Spatial Implications of Tax and Expenditure Limitations

Working Paper *DRAFT*

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Introduction

The economic potential of any system is not only driven by the presence of natural and/or developed capital, but also the institutions that govern the exploitation of these valuable 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 in institutional design for economic growth, therefore, ought to be the facilitation of those activities that increase the marginal product of value extraction. This broad goal is unlikely to draw many detractors. The great debates in economic policy are less about the importance of the goal and more about how to achieve it.

Among the multitude of policy innovations that have been advanced in service of increasing economic growth, one particular strategy in local government finance stands out over roughly the past century: institutional reforms that act on the property tax base. As early as the 1880s, these reforms were dominated by efforts to target specific populations via circuit breakers and homestead exemptions primarily. (Bowman, 2008) 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: tax and expenditure limitations. 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, dropping as a percentage of general revenue from 34% to 27% over the 1977-2002 period. (Edwards, 2006)

The economic context of the revolt in the 1970s was driven by stagflation and home price increases that often exceeded income increases. Poor economic growth and rising tax costs placed strain on taxpayers. Although institutional reforms were not new phenomena, a renewed vigor had taken hold. The clear choice for many was to pursue those reforms that made it easier to keep money out of the public coffers. TELs (among other reforms) were offered as a straightforward method. This study is predicated on the idea that the implications of TELs are anything but straightforward. In particular, this paper utilizes TABOR and related reforms in Colorado to argue that TELs increase the amount of fiscal clustering that occurs across local jurisdictions. Fiscal clustering is, in this case, defined as the clustering of local fiscal capacity and revenue generation.

TELs vs. Taxes

Relative Price Shifts

TELs are perceived as simple instruments because the mechanisms they employ, growth limits and ceilings, are easy to grasp. The complexity is on the back end, in the manner in which the effects ripple through the tax base and the economy. This complexity is a function with two primary arguments. The first is a shift in the relative prices of ongoing economic activities in the affected jurisdictions. In 1985, Agarwal & Morgan discussed the compositional impacts of taxation and TELs. (Agarwal & Morgan, 1985) Any time a tax is imposed, it creates a wedge between the underlying economic value of an asset and the explicit cost of practical acquisition. This wedge adjusts the expected return over expenditure and thus adjusts the opportunity costs in any economic calculation. This will confer non-random biases in favor of some activities over others as relative prices shift towards a new equilibrium. The magnitude of this shift in relative prices will be driven by the size of the tax. The tax wedge is but one side of the equation. As this tax revenue is redirected in the economy, the chosen expenditure target base will experience a subsidy, which further shifts relative prices in the economy (albeit via a different method then the tax side). Both sides of the fiscal equation feed into the cycle that Musgrave referred to as the revenue-expenditure process. (Musgrave, 1939) With each fiscal policy shift, perturbations to the existing price equilibrium are introduced. Fiscal policy-induced perturbations, then, lead to new patterns of economic activity. The size of the divergence from the status quo is, again, a function of the size of the disturbance. In this shifting of relative prices, TELs find a suitable analogue in explicit taxation. Like taxes, TELs impact both the revenue and expenditure side of the fiscal equation.

Distributional Impacts

The second argument concerns the distributional impact of TELs. When a TEL is imposed, the impact is not evenly distributed. On the revenue side, if the cap is sufficiently low, revenues per capita will decrease.

However, depending on the nature of the limitation, some taxpayers will not enjoy any tax relief. In truth, some taxpayers may actually pay more. Dye et al. studied the nature of assessment limits, developing algebraic explanations for the unexpected consequences of these instruments. (Dye & McMillen, 2007) The most intriguing finding was the idea that tax burdens could be transferred to both the people under the assessment growth cap *and people above the cap.* Granted, they assumed flexible tax rate setting. The central takeaway, however, was that simple rules did not have simple effects. These effects are not limited to the revenue side either. Fiscal systems in the US rely disproportionately upon broad-based revenue instruments while expenditure programs remain necessarily specific. The parties that benefit from public expenditure will acutely feel a general reduction in revenue.

In addition to the "within tax" distributional concern, TELs force broader shifts in tax burden by encouraging shifts in the composition of the revenue portfolio. Just as TELs modify the relative prices of economic pursuits in the private sector, TELs also modify the costs and benefits of using certain taxes. On a basic level, TELs restrict the growth of property tax revenues, thereby reducing the productivity of the instrument as a revenue source. If demand for public services does not diminish in a manner commensurate with the imposed reduction in property tax revenue, public officials will seek to increase revenue yields elsewhere. Indeed, Joyce and Mullins (1991) have demonstrated that a general revenue portfolio shift has actually occurred. The tendency has been to shift towards expanded use of marginal cost pricing structures (fees and charges) which do not, by design, attempt to adhere to an ability to pay framework. While there are substantial efficiency advantages to marginal cost pricing, such policies mechanically shift proportional tax burdens from higher to lower income residents. These shifts in revenue portfolios are complicated by the political implications of institutional reforms. To the extent that limits on the property tax reduce the marginal property tax burden for individual taxpayers, there is likely to be a countervailing increase in political palatability.

Mechanics: Taxes vs. TELs

It is with respect to distributional impacts that taxes differ from TELs. It is not that tax policy cannot impose burdens that shift the locus of economic activity. Rather, what matters is the path by which this shift is imposed. Taxes are, to borrow administrative terminology, "bottom up". Their impact on the cost side is commodity specific, and thus can be “easily” anticipated and aggregated. The distributional impacts are known because they depend only on the statutory definition and the value of the base. TELs, in contrast, are “top down.” They are macro-level constraints that do not attempt to consider, much less govern, the path to compliance. As a consequence, they are vulnerable to movement in a larger set of variables than are explicit taxes. For these reasons, TELs not only complicate anticipation of policy consequences, but in so doing, also substantially undermine the pursuit of distributional goals. Understanding the disparate paths taken by explicit taxation and TELs to effect policy goals is critically important to understanding the growth impacts of fiscal policy. To be sure, the literature discussing the impacts of taxation on growth illuminate many important insights. TELs, however, are a different animal and should be treated as such.

General Overview of Research Program

A handful of studies have sought to link TELs and economic growth, and most of this work is very recent. An inquiry by Poterba & Rueben found that local TELs did successfully reduce the size of government by way of lower public sector employment and wage growth. (Poterba & Rueben, 1995) McGuire & Rueben found that the state’s economic growth rate did increase in the short-term due to TELs, but found no long term impact. (McGuire & Rueben, 2006) Bae, Moon, & Jung found that state TELs lowered employment levels, but not per capita income. (Bae, Moon, & Jung, 2012) Deller & Stallman found that economic growth at the local level diminished in the short run with no long run impact. (Deller & Stallman, 2007) State TELs also have a differential impact over time (Stallman & Deller, 2010). The longer TELs are in effect, the more likely it is that short term increases in economic convergence across states will dissipate, ultimately giving way to lower rates of convergence. If anything, state TELs lower economic growth overall (Stallman & Deller, 2011), although the evidence for this negative impact is weak. Finally, Stallman et al. found that credit ratings are positively impacted by expenditure limitations, but revenue limitations have a clear negative effect on creditworthiness. (Stallman, Deller, Amiel, & Maher, 2012)

In general, the literature has not shown that TELs have unabashedly negative effects on growth. The ambivalence of empirical assessment here may be driven by the relatively small proportion of firm costs dedicated to tax payments. That being said, growth measures like per capita income are far downstream of the Morgan & Agarwal-type compositional impacts. The literature has evaluated growth impacts of TELs from a number of angles, but comparatively little care has been taken to capture the varied local economic impact of TELs driven by differing socioeconomic bases and spatial characteristics. This study seeks to provide a clearer view of the mechanisms at work when local governments attempt to operate under tax and expenditure limitations. The transparency of the policies required for this analysis requires that critical attention be paid to the operational consequences of each policy component (e.g. - growth limitation formulae). In the area of institutional reform generally, statutory labels can be misleading. As a consequence, each policy component (and their interactions with one another) will be processed into a customized classification framework to enable meaningful inference. The key is to abstract away from labeling and find common points of interaction (e.g. implications for property tax base growth). In modeling the impact of overlapping policies, this study takes a step in this direction.

TELs and Fiscal Clustering

For the purposes of this study, fiscal clustering refers to spatially proximate local jurisdictions experiencing convergence in revenue and/or economic per capita over time. The analysis developed in this paper is designed to make the case that TELs impose shifts in patterns of fiscal behavior that are observable at the macro-level (within state). Fiscal clustering of fiscal and economic summary measures is one view of such behavior, to be complemented by additional compositional details in future work. In demonstrating variance in the spatial distribution of fiscal behavior, this analysis is effectively offered as a justification for the broader research program.

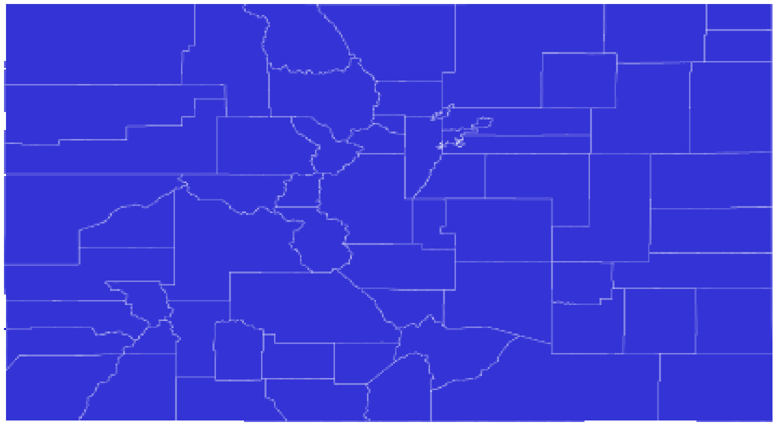
From a theoretical standpoint, there are two main features of TELs that would promote fiscal clustering among low-capacity jurisdictions. First, TELs impose asymmetric pressure on revenue yields over time. The rate of increase is limited by an explicit growth limit, but decreasing yields are not so constrained. Furthermore, once a drop in revenue has been experienced in one year, the baseline is “ratcheted” down because current year allowable revenue 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 extent that TELs 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 the revenue generation, while the second impacts the capacity of the economic base itself. It is critical to explore both to understand the distinction between the outcomes of a public choice process and basic impacts.. This paper explores both to some extent, but the focus is on revenue impacts to help think about how base impacts may be better explored in the future.

TEL Structure in Colorado

This analysis focuses on Colorado, a state characterized by one of the most restrictive TEL regimes in the country. Two properties of the TEL structure make Colorado an attractive empirical source. First, while much of the literature regarding TELs in Colorado focuses on the Taxpayer Bill of Rights (TABOR), in reality TABOR is only one piece of the puzzle. In addition to TABOR, Colorado features a general statewide limit on property tax revenue, the Gallagher Amendment, and Amendment 23.[1] These overlapping reforms are a double-edged sword. On the one hand, they complicate the model insofar as none of them are observed independently in the period of time evaluated in this study. On the other hand, they provide a means to incorporate temporal, statewide variation in the form and impact of TELs on each of Colorado's 64 counties.

1An extensive discussion of the context and mechanics of these reforms is beyond the scope of this paper, but the interested reader can find an excellent background piece in the study generated by the Colorado Legislative Council Staff in 2003. The elements critical to the modeling approach here are highlighted in the methodology section.

Counties of Colorado



Second, Colorado is also desirable because of "De-Brucing". Since the inception of TABOR, a number of counties have passed local legislation designed to avoid the constraints established by this and prior legislation. This practice is known as "De-Brucing". It is a major source of horizontal variation, insofar as those counties that passed such legislation do not have the constraints on revenue associated with our policy of interest.

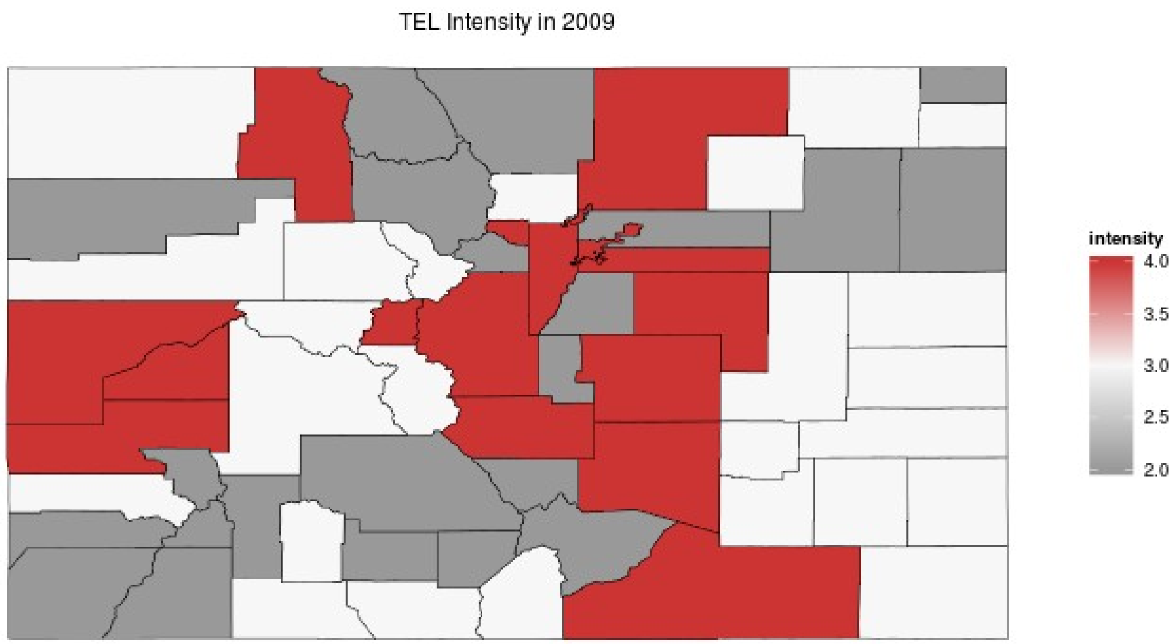
Measuring the Impact of TEL Intensity

A major characteristic of this analysis, as alluded to in the previous section, is the effort to capture variation in TEL impact. The first attempt to capture this variation takes the form of an "intensity score". An ideal intensity score would capture three characteristics of any given county at time *t*:

1. The accumulation of statewide legislation over time;
2. The proliferation of locally derived exemptions from TABOR and the Statewide Limitation of Property Tax Revenue (SLPTR); and,
3. The local economic dynamics that may trigger a breach in the ceilings imposed by the aforementioned legislation.

The initial indicator to be used in this research program is an ordinal score that regrettably captures only the first two. Effectively, the score adds a point for each additional constraint. For example, all counties in 1987 will carry a score of two given the general application of both SLPTR and the Gallagher Amendment. These scores are subsequently modified by De-Brucing, which 47 of 64 counties chose to do in the 1993-2009 time period.

The exemptions from these De-Brucing efforts are for TABOR and sometimes the SLPTR. If only TABOR is waived, one point will be removed. Two will be removed if both are waived. The figure below provides a 2009 snapshot of the horizontal variation these local legislative initiatives have offered.



Analysis of Spatial Clustering

Testing whether or not the constraints imposed by Tax and Expenditure Limitations (TELs) lead to local 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. Obviously this covers up local variation, but perhaps more interestingly, this choice in geographic scope encourages certain questions. What is the impact of TELs on revenue volatility (St. Clair 2012)? Do TELs constrain property taxes (Dye & McGuire 1997)? Do TELs constrain growth in employment and wages (Poterba & Rueben 1995)? Exploration of such questions can rely on binary indicators of TEL presence, or indices that incorporate information about legal basis, ease of circumvention, and scope of application among other characteristics.

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 of jurisdictions for which the statewide legislation is a common denominator. Once this issue comes to fore, one is immediately confronted with the following question: if the statewide legislation does not vary cross-sectionally, do we expect uniform impact across all local jurisdictions at time *t*? The unlikely nature of this situation is the motivating factor for this study. Fiscal behavior is a function of economic circumstance, and given the variation in economic bases across a given state, one would expect that TELs have different impacts in different jurisdiction. In identifying patterns in the variation of local revenues and expenditures, Mullins (2004) stands out as an important example of why higher resolution is needed.

A second, and related, question is whether or not we expect a temporal element in the impact of TELs. Is it more constraining as a jurisdiction spends more time operating within the TEL environment? Furthermore, given the fact that the TEL environment in Colorado is composed of overlapping policies, do we expect interaction effects to play a significant 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.

Strategy

This analysis seeks to identify spatial clustering of fiscal behavior. To do so we will examine the fiscal clustering over the given time period, and seek to identify whether or not it has changed as a consequence of the four primary elements of Colorado TEL structure:

1. **General Statewide Limit on Property Tax Revenue (SLPTR)**: Local property tax revenues may not increase by more than 5.5% in a given year (the limit was 7% before 1988)
2. **Gallagher Amendment (GA)**: Assessment rates for residential property are set statewide, calculated to keep historical ratios of residential and non-residential property tax revenue consistent (with some minor space for modification)

3. **Taxpayer Bill of Rights (TABOR):** Limits annual growth in revenues to inflation plus a measure of growth (new construction for local governments and enrollment for school districts)
4. **Amendment 23 (A23)**: Mandates minimum increases in school funding and removes a portion of revenue from the TABOR base

To measure the impact of these TELs, the inquiry proceeds with two related evaluations. The first, a necessary antecedent to the second, is the establishment of variation in clustering intensity over time. Once this is shown, econometric modeling is employed to uncover the estimated impact of TEL intensity.

Verification of Variation

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. To capture this we will take snapshots of fiscal and economic hot spots every five years, starting with 1987. These hotspots will be identified using Local Indicators of Spatial Autocorrelation (LISAs) developed initially in Getis & Ord (1992) and Anselin (1995). These are the G^*_i and Moran's I_i statistics, respectively.

To evaluate clustering, LISAs require a definition of the linkages of importance between jurisdictions. Said differently, they require an explicitly defined neighborhood. Spatial analysis is generally sensitive to choice in weight matrices, so we will test multiple neighborhood criteria and look for corroboration among the tests.

We will define neighborhoods by the following metrics:

1. Rook Contiguity (*w_rook*)
2. Queen Contiguity (*w_queen*)
3. Distance Band - Binary (*w_db_b*)
4. Distance Band - Continuous (Inverse Distance Decay; *w_db_c*)
5. Kernel (Gaussian Decay; *w_kern*)

The following charts provide a view of the cardinality of each the utilized weight matrices.

Each of the panels above features a histogram of neighbor counts for each weight matrix. For example, for Rook Contiguity (*w_rook*), five is the most frequent neighborhood size. This is so because 15 counties have five neighbors in their local neighborhood. This is in sharp contrast to the Kernel matrix (*w_kern*), which only has six counties with a neighborhood size of five. Visual inspection of the neighborhood size distribution demonstrates the substantive variation in the definitions employed by each weight matrix.

With neighborhoods defined, LISAs can be evaluated. There are two primary measures used to establish spatial clustering for each weight matrix/year combination. Moran's I measures the global spatial autocorrelation in an attribute y over a given neighborhood defined by w_{ij}.

The local version is implemented as follows:

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

which is then calculated for each of *i* observations.

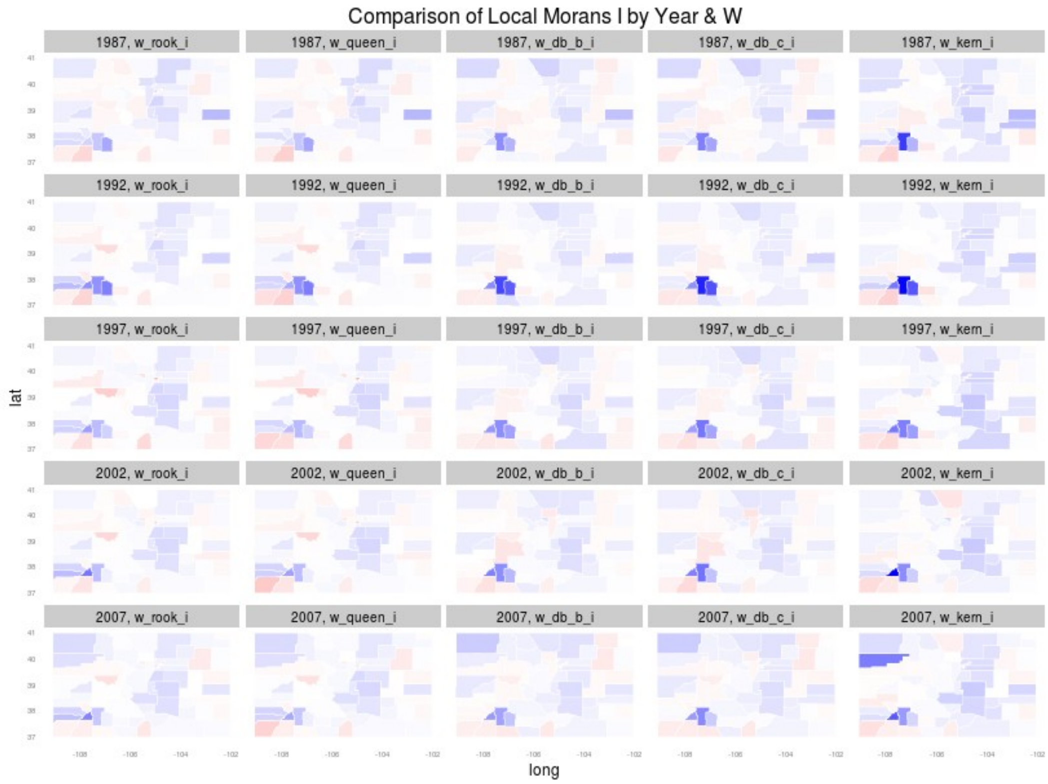
Local Moran's I_i permits a kind of topological view of autocorrelation. Just as providing a single moment of a data set masks distributional content, providing a global parameter masks regional dynamics. In this way, one may identify clusters of counties with similar per capita revenue values. That being said, as noted by Anselin (1995), the interpretation of Moran's I_i is insufficient for a comprehensive knowledge of the clustering behavior of spatially related activities.

Getis & Ord's G^*_i is a natural complement in this regard, because it explains a fundamentally different kind of spatial association.

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

Ii returns high values when *similar* values are clustered and low values when *disimilar* values are clustered. Whether or not they are high or low does not impact the magnitude of the statistic. By contrast, G^*_i returns high values when *high* values are clustered and low values when *low* values are clustered. If one were to rely solely on the former, it would not be possible to determine the distinction between fundamentally different clusters. For example, clustering of low revenue capacity would be indistinguishable from clustering of high revenue capacity. If one were to rely solely on the latter, it would not be possible to detect unusual patterns of discontinuity arose (discontinuities that were beyond that which would occur with random shuffling of values). In this instance local anomoly detection would be made more difficult, and the measure does not lend itself to the identification of spatial non-stationarity.

The spatio-temporal plots below display spatial clustering over time for each weight matrix. The first collection features clustering as measured by Local Moran's I_i while the second features Getis & Ord's G^*_i. In both collections, the first plot matrix displays clustering of per capita revenue and the second displays per capita annual payroll.


Comparison of Local Morans I by Year & W
1987, w_rook_i
1987, w_queen_i
1987, w_db_b_i
1987, w_db_c_i
1987, w_kern_i
1992, w_rook_i
1992, w_queen_i
1992, w_db_b_i
1992, w_db_c_i
1992, w_kern_i
1997, w_rook_i
1997, w_queen_i
1997, w_db_b_i
1997, w_db_c_i
1997, w_kern_i
2002, w_rook_i
2002, w_queen_i
2002, w_db_b_i
2002, w_db_c_i
2002, w_kern_i
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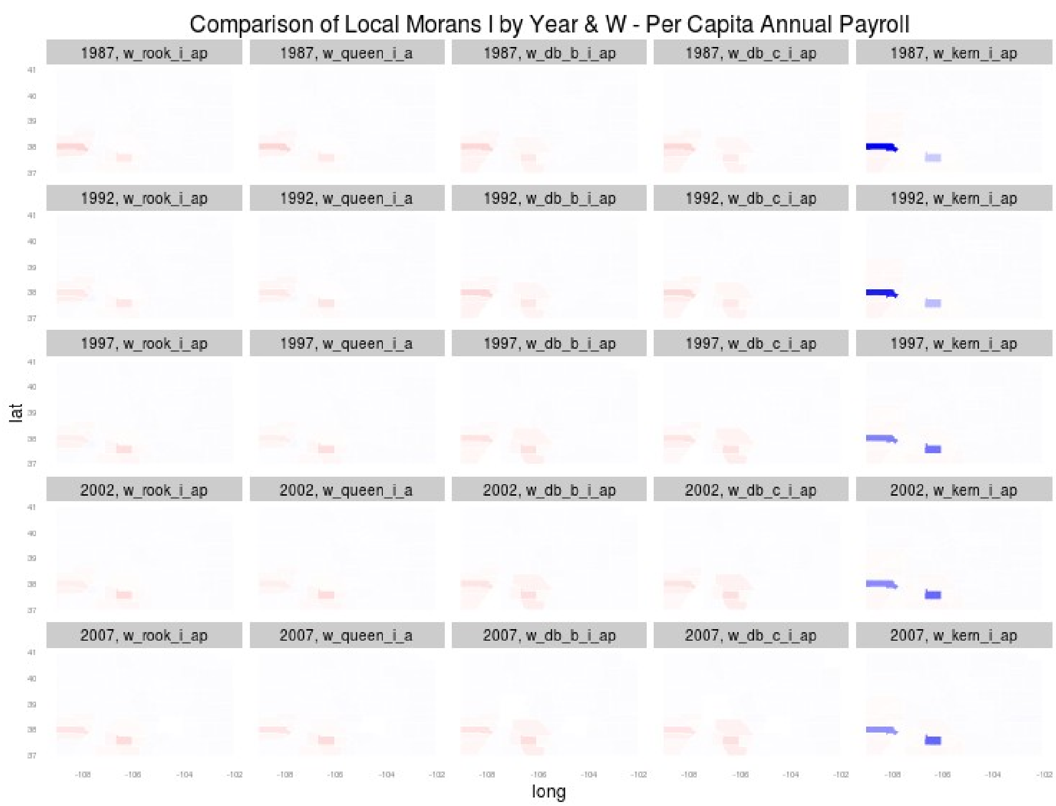
Comparison of Local Morans I by Year & W - Per Capita Annual Payroll
1987, w_rook_i_ap
1987, w_queen_i_a
1987, w_db_b_i_ap
1987, w_db_c_i_ap
1987, w_kern_i_ap
1992, w_rook_i_ap
1992, w_queen_i_a
1992, w_db_b_i_ap
1992, w_db_c_i_ap
1992, w_kern_i_ap
1997, w_rook_i_ap
1997, w_queen_i_a
1997, w_db_b_i_ap
1997, w_db_c_i_ap
1997, w_kern_i_ap
2002, w_rook_i_ap
2002, w_queen_i_a
2002, w_db_b_i_ap
2002, w_db_c_i_ap
2002, w_kern_i_ap
2007, w_rook_i_ap
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2007, w_kern_i_ap
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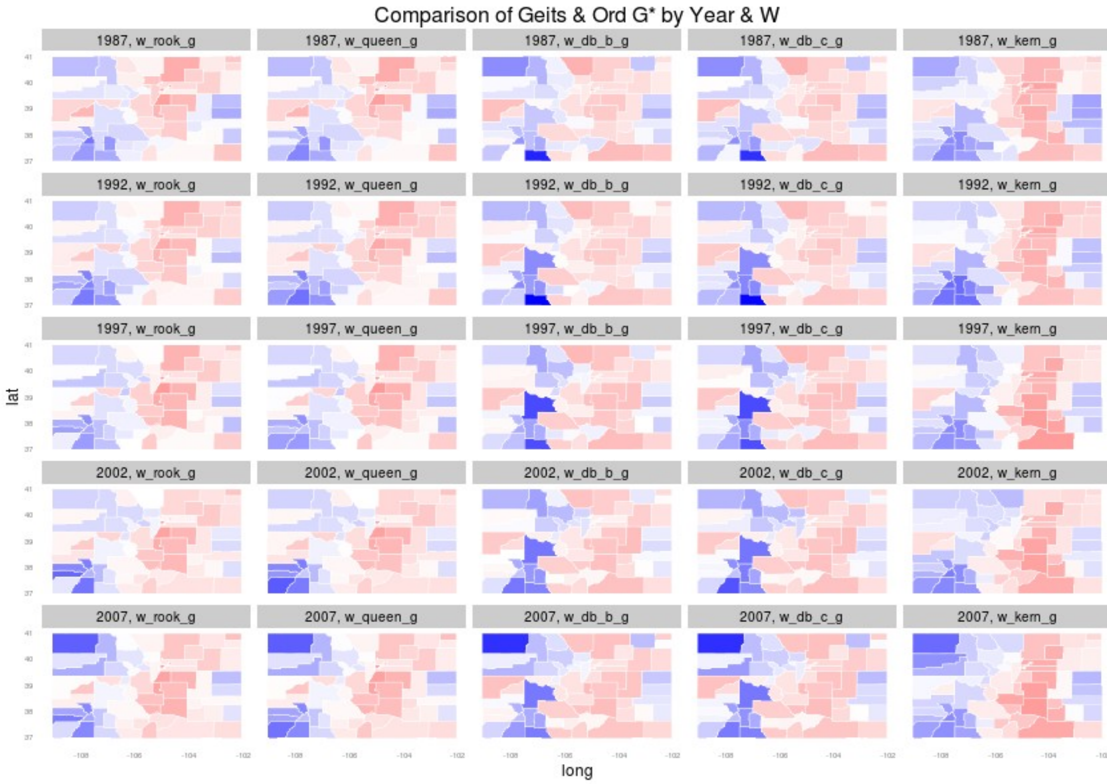
Comparison of Geits & Ord G* by Year & W
1987, w_rook_g
1987, w_queen_g
1987, w_db_b_g
1987, w_db_c_g
1987, w_kern_g
1992, w_rook_g
1992, w_queen_g
1992, w_db_b_g
1992, w_db_c_g
1992, w_kern_g
1997, w_rook_g
1997, w_queen_g
1997, w_db_b_g
1997, w_db_c_g
1997, w_kern_g
2002, w_rook_g
2002, w_queen_g
2002, w_db_b_g
2002, w_db_c_g
2002, w_kern_g
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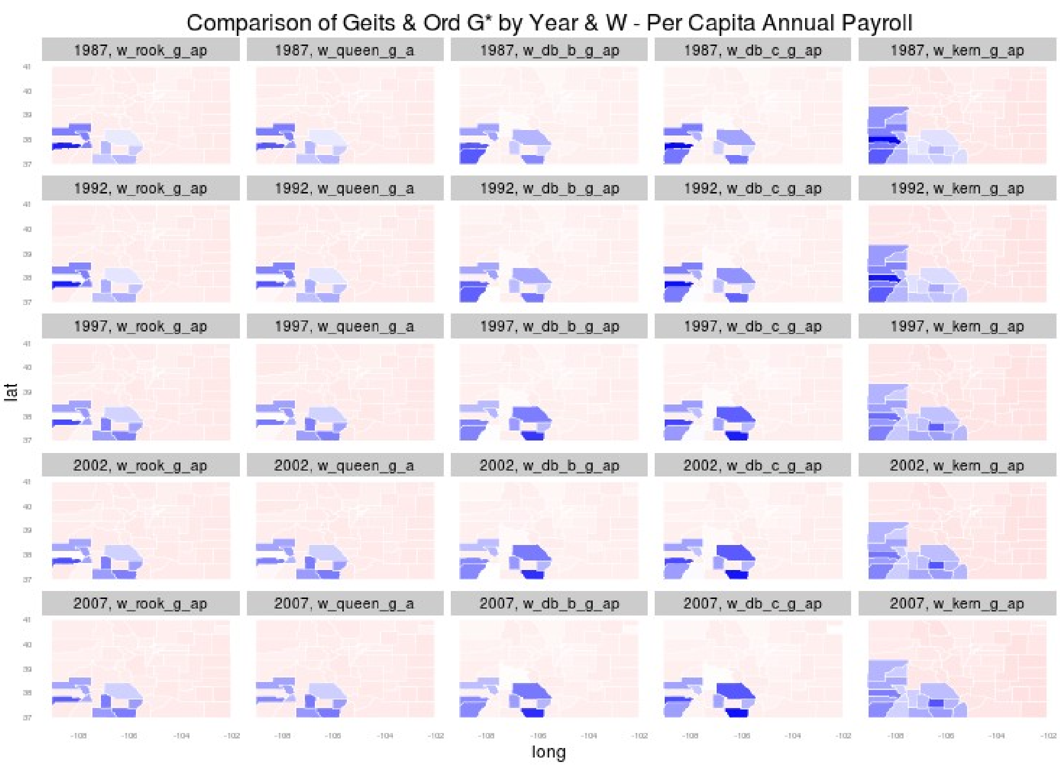

Comparison of Geits & Ord G* by Year & W - Per Capita Annual Payroll
1987, w_rook_g_ap
1987, w_queen_g_a
1987, w_db_b_g_ap
1987, w_db_c_g_ap
1987, w_kern_g_ap
1992, w_rook_g_ap
1992, w_queen_g_a
1992, w_db_b_g_ap
1992, w_db_c_g_ap
1992, w_kern_g_ap
1997, w_rook_g_ap
1997, w_queen_g_a
1997, w_db_b_g_ap
1997, w_db_c_g_ap
1997, w_kern_g_ap
2002, w_rook_g_ap
2002, w_queen_g_a
2002, w_db_b_g_ap
2002, w_db_c_g_ap
2002, w_kern_g_ap
2007, w_rook_g_ap
2007, w_queen_g_a
2007, w_db_b_g_ap
2007, w_db_c_g_ap
2007, w_kern_g_ap
lat
long

While the intensity of clustering does vary to some extent across different weight matrices, 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 (kernel density estimates are not shown), three main properties stand out.

1. Variation is substantially higher in G^*_i, which indicates relative consistency in clustering activity, with larger variation in the magnitude of clustering values. This could mean simultaneous revenue capacity transitions occur in multiple counties within given neighborhoods.
2. Variation is generally more substantial in the higher values for both statistics. For Moran's I_i, this indicates varying intensity of spatial association amongst similar values. For G^*_i, this indicates low revenue capacity counties are more tightly coupled than high revenue capacity counties.
3. Central tendency generally leans right of zero for I_i, while leaning left of zero for G^*_i. This suggests a tendency towards the existence of spatial clustering, but this clustering occurs more often among low revenue capacity jurisdictions.

Spatial Modeling

Globally consistent trends in clustering are far from clear in the plots above, but it is clear that there exists variation in the intensity of clustering as time passes. Extracting the marginal effect of TEL intensity requires econometric exploration. At the current stage, the analysis focuses on per capita revenue yield as the dependent variable, modeled as a function of three regressors:

1. **TEL Stringency** - The policy variable of interest
2. **Relative County Per Capita Output** - Provides a sense of placement in the statewide distribution of economic capacity without being associated with Gross State Product
3. **Gross State Product** - Provides information about the business cycle

To test the impact of TEL intensity on revenue yield, variations on four modeling approaches were implemented:

- **Ordinary Least Squares** - OLS serves as a non-spatial pooled estimate

$$y = X\beta + \epsilon$$

- **Spatial Error Model** - The error term in this model seeks to mitigate spatial dependency across counties (repeated cross-sectional application)

  $y = X\beta + \epsilon$ and

  $\epsilon = \gamma W\epsilon + u$

  becomes $y = \gamma W y + X\beta - \gamma W X\beta + \epsilon$

- **Spatial Lag Model** - This model explicitly incorporates the weighted average of neighborhood values (repeated cross-sectional application)

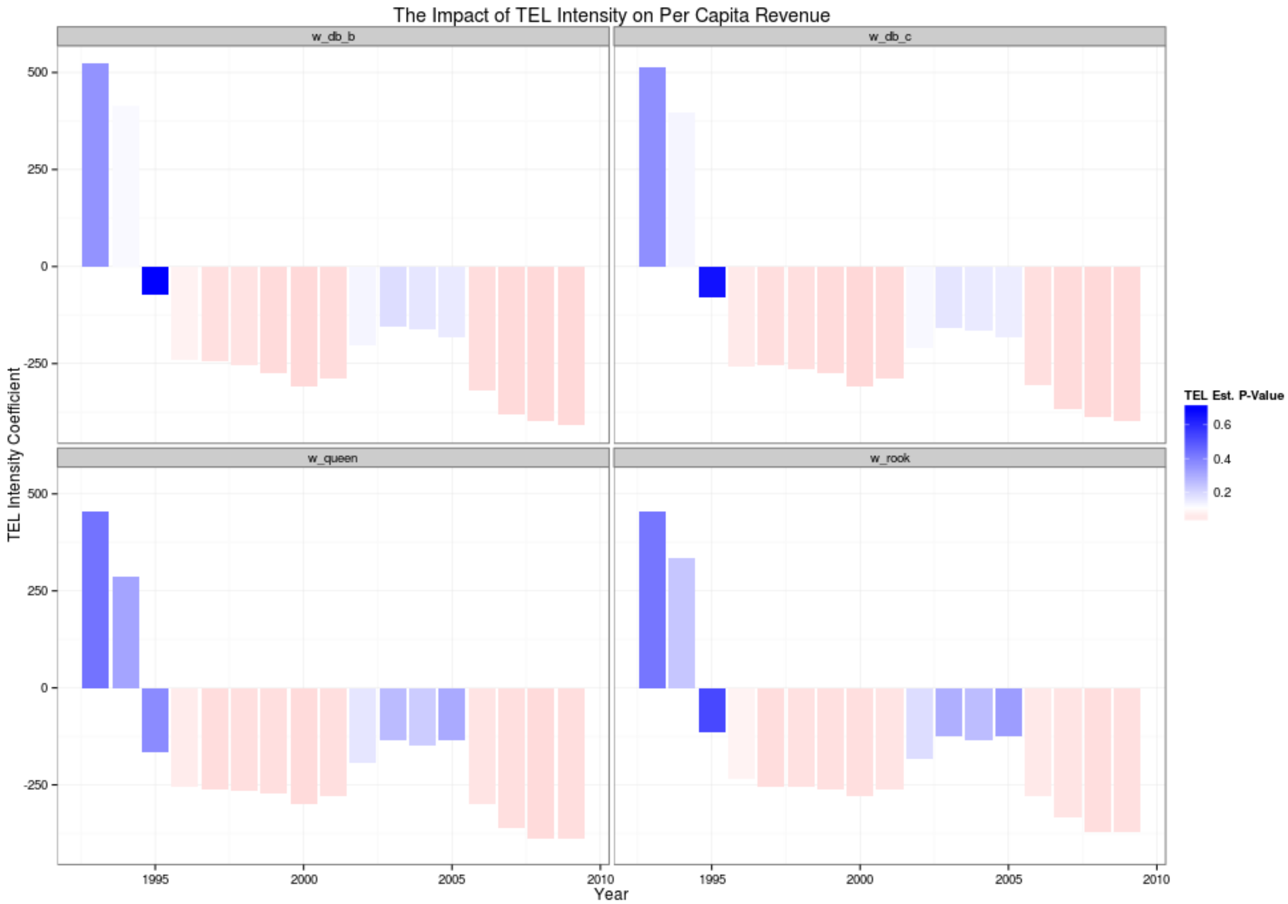
  $y = \rho W y + X\beta + \epsilon$

  becomes $y = (I - \rho W)^{-1} X\beta + (I - \rho W)^{-1}\epsilon$

- **Fixed Effect Spatial Lag Model** - This model both incorporates the weighted average of neighborhood values in the current period and the value of the observation in the preceding time period

  $y = \lambda(I_T \otimes W_N)y + (\iota_T \otimes I_N)\mu + X\beta + \epsilon$

While this paper focuses on the estimates of the last spatial panel routine, it must be noted that the expected negative effect of TEL intensity was verified in every model. The magnitude of that impact, however, varied based upon the treatment of the autocorrelation structure. The negative impact of TEL intensity on per capita revenue grew by approximately 25% when spatial impacts were introduced, and fell by an order of magnitude when temporal effects were subsequently added (~ -.3σ to -.03σ). Furthermore, the repeated cross-section application (that is, year-specific runs) of the Spatial Error and Spatial Lag Models revealed an impact of increasing magnitude over time. The charts below display the estimated coefficient for TEL intensity over time. The colors are given by the year-specific coefficient's p-value. The greater the significance, the more red the bar. White, the transition color between blue and red, indicates a significance level of $p = 0.1$. The impact unexpectedly starts as a positive figure of high magnitude, but given that TABOR started in 1993, it is likely that an adjustment period was needed before the persistently negative impact could materialize. It is nonetheless clear that the impact becomes more negative with time. Further exploration is required to determine whether this is due to within county degradation or an evolving sample (each passing year increased the number of "De-Bruced" counties).



The Fixed Effect Spatial Lag Model revealed a rather modest, yet clear negative signal for TEL intensity. Again, the sign accords with intuition, but the variance in magnitude suggests that further specification work can be done to improve the estimate. It should also be noted that relative per capita output and gross state product did not become significant until the temporal dependency structure was taken into account.

Coefficients:

```
             Estimate  Std. Error t-value  Pr(>|t|)    
lambda     5.9766e-01  4.9484e-02 12.0778 < 2.2e-16 ***
rho       -6.0707e-01  8.8319e-02 -6.8736  6.26e-12 ***
intensity -1.8661e+01  9.3619e+00 -1.9933   0.04623 *  
pcap_rel2  3.3142e+02  2.3204e+01 14.2828 < 2.2e-16 ***
gsp        8.2819e-04  8.7028e-05  9.5164 < 2.2e-16 ***
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Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
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Conclusion

The exploration of TEL intensity in Colorado has revealed four main findings:

1. While the magnitude of the effect is not yet solid, the expected negative impacts of TELs on revenue yield are robust across a range of specifications. *This includes modeling approaches that capture both temporal and spatial dependency within and across jurisdictions.*

2. Clustering appears to occur more readily in lower capacity jurisdictions. Given that property revenue limitations are driven by percentages of the previous year's baseline, this accords with intuition. The results in this area, however, are only suggestive because we have observed the average effect over all jurisdictional starting conditions.

3. Spatial and temporal dependencies have non-trivial impacts on fiscal outcomes, and must be included if the impacts of TELs are to be accurately measured.

4. It appears that fiscal clustering of revenue generation is negatively impacted to a greater extent with the passage of time under a given TEL structure. To the extent that TELs are biased towards depressing revenues and longer time periods provide more opportunities to manifest this bias, this behavior also accords with intuition. That being said, this behavior remains suggestive at best.

This paper represents only the opening salvo in the research program described early on in this analysis. From this point, the two primary next steps are the development of a more refined TEL Intensity measure econometric exploration of the economic capacity (as opposed to revenue generation) that affords conclusions beyond the descriptive treatment above. The former will help to differentiate the economic starting conditions and ongoing property base dynamics across counties. The latter, when coupled with the view of revenue generation offered here, will help to shed light on the differences between fiscal choice and fiscal necessity.

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