019	
Akaike Inf. Crit.	679.134	680.038	
Residual Std. Error			13.443 (df = 490)
F Statistic			4.231*** (df = 35; 490)

Note: *p<0.1; **p<0.05; ***p<0.01

the sign in the OLS model conflicts with theory. One would expect that the greater the constraint placed upon a given county, the more likely an exemption vote would be. It is quite possible that this is a consequence of an endogenous relationship. Rather than being motivated by COTEL intensity to pass an exemption vote, the intensity may itself arise because voters aren't passing exemption votes. Simply evaluating the relationship between results and lagged COTEL intensity or lagged percentage change in COTEL intensity does not resolve the issue. Developing a method to tease out this relationship in more detail is a subject for future work.

The Gallagher Ratio (*prop_ratio*) also conflicts with theory. To reiterate, the ratio is the residential assessment base value over the non-residential assessment base value. Thus, the share of the burden from a property tax increase is borne by voters is actually higher with higher Gallagher ratios, which suggests that an inverse relationship with successful exemption should be observed. The author speculates that this is likely an artifact of the specification, due to the joint distribution of the constraint variable and other model components. For example, ballots in counties with "high" Gallagher Ratios (those above the median value) are 11% less likely to include sales tax changes, 13% less likely to include open ended waivers, and 19% less likely to have property tax changes. As can be seen in Table 7.4, all of these components drop the likelihood of passage. This accords with a certain logic, insofar as counties with high Gallagher ratios may employ officials that are unwilling to put property tax increases on the ballot.

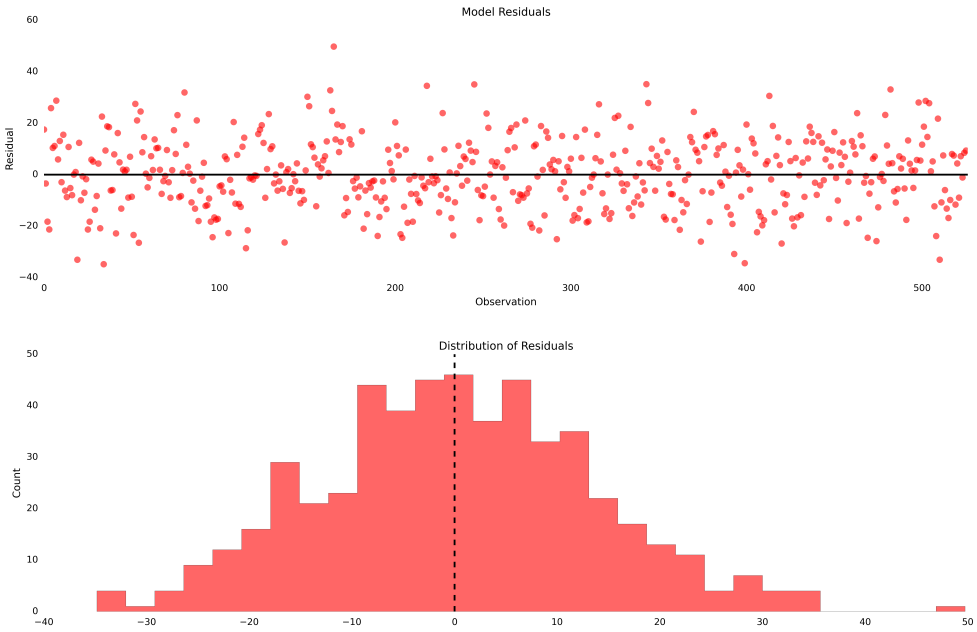
In general, the estimation strategy has proven fruitful insofar as it has identified several drivers of ballot outcomes, and the importance of preferences. Now that identification has occurred, precise estimation of marginal effects remains a subject for future study.

7.6 Conclusion

The decision by a county to exempt itself, in full or in part, from the constraints of TELs in Colorado is a multifaceted one. It depends on the underlying attitudes of the population, which this study and earlier work has proven difficult to estimate. It also depends on the components of the proposed initiative, which has been demonstrated here. Determining the precise impact of each component, however, remains an elusive goal.

This chapter represents only a single step in research that aims to provide local policymakers with sufficient information to judge future exemption efforts. Moreover, it provides context for states considering the adoption of TELs that parallel the structure of TABOR, SLPTR, and/or the Gallagher Amendment. The Colorado example holds lessons regarding the complexity of the interaction between these TELs and the socioeconomic circumstance of individual counties. In the context of future research, it is important to understand what exemption votes look like, and the ease with which extenuating circumstances like fiscal stress can be accommodated.

Figure 7.6: Error Behavior in Linear Probability Model



Chapter 8

Conclusion

This study has explored the overlapping impacts of TABOR, SLPTR, and the Gallagher Amendment in Colorado. In so doing, the analysis seeks to shed light on intergovernmental linkages writ large. The decisions made at one level of government most certainly have implications for policymakers at other levels, particularly as one moves down in jurisdictional scope. From an institutional perspective, these changes are not absolute. However, they do violence to the structure of the political economy that prevails prior to their implementation. Indeed, it is with this goal that such measures are often pursued. By that narrow standard, if implemented, the author believes that they must be considered a success.

A broader definition of success, however, evaluates the implications of the shift from regular order. Are constituents better off as a consequence? To answer this question, one must capture value judgments across alternative states in an unambiguous way. Taking a shot at an answer to this question is necessarily beyond the scope of this analysis for (at least) two reasons. First, and most practically, the author lacks access to any data that even approaches precise measures of the utility functions for each constituent, or at least some measure of central tendency. Chapter 7 opens the door on preference revelation, but this must be seen as only a proxy of the roughest kind. Second, it is not clear that any absolute answer exists. Why should we expect that even if a utility maximizing revenue-expenditure bundle could be identified at time t, that it would be either the same at $t + n$, or possess properties that would permit its use in predicting an optimal bundle at $t + n$? Populations, and the context in which they live, change. It seems likely that prevailing preferences are a function of at least these two things. For these reasons, this analysis has not focused on whether changes are good or bad, but rather on whether or not changes have occurred at all. From here, we can at least speak to operational implications, if not abstract value.

On this front, this study has reviewed the history of tax and expenditure limitations, as well as scholarly documentation of their effects. To the extent that students of TELs find, more often than not, that TELs alter fiscal behavior,

this study continues that narrative. The value add has been essentially in the area of measurement. This study advanced the idea that spatial relationships across jurisdictions matter in a more robust way than had been attempted in the past. While some studies have focused on intra-metropolitan areas, this study exhausted the state, relating all counties to those around them. It also provided a novel way of measuring TEL impact. The two continuous measures employed, COTEL intensity and the Gallagher ratio, provide finer measures of actual TEL constraints than do the binary and/or index measures that have dominated the existing literature. As Mullins has demonstrated [73], the context in which a county operates has substantial implications for its ability absorb such restrictions. *The approach taken here permits exploration of this context in a way that has not been done before, and in so doing, provided a way to speak to the behavior both within and across counties.* It is perhaps comforting that, in light of these attempts to pursue tighter measurement, the prevailing theme persists. TELs do have an impact, and now we can see what that impact is on a specific county.

That being said, the findings from the analysis present a view that suggests TEL impacts are relatively modest in the scheme of things. Chapter 5 demonstrated that COTELs depress revenue, but that should be true almost by construction. They have some problematic implications for exaggerating fiscal clustering among low income jurisdictions, but there is no measurable impact on economic capacity. Granted, the linkages are long here, but ultimately capacity is what we want to know about. Chapter 6 revealed that COTELs are likely to shift expenditure behavior from the trajectory that might otherwise have occurred, albeit modestly. The magnitude of that shift is dominated by demographic factors.

The goal of Chapter 7 was materially different than, but contextually relied upon, the preceding chapters. Rather than focus on the impacts of COTELs, the final empirical chapter sought to explore institutional machinery. Insofar as it identified a few ballot components that have comparatively important effects on the likelihood of the passage of a deBrucing vote, its provides some limited intelligence for policymakers. The surprising element from this analysis again highlights the importance of socioeconomic context. The prevailing propensity of a county to pass any exemption vote was identified as being at least as important as the most critical design choices. Even if local managers cannot change the prevailing propensity, it should materially affect their strategic decisionmaking.

8.1 Next Steps

Ultimately, the analysis presented here has only scratched the surface of the three topics addressed in the empirical chapters. To be candid, future work in the areas evaluated here would require a deeper dive. For one thing, better methods of mitigating spatial and temporal non-stationarity would have to be developed. Second, the acquisition of better fiscal data for the other gov-

ernments in the county would be a material addition. At the current time, the analysis relies on a rather unsatisfying imputation from the USA Counties Database. Unfortunately, the school district fiscal data early in the study period has proven elusive. Given that information, school district and municipal finances could be proportionally allocated to the counties that contain them. Additionally, an enormous amount of work could be done exploring different definitions of "local neighborhoods". This study has employed two grouping definitions, based upon first order contiguity and position in fiscal space. However, there are a large variety of directions that could be explored. Finally, a great deal more work could be done in the selection of estimators. For example, relatively straightforward transformations can be applied to OLS specifications to mitigate AR(1) dependence structures (e.g. the Prais-Winsten approach). Such methodological improvements could improve the precision and accuracy of the estimates dramatically.

Substantively, not enough is known about TELs and the business cycle, from the perspective of individual jurisdictions. It is reasonable to suppose that the expectations and behavior of local fiscal managers changes in response to prevailing business conditions, not just in Colorado but elsewhere as well. The dynamic effect of changing revenue profiles is a material characteristic of binding TELs, and it would behoove local managers to better understand this action.

Finally, while the COTEL intensity measures used in this study have increased the information we can capture about TEL effects, they are far from perfect. At the very least, they rely on assessment data and imperfect assumptions about starting conditions. Ideally, a better implementation would also incorporate information about voter preferences, although reconciling the endogeneity in this approach is a non-trivial concern.

In general, this work served as a highly imperfect first step. From that perspective, it has in part been motivated by a desire to incite future research. Furthermore, it has sought to encourage new ways of addressing old problems, in the hopes that future work may provide fresh insights that may have previously been hidden by prevailing practice. With any luck, it has at least partially succeeded on these fronts.

Chapter 9

Appendix

As discussed in Chapter 2, comprehension of TELs is well served by understanding the additional reforms in play before and during the growth in the TEL movement. The discussion of these reforms is continued here, stratified into three groups: targeted on-neutralities, neutral reforms, and general restrictions. In general, these reforms stem from what Mullins refers to as a "love-hate relationship".[74] Despite a reduction in proportional significance, the property tax remains a stalwart of local public finance, and for good reason. Despite the legitimate criticisms levied by Seligman and others, the tax is a reliable, immobile generator of revenue. Moreover, when polled, residents seem to be reasonably satisfied with the local services that rely heavily on the tax.

That being said, the visibility of the property tax does come with popular backlash. Surveys reveal the tax to be perceived as the worst or most unfair tax. The levy is always in the spotlight, and residents often feel the collection acutely. It is the disdain that accompanies these characteristics that has led to a host of "relief" reforms, many of which are discussed below. That said reforms render the tax less effective and efficient, there can be no doubt. However, if these reforms are the path by which the property tax remains a viable portion of the local revenue portfolio, these may be small costs to pay.

9.0.1 Targeted Non-Neutralities

9.0.1.1 Circuit Breakers

One of the challenges in researching relief mechanisms is the establishment of definitions that provide clear delineations across different policy alternatives. The variety in implementation that occurs for these relief mechanisms creates an environment in which considerable grey areas arise in classification. Bowman notes that these arise because all property tax relief measures necessarily act on one of three things: the tax base, the tax rate, or the income of the taxpayer.[15] In particular, the potential to confuse homestead exemptions and circuit breakers is particularly high. For this reason, this section will use Bowman's definition

of circuit breakers. The key criterion for qualification as a circuit breaker is"an inverse relationship, over a significant range of income, between income and tax relief amounts for a givene property tax amount." There are two classes of circuit breakers that exist:

1. *Threshold Circuit Breakers* exempt all property tax liability that exceeds a given percentage of income; and,

2. *Sliding Scale Circuit Breakers* exempt a given percentage of the property tax liability based upon the income bracket in which the taxpayer resides. The exemption level decreases with each successively higher income bracket and it phases out entirely at a statutorily defined threshold.

An example will clarify the need to define these items explicitly. Tennessee has enacted a "circuit breaker" relief program that reimbursed senior citizens for taxes paid on the first $250,000 of market value. There is no phase out, nor is there a reference to income. This is actually a targeted homestead deduction.

The impact of circuit breakers on property tax revenues requires empirical discovery. On the one hand, circuit breakers can increase the propensity of the constituent base to accept tax increases.[14] To the extent that a voter already owes the maximum allowable percentage of their property value, votes for increased property taxes carry no additional cost. On the other hand, circuit breakers directly decrease the property tax base, thereby potentially increasing liabilities for everyone else. Consequently, this instrument does particularly well to stoke tensions in the politicial space (voters abover the threshold versus voters below the threshold) that serve as an instrinsic characteristic of public finance.

Colorado has no general statewide circuit breaker[66], but some relief is provided conditional on senior status.

9.0.1.2 Homestead Exemptions

The homestead exemption was a product of the housing issues experienced during the Great Depression. At the time, the incomes of taxpayers were plummeting, creating untenable property tax liabilities for much of the citizenry. The response to this issue in 14 states was an exemption on a predefined portion of property value. (Walker(1964) via [15]). The proliferation of the instrument slowed as macroeconomic conditions eased, and criticism mounted. Unlike circuit breakers, homestead exemptions were poorly targeted and conferred arguably undue relief on relatively affluent individuals.[43]

Homestead exemptions generally apply to owner-occupied housing. The vehicle for relief is a fixed portion of the property value. This portion can either be measured in a static dollar amount, or it can be structured as a percentage of home value. The choice among these two definitions carries significant implications for vertical equity. The former is more progressive because it does not permit an increase in the size of the benefit as a function of increasing home values (which are typically associated with higher incomes). This distinction also drives the political economy dynamic in the sense that those that reside in

a jurisdiction that defines homestead exemptions as a percentage of home value are explicitly impacting the marginal cost of additional expenditure. Insofar as the prices is reduced by the homestead percentage, individuals will have a higher propensity to seek additional public services even as the exemption narrows the base.

In Colorado, the homestead exemption currently stands at $60,000 for non-elderly/disabled filers and $90,000 for the elderly/disabled subgroup of the population.

9.0.1.3 Preferential Classification

> "In those states with a legal classification system, business property is assessed or taxed higher in proportion to value than residential or farm property. Within the business class, utility property is usually assesses or taxed higher than other business property. Clearly this reflects the reality of electoral and legislative politics. Every home and every farm is represented by one or more voters. Utility companies are far less represented in the electorate."[43]

Fisher succinctly captures the essence of property tax relief, generally. Measures which benefit politically privileged or motivated classes tend to prevail. In the context of classification, this occurs via differential assessment.

Clearly the motivation behind classification is the direct benefit. To the extent that businesses shoulder a disproportionate share of the taxable base, residential property taxpayers are benefiting from public services at a discounted price. Gervais notes that the return to housing capital exceeds the return to business capital.[45] Gervais is actually studying the wedge caused by the failure to tax imputed rent and the mortgage interest deduction. however, preferential classification necessarily increases the size of said wedge, which generally implies underprovision of capital for businesses within the jurisdiction in question, which in turn implies lower commercial productivity. Dye et al. look directly at the property tax classification dynamic in the Chicago area.[36] In particular, they evaluated the impact of classification in Cook County versus property tax rate regimes in the peripheral counties. They found that higher commercial property tax rates 1) hampered the growth of industrial value and employment, and 2) inhibited commercial property value growth as well.

This is, of course, the static assessment. The dynamic impact is far less clear. To the extent that commercial taxpayers can secure deferred or reduced tax liability in exchange for increased capital investment in the area, measuring the distribution of liability on balance is an empirical imperative. The bottom line is that artificial obstacles to equitable to equitable taxation have the potential to reduce long-term welfare for resident income groups across the economic spectrum.

Colorado has a two-tier classification scheme. All non-residential property is taxed on 29% of the property value as of 2014, while the residential rate

is calculated each year (pursuant to the Gallagher Amendment) so that the residential share of the overall property tax burden is held constant.

9.0.1.4 Relief for Seniors

Perhaps the single largest complaint about the homestead exemption is poor targeting. The relief provided simply does not focus on those who have a difficult time accommodating the property tax liabilities associated with their home. A partial response to this criticism has been manifested as a movement to provide relief specifically to low-income seniors.

The rationale for the low-income component is evident given the targeting criticism. The age component requires another critical contextual element. This movement began in the 1950s, a couple decades after the passage of Social Security. The country was accumulating evidence that this program was changing the prevalent life cycle sequence. In particular, Social Security was facilitating retirement for older Americans, albeit on limited income.

> "In the 1950s, a sharp drop occurre in labor force participation for men 65 and older, as Social Security retirements affected labor force participation rates. [...] Another reason for the decline in men's labor force participation rates, mainly older men, is that pensions and disability awards became more available. The decrease in participation for men 65 and older was 29.3 percentage points over the 1950-80 period, with most of the decrease occurring in the 1950s."[63]

This method of property tax relief was designed specifically for this group. Evidence of this motivation is apparent in the definition of income that was considered pertinent for this relief. The definition was sufficiently broad to contain all sources of income (including Social Security), making it a far broader definition than that which is used for the income tax.[15] This method of relief, like other targeted reforms provides acute benefits for a particular segment of the population. Thus, it creates a strong incentive for political mobilization and pushes yet more political elements to the forefront. This type of action, no doubt, led to Colorado's adoption of the quasi-"circuit breaker" mentioned above.

9.0.2 Neutral Reforms

9.0.2.1 Truth-in-Taxation

Truth-in-taxation reforms were one of the less caustic responses to the environmental elements that led to the tax revolts of the 1970s. Among the most pressing concerns at the time was the rapid increase in housing values and the subsequent rise in assessment values. This enabled jurisdictions to increase property tax revenues without modification of the tax rate, creating automatic increases in liabilities for homeowners who, in many cases, were not experiencing commensurate increases in income.

In his appraisal of the tax revolt, truth-in-taxation topped Musgrave's list of "remedial measures" designed to improve administration and avoid the problematic consequences of more stringent reforms.[78] In his words, he felt it prudent to "[i]dex the tax system, therby removing hidden tax increases in tax rates that permit the government to receive windfall revenue gains without having to ask explicitly for tax rate increases." The operational mechanisms involved are identified by Florestano.[44] To set a new rate assessors must advertise the proposed yield and submit the information to public explicitly, by way of formal hearings and a subsequent vote. Mullins found that such provisions had spread to 22 states, or 44% of states with some form of TEL.[75] Cornia and Walters found full disclosure initiatives to be helpful in supporting convergence in tax administration.[26] They also evaluated the revenue impact of disclosure laws in Utah over time.[27] They found the measures to be "effective at restraining growth in the property tax without imposing hard statutory or constitutional limitations on local governments." While property yields grew over the study period, they did not grow as fast as property values. The effectiveness of these measures also received strong support from Springer et al.[104] They utilized a natural experiment in Kansas to conclude that, contrary to popular belief, truth-in-taxation was a more effective fiscal constraint than a general property tax levy limit. Per capita property taxes, own-source revenues, and own-source expenditures were all lower during the full disclosure regime relative to the period characterized by the explicit levy limit. These empirical results suggest that the impact of full disclosure is varied, but in any case they serve as a high value informational tool. The informational detail offered by such provisions cannot be matched by blanket rules that hold constant no matter what environmental circumstance may prevail at a given time.

In Colorado, TABOR provides a framework for truth-in-taxation practices. In general, all tax rate increases must be explicitly voted on in non-exempt local governments, as does any increase in revenues that exceeds the TABOR limit. In contrast, revenue reductions need not be voted upon, *but they do set a new baseline for subsequent years.*

9.0.2.2 Deferral Payment Systems

Deferral programs "allow certain citizens to postpone payment of all or a portion of their property tax until they die, give up their property, or sell it."[47] Sexton notes that the amount of liabilitthat can be deferred is typically restricted to 80-85%.[96] Gold argues that there are two general classes of relief measures, those that are automatic and those that are induced. The former group seeks to correct what is perceived to be a standing issue, while the latter group may be characterized as a response to environmental conditions. While it may initially seem that these deferral programs would have been a result of the rising property values that catalyzed the so-called tax revolt, Gold argues that these programs are in fact automatic reforms seeking to mitigate cash flow problems due to property tax burdens. In particular, they are designed to assist seniors that may have benefited from home appreciation that far outstrips the growth in their

incomes (particularly after retirement). These programs serve as a method to utilize the capital value accumulated in their home to handle their tax liability, albeit at subsidized rates.

Although deferral payment systems are reasonably common,[1] constituents often do not take advantage because they seek to avoid the new liability.[59] Furthermore, from the administration perspective, deferral payments complicate fiscal accounting by adding uncertainty to the system. Nevertheless, they serve as an important relief valve for a targeted constituency.

In Colorado, a state program exists for seniors and military personnel. The State Treasury actually pays the tax on the beneficiary's behalf, and then scores the payment as a lien against the property, to be repaid when a qualifying event (death or sale) occurs.

9.0.3 General Restrictions

9.0.3.1 Dillon's Rule

There are two broad operational regimes in the US that govern state-local relations in the context of local autonomy. The first is known as Dillon's Rule. The origin of this doctrine dates back to 1868 when John Forrest Dillon, then sitting on the Iowa State Supreme Court, issued an opinion in the *Clinton v Cedar Rapids & Missouri River Railroad Company* case. The component of that opininon that has had lasting effect in subnational governance, and which was elaborated upon extensively in his treatise *Municipal Corporations[30]*, is the following:

> "It is a general and undisputed proposition that a municipal corporation possesses and can exercise the following powers, and no others: first, those granted in express words; second, those necessarily or fairly implied in or incident to the powers expressly granted; third, those essential to the accomplishment of the declared objects and purposes of the corporation - not simply inconvenient, but indispensible. Any fair, reasonable, substantial doubt concerning the existence of a power is resolved by the courts against a corporation, and the power is denied."

This view was not universally held. A contrasting opinion was penned by Thomas Cooley of the Michigan State Supreme Court in his opinion relating to *People v Hurlbut* (1871):

> "[L]ocal government is a matter of absolute right; and the state cannot take it away."

In support of fewer restrictions on local government, Cooley went on to argue in the *General Principles of Constitutional Law in the United States of America*[25] the following:

[1] Mullins and Mikesell note that they exist in 22 states, the District of Columbia, and a number of local governments.[70]

> "It is axiomatic that the management of purely local affairs belongs to the people concerned, not only because of being their own affairs, but because they will best understand, and be most competent to manage them. The continued and permanent existence of local government is, therefore, assumed in all state constitutions, and is a matter of constitutional right, even when not in terms expressly provided for. It would not be competent to dispense it by statute. [...] Nevertheless there is no constitutional form or model of local government, or a standard or measure of local powers; and these need to be different according to the circumstances."

In effect, Cooley believe that relying on the positive list concept of state enumerated powers advanced by Dillon would unnecessarily constrain the local capacity to govern. He advocated for a negative list framework, a perspective that coincides with the modern theory of Home Rule. Dillon's Rule ultimately prevailed at the national level, gaining support from the Supreme Court rulings in *Merrill v Monticello* (1891) and *Hunter v Pittsburgh* (1907).

In the context of the current study, these competing doctrines have implications for local tax policy. Localities with Home Rule status have far greater discretion in designing the local revenue portfolio. Dillon's Rule became the de facto standard for states, whith Home Rule statutes being implemented as deviations from it. The first departure was enacted by Missouri in 1875, but it was not a general repudiation of the doctrine.[87] Rather, the statute permitted the possibility of granting Home Rule, and over the following 75 years, only St. Louis and Kansas City achieved that status. Conceptually similar, but statutorily distinct, provisions proliferate throughout the country, capturing 45 states by the year 2001.

Although state legislatures enacted these Home Rule provisions, they were typically written in such a way as to avoid universal application within states. This intra-state heterogeneity is an important analytic characteristic of the system. It provides a handle for assessing the impact of such provisions while holding state and spatially proximate economic characteristics constant, thus enabling the study of both revenue composition and revenue growth. With respect to the former, Rooney finds that the elimination of Home Rule does not create differences in reliance on property tax revenue or average burden.[87] With respect to revenue growth, affected residents generally do not feel that Home Rule corresponds with a higher propensity for local officials to tax at greater levels.[9] Furthermore, in Illinois, property tax revenue actually increased faster in jurisdictions bound by Dillon's Rule.[35][2]

Note that in the state of Colorado, Home Rule does not exempt local governments from the restrictions of TABOR[67], but it may have implications for mitigation strategies. The state level authorization to permit the exercise of Home Rule was passed in 1902 and strengthened in 1912. By 2009, 100 cities

[2]This finding may be an artifact of restrictions on the ability to leverage previously unauthorized revenue handles.

and towns had adopted some form of it.[3] By contrast, only two counties have acquired Home Rule charters: Pitken and Weld.

9.0.3.2 Educational Mandates

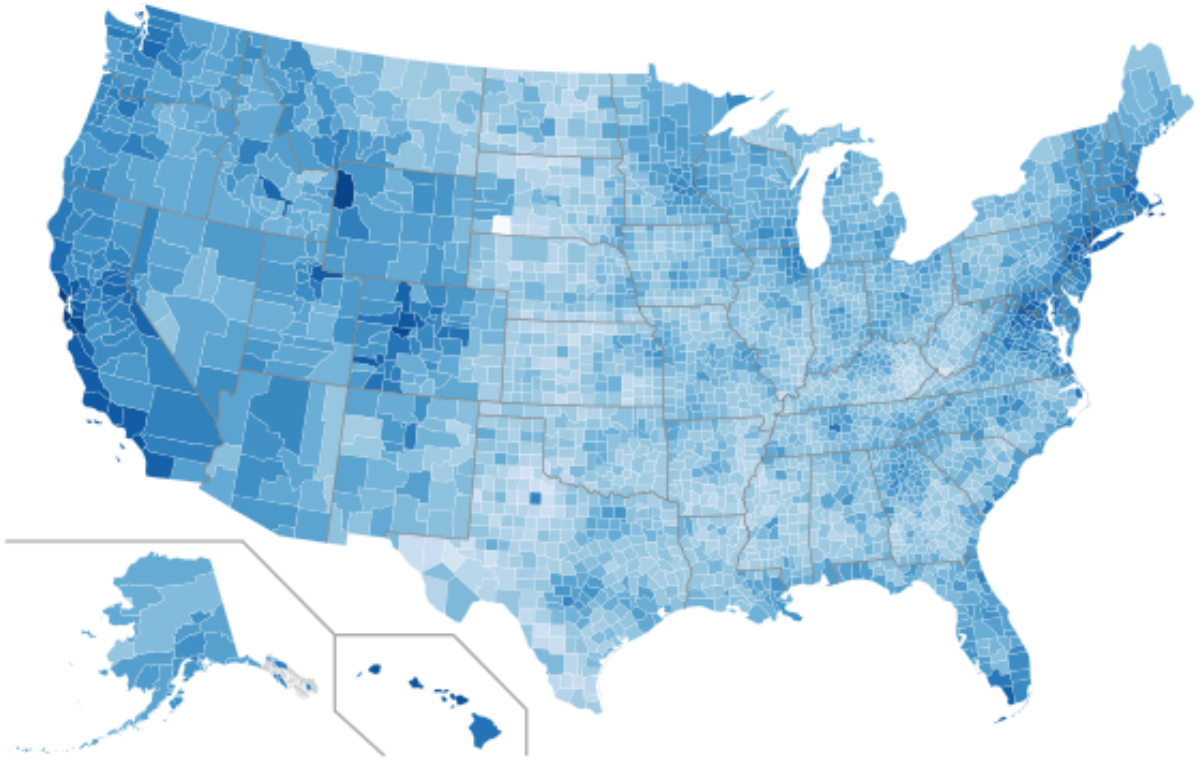
Educational mandates are a product of a constitutional conflict over the appropriate method to finance education. Education is among the most costly expenditure responsibilities at the local level. Consequently, it is unsurprising that such a large expenditure depends heavily on the property tax. The problem arose in tying property wealth to the resources available to finance the education of children within the jurisdiction in question. Unsurprisingly, variation in real estate wealth is substantial, necessarily leading to wide variation in educational resources across jurisdictions.

The practical effect is an institutional arrangement that tends to widen divides in economic potential as children from poor neighborhoods are unable to access the same advantages of their wealthier counterparts. Concern over this issue in California seems to have influenced the *Serrano v Priest* decision, which proclaimed that this arrangement violated the equal protection clause of the 14th amendment. The court mandated a more equitable distribution of resources managed by the state, a decision echoed in subsequent cases around the country. The implication for local property taxation was an effective divorce of the tax from local funding for schools. Fischel argues that this obscured the price link between local taxes and educational services, transforming the property tax into a more abstract instrument.[42] With reduced direct benefits linked to the tax, the extant disdain for the tax grew, perhaps furthering efforts to limit its application.

From the perspective of this study, the Colorado Supreme Court did not move on this issue until 2011 (after our study period) in *Labato v the State of Colorado*. Although *Labato* declared the funding mechanism unconstitutional in Colorado, this decision was overturned in the 2013 *State of Colorado v Labato* case.

[3] In 2007, 90% of the municipal population lived in municipalities with Home Rule charters.[18]

Figure 9.1: Logged Median Home Values by County (2007-2011 5-Year ACS)



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