Dynamic Fiscal Limits on Local Governments

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Abstract

Most states limit the ability of local governments to increase taxes without first asking the voters for approval. These limits are often determinative of local budgets, which are frequently set right at their limit. Yet little is known about how these limits should be structured to benefit the voters. Limits are not tailored to individual local governments but instead state laws defined the limits at their introduction and set rules under which they evolve from year to year. This paper considers how rules governing the dynamic evolution of limits affect their ability to keep taxes in line with voters' preferences. I develop a model of a voter and an official who interact to set the level of tax revenue. The official, who prefers higher spending than the voter, has agenda-setting power in that they can propose a take-it-or-leave-it referendum to the voter. The limit evolves according to the most common rule in practice among the states, where next year's limit is equal to this year's policy choice. I show that in this dynamic setting, the official can achieve higher levels of spending than in the static case by credibly threatening to set taxes lower than the voter prefers. The limit is therefore less effective in constraining the official.

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1 Introduction

Local elected officials are not typically allowed to levy taxes on their residents as they see fit. Instead, state law limits their taxing power. To exceed their unilateral authority they must ask the voters to approve taxes in an override referendum. These limits to a great extent determine the budgets of local governments in the United States. While the details vary by state, local budgets are often set at the maximum allowed by their limits and local budgeting amounts to deciding when to propose overrides via public referenda. For example, in Wisconsin, 70% of municipalities set taxes at the maximum they were allowed to between 2015 and 2016. In Massachusetts between 2000 and 2016, 70% did so.

Among the three prominent types of tax limits on local governments, *levy limits* are often considered the most effective at constraining taxes. This is because they encourage steady property tax revenue. In contrast, *rate limits* can result in sticky property tax rates but revenues that fluctuate with with changes in the local housing market. The third type, *assessment limits* redistribute tax burdens but do not directly constrain their total size. Levy limits constrain revenues but typically allow elected officials to exceed the limit by making a proposal which is accepted by voters. This process gives the official agenda-setting power.

Levy limits typically cover budgets for current expenditures funded primarily through the property tax and are intended to restrain local governments from taxing an ever larger share of their resident's budgets. Since there are thousands of local governments in most states, limit are not individually tailored to each local government. Instead, the limit was typically set at the level of current spending for each government at the time of its creation and include rules that determine how they evolve from year to year. This evolution depends on the previous year's limit, policy decisions, and referenda results. In most cases, they are based on the prior year's *policy choice* but in some cases they are based on the prior year's *limit*. Several more recently adopted levy limits take a hybrid approach.

Since the status quo in the following year depends on the decisions in the past, evolution policies alter the incentives of the voter and official. This paper studies how the dynamic evolution of tax limit's affect their ability to restrain local governments.

I first catalog in detail the rules that govern the evolution of levy limits in the states. This

reveals heterogeneity in a previously unexamined policy detail. The most common structure is a levy limit that evolves based on the policy chosen each year and allows a voter override, which is employed by thirteen states in which a quarter of the United States population resides.

I then develop a model that describes the voter's interaction with a bureaucrat to set the level of tax revenue, subject to the most common type of levy limit. The bureaucrat prefers higher spending than the voter but is constrained by a limit. They may set spending freely under that limit, or propose a level above that limit through an 'override'. In that case, the voter decides whether to approve this override. If they do not, the bureaucrat must stay within the limit that year. The following year's limit is equal to this year's revenue choice, whether that is within the current limit or the result of a successful override.

The dynamic setting allows the agenda-setting official to achieve higher taxation levels than in a static alternative. The static literature on fiscal limits find that there is an equilibrium where the official sets the policy at the limit in cases where the voter prefers an amount less than the limit. When the voter prefers a level above the limit, the official proposes an override at an even higher amount such that the voter is indifferent between that level and if the policy was set at the limit (Romer and Rosenthal, 1978, 1979). In the dynamic setting, an equivalent equilibrium can only be maintained when the official heavily discounts future policies in favor of the present.

This result suggests an advantage to voters of having elected officials who are biased towards the present. When the official does not heavily discount the future they can use that to extract higher spending in the future. This is in contrast to models of politicians who are encouraged by the political process to be present-biased and take on more debt than is optimal for their constituents (Alesina and Tabellini, 1990; Persson and Svensson, 1989).

When the official does not sufficiently discount the future, there is an equilibrium in which the official extracts higher funding than would be possible under the static equilibrium. The voter will even approve overrides to exceed the limit when the limit is already higher than their preferred tax level. The official achieves this by credibly threatening that if their override is not successful they will set spending at a level that is lower than the limit. This would result in a lower limit in the subsequent year, giving the official greater agenda setting power. In equilibrium however, this does not occur, instead the voter approves overrides for higher taxes. This suggests that the dynamic nature of limits makes them less effective in limiting taxes.

I next show that the initial limit that maximizes the voter's welfare exceeds the voter's optimal level. With the evolution set by the typical rules, the benefit to the voter of the existence of the limit is determined by how the limit is initially set. Without a limit, the bureaucrat would set taxes at their preferred level each year. The existence of the limit can still restrain taxes and thus improve the welfare of the voter. The extent to which this occurs depends on how the limit is initially set. By giving the official the ability to set the policy higher than what the voter would prefer it restricts the official's desire to use their dynamic power. The official would have to set the policy much lower than the limit in order to extract a higher policy in future years and this is costly to the official in the short term.

This work builds upon a large literature beginning with Romer and Rosenthal (1978) that studies an agenda setter and a veto player, which has been extended to dynamic settings. The prior literature has assumed that after a failed referendum the official would set the policy at the limit. This assumption originates with Romer and Rosenthal (1978) which states, "The rule determining the status quo or fall-back position is generally specified by law, and is not subject to the setter's control." Subsequent work follows this when extending it to dynamic settings in which the fallback option is endogenous. For example, Diermeier and Fong (2011) assumes that the fall-back option is the previous year's policy choice. In practice, this is not required. In this paper's model, the official can set the policy at any level below the limit. This is important because it allows the official to credibly threaten to set the policy at a level that is lower than the limit. This threat is credible when the official cares enough about the future to be willing to pay the short term cost of lower spending and allows the official to extract higher levels of spending.

Many authors have extended the citeromer1978political work to dynamic and uncertain settings. Recent works have explored sequential decision-making processes and their implications for policy outcomes. Chen (2023) investigates strategic and informative voting in sequential agenda setting, highlighting how voters' preferences and information can shape policy decisions over time. Ali et al. (2023) focus on sequential veto bargaining with incomplete information, demonstrating how uncertainty and strategic interactions influence the bargaining process. Rosenthal and Zame (2022) analyze sequential referenda with sophisticated voters, emphasizing the role of voter sophistication in determining the outcomes of sequential referenda. Building on these insights, this paper examines how the dynamic nature of fiscal limits affects local governments' ability to align tax

policies with voters' preferences. By incorporating the sequential agenda setting framework, this study provides a deeper understanding of the strategic interactions between voters and officials in the context of fiscal constraints, offering new perspectives on the effectiveness of tax limits in restraining local government spending.

This paper is most closely related to Barseghyan and Coate (2014) in that both their work and this paper considers agenda setting in a dynamic context where the dynamics are caused by a durable public good. Our setting differs in two important ways. First, I have a consumable public good with an endogenous limit, which differs from the endogenous reversion level they study as the bureaucrat has some freedom within the limit rather than being constrained to a particular level absent a successful override. Our model is realistic for most states setting local budgets for current expenditures (rather than capital investments that they study) under a levy limit. They show that in their context there is an equilibrium that follows the static equilibrium in many situations. In our context, that is only true with very high discounting of the future.

The empirical literature that studies the effects of local fiscal limits finds mixed results on a variety of outcomes. These studies have examined fiscal outcomes such as government spending, revenue generation, and the use of alternative revenue sources like user fees. For instance, Figlio and Rueben (2001) and Poterba and Rueben (1995) investigate the impact of fiscal limits on local government spending and revenue patterns. Dye and McGuire (1997) and Rose (2010) explore how these limits influence the allocation of resources and the efficiency of local governments. Collectively, these works find large effects of fiscal limits on local governments. However, Eliason and Lutz (2018) find that one of the strictest limits has not altered the fiscal trajectory of Colorado relative to its peer states. They argue that the creation of the limit may reflect the pre-existing preferences of voters which even in the absence of the limit would have resulted in similar fiscal outcomes. This paper suggests an additional explanation, that the design of the limit may limit its ability to constrain spending.

The paper is structured as follows. Section 2 describes the structure of levy limits in the United States. Section 3 presents the model and results. Section 4 concludes.

2 Property Tax Limits

There are three prominent types of tax limits that apply to taxes levied by local governments, levy limits, rate limits, and assessment limits. These limits, which are governed by state law or in some cases state constitutions, govern the property taxes local governments can levy, but may also apply to other types of revenue sources. Nearly all states have at least one of these policies in effect. Proponents of these limits typically argue that they will help restrain local government expenditures to benefit the local taxpayers.[1] This section briefly describes rate and assessment limits, and then discuss levy limits, the focus of the paper, in detail.

Rate limits limit the property tax rate rather than the amount of revenue received. As a result, when property values increase the amount of revenue officials are allowed to generate increases. In some ways they are similar to levy limits. Each year, there is an amount of revenue that the government can generate, its property tax base times its rate limit, and to exceed that they would need to propose an override. However, they differ in the evolution of the limit. The limit next year is equal to this year's chosen rate times next year's property tax base.

Assessment limits change tax shares but do not directly limit tax revenues. By limiting the growth in assessed values of individual properties, assessment limits redistribute the tax burden among property owners. Relative to what would occur if properties were assessed at market values, they put a larger tax burden on properties whose value has increased less relative to those whose values have increased more. Under many assessment limits, properties are reassessed at market value upon their sale and so these policies typically put a heavier tax burden on recently sold properties relative to those whose ownership has remained unchanged. States with stringent assessment limits, like California's Proposition 13, typically accompany them with rate limits. Assessment limits alone do not have the structure common to both levy and rate limits that there is a set amount of revenue that would be allowed without an override. Assessment limits do not typically contain override policies, although they are often paired with either rate or levy limits which do.

Rate limits and assessment limits do not fit the model in this paper because they fundamentally differ in how they constrain local government taxation. Rate limits restrict the property tax rate

[1] Other potential motivations for limits have been explored in the literature including their insurance value (Anderson, 2006) and their value to people living outside the jurisdiction (Vigdor, 2004).

rather than the total revenue, meaning that revenue can still fluctuate with changes in property values. This makes it inappropriate to model the voter's and official's preferences based on a fixed spending level, as the actual revenue generated can vary significantly. Assessment limits, on the other hand, change the distribution of the tax burden among property owners by capping the growth in assessed values, but do not directly limit the total revenue or tax rate. This redistribution effect does not align with the model's focus on the total level of spending and the dynamic interaction between the voter and the official regarding overrides and spending limits. Therefore, the model's structure, which is based on a fixed limit evolving over time and the strategic behavior around this limit, is not applicable to rate or assessment limits.

2.1 Levy Limits

Levy limits are designed to restrict the total amount of revenue that a local government can collect from property taxes. Each year, the government is allowed to generate a maximum dollar amount in property taxes, which is determined by the levy limit. The governing body can set the property tax rate such that it will generate any level of revenue up to the limit. At their provenance, state laws determined initial levy limits for local governments and how they would evolve from year to year.

In most cases, levy limits are accompanied by provisions that allow for voter overrides. If a local government wishes to exceed the levy limit, it must seek approval from the voters through a referendum.[2] This mechanism is intended to ensure that any significant increase in property taxes has the support of the community. The override creates a way to escape the limit for local governments whose funding needs exceed the limit. However, it also bestows an agenda-setting power on the official. The official can make a take it or leave it proposed level of taxation that exceeds the limit. If the voters can approve or reject it. If it is rejected than the taxes must be set within the limit. In most cases, overrides permanently increase levy limits. Thus, passing an override has long-lasting effects on the taxing authority of the government. However, in some states overrides expire after a set time period or governments can elect a length (or choose between a set expiration and permanent overrides). The combination of a levy limit with a permanent voter

[2]Two states, South Dakota and Kentucky have an alternative override structure, where levies that exceed the limit are subject to a recall petition which, if successful, results in a referendum. In Figure 1, these are counted as voter overrides.

override procedure, the most common type of levy limit, is the focus of this paper.[3]

Most levy limits update annually to new levels according to one of two major categories of rules, while some states using a hybrid approach. In one type of rule, the limit for the next year depends on the policy choice made in the current year. The levy limit for the next year is equal to this year's chosen levy plus an adjustment amount. Thus, $\ell_{t+1} = t_t(1 + a_{t+1})$, where ℓ_t is the levy limit in year t, t_t is the actual levy in year t and a_t is an allowed growth rate for year t. In the other type of rule, the limit for the next year is a function of the limit from the current year. The levy limit for the next year is equal to this year's limit plus an adjustment amount. Thus, $\ell_{t+1} = \ell_t(1 + a_{t+1})$.

Several states have hybrid approaches where the limit depends on both past policy choices and the limits. While these are not common, they are more prevalent among recently adopted limits. The most common hybrid approach is that the limit for the subsequent year is equal to this year's policy choice, plus a limited carryover of excess room under the limit. There are two types of carryover limitations used by multiple states. First, some states limit the total amount of the carryover to a set percentage of the total levy. Thus, $\ell_{t+1} = t_t(1 + a_{t+1}) + \min(c * t_t, \ell_t - t_t)$, where c is the carryover cap. For example, in New York, the limit for the next year is equal to this year's policy choice plus the difference between this year's limit and levy, limited to 1.5% of the total levy. Second, some other states limit the number of years that a carryover can persist. As a result, next year's limit depends not just on this year's limit and policy choice, but also on the policy choices of the past. For example, Texas's levy limit, which was revised in 2024, is equal to the previous year's levy (plus an allowable growth rate) plus any excess room under the limit from the prior three years, but where excess room is calculated ignoring any carryover from previous years. When the allowed growth rate is constant (denoted a), this system can be described as $\ell_{t+1} = (1 + a)t_t + \sum_{k=1}^{T}((1 + a)t_{t-k-1} - t_{t-k})$, where T is the number of years that excess room can be carried over. This simplifies to $\ell_{t+1} = a\sum_{k=0}^{T} t_{t-k} + t_{t-T}$.

Twenty-nine states have levy limits that the local governing body cannot exceed with their own powers alone.[4] Twenty-one of these states have voter overrides and hence fit the description above.

[3] States that have levy limits but do not allow for overrides via referendum either have relatively lenient limits without any way to override, them, have a procedure for the local government to petition the state government for an exemption, allow the local government to exceed the limit in cases of emergency, or allow the local government to exceed the limit if it is approved by a supermajority of the local governing body.

[4] This excludes limits where the local governing body can exceed the limits through their own actions alone, typically via a sufficiently large supermajority. This explains the difference between this count and that in (Paquin, 2024).

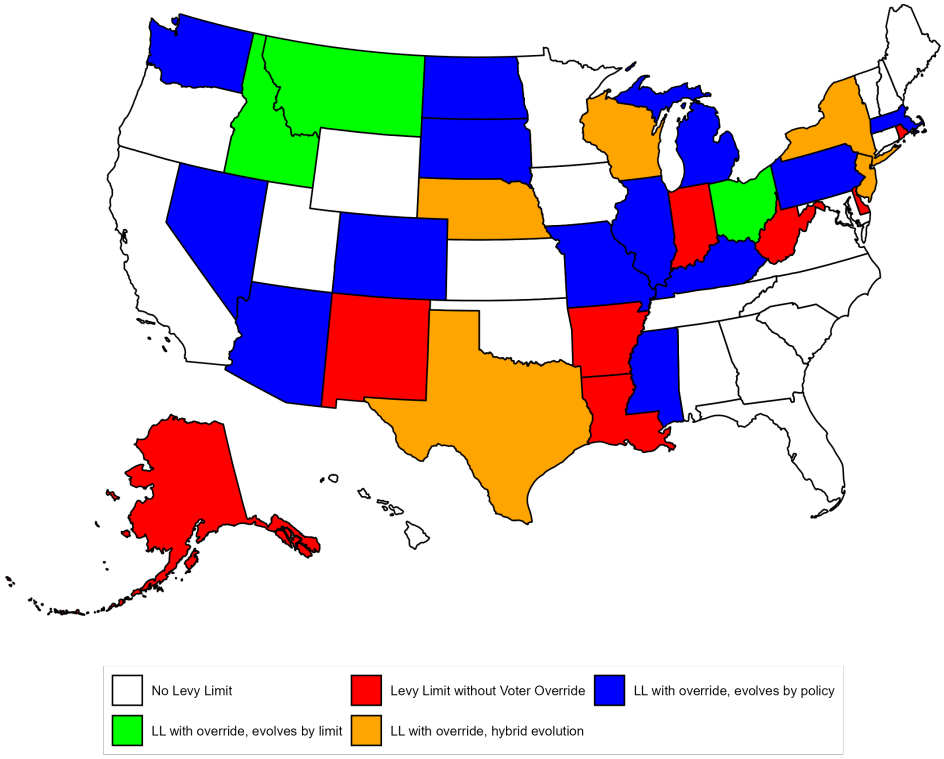


Figure 1: Map of Levy Limit Policies by State

Note: The map shows the number of states with each type of levy limit policy. Sources include Paquin (2024), Lincoln Institute of Land Policy (2023), and various state sources.

Figure 1 shows the number of states with each type of limit. Of the states with voter overrides: thirteen states have limits where the limit follows the prior year's policy choice; three states have limits that follow the prior year's limit; and the remaining five states have hybrid limits that depend on both the prior year's limit and policy choice, via a limited carryover procedure.

All of these evolution policies can accommodate some form of allowable growth rate, which takes two forms: a growth rate common to all local governments and increases specific to each local government. While some states do not allow any common growth in the levy limit those that do either use a fixed percentage increases or are tie the growth to an economic indicator. Fixed percentage increases range from 1% to 12%. Other states allow growth based on an economic measures, most commonly inflation, typically measured by the Consumer Price Index (CPI).[5] Many states cap the growth allowed due to the economic indicator.

In addition to the common growth rate allowed to all local governments, some states allow for

[5]A few states use measures based on state and local government expenditures or based on statewide income growth.

local governments to receive additional growth based on their individual circumstances. The most common type of additional growth is for new construction. In many states, the levy limit is allowed to grow by the amount of revenue that would be generated by new construction at the prior year's tax rate. Other states allow for additional growth due to annexations or other boundary changes. A few states allow for additional growth due to changes in state law or court decisions that require additional spending. These idiosyncratic increases are either in addition to the common growth rate or the total growth in the levy limit for a government is the greater of the two.

3 Model

Both the voter and official have desired levels of spending and their per period payoff depends on the distance between the realized policy and their preferred level. The voter has a desired level of spending τ and each period experiences a payoff $u(t;\tau)$ where t is the realized level of spending. $u(t;\tau)$ is maximized when $t=\tau$ and is symmetric around τ such that $u(\tau-a;\tau)=u(\tau+a;\tau)$. I assume that $u'(t;\tau)>0$ for all $t<\tau$ and greater than zero for all $t>\tau$ and $u''(t;\tau)<0$. I further normalize $u(\tau;tau)=0$. The official is biased towards higher spending relative to the voter and has desired level of spending $\tau(1+b)$ and experiences a payoff of $u(t,\tau(1+b))$ each period. The voter and official discount future payoffs at the rates β_V and β, respectively.

Each period the official proposes a level of spending. If it is no greater than the current limit ℓ it is adopted. If it is greater than ℓ it goes to an override referendum. The voter votes for it or against it. If it prevails, it is adopted. If it fails, the official must choose a level of spending for that period that is no greater than ℓ. The limit in the next period ℓ' is a function of the level of spending that is adopted this period and the current limit. Thus, the choices made by both actors have dynamic consequences.

I look for a Markov perfect equilibrium where the actor's strategies just depend on the current limit ℓ. Let $t(\ell)$ denote the official's strategy and let $W(\ell)$ and $V(\ell)$ denote the official and voter's value functions respectively. Then $t(\ell)$ solves the problem

$$\begin{aligned} \max_{t} \quad & u(t;\tau(1+b)) + \beta W(\ell'(t,\ell)) \\ \text{s.t.} \quad & u(t;\tau) + \beta_V V(\ell'(t,\ell)) \geq u(\underline{t}(\ell);\tau) + \beta_V V(\ell'(\underline{t},\ell)) \\ & u(\underline{t};\tau(1+b) + \beta W(\ell'(\underline{t}(\ell),\ell)) \geq u(\hat{t};\tau(1+b)) + \beta W(\ell'(\hat{t},\ell)) \quad \forall \hat{t} \leq \ell \end{aligned} \tag{1}$$

The constraints together ensure that either the policy adheres to the limit or the voter would approve an override. The first constraint requires that the voter would approve the override – that spending level selected is at least as good for the voter as the one that the official would set the policy at following a failed override, which I denote $\underline{t}(\ell)$. The second constraint requires that $\underline{t}(\ell)$, the spending level the official would set the policy at following a failed override, is at least as good for the official as any other possibility no greater than the limit.

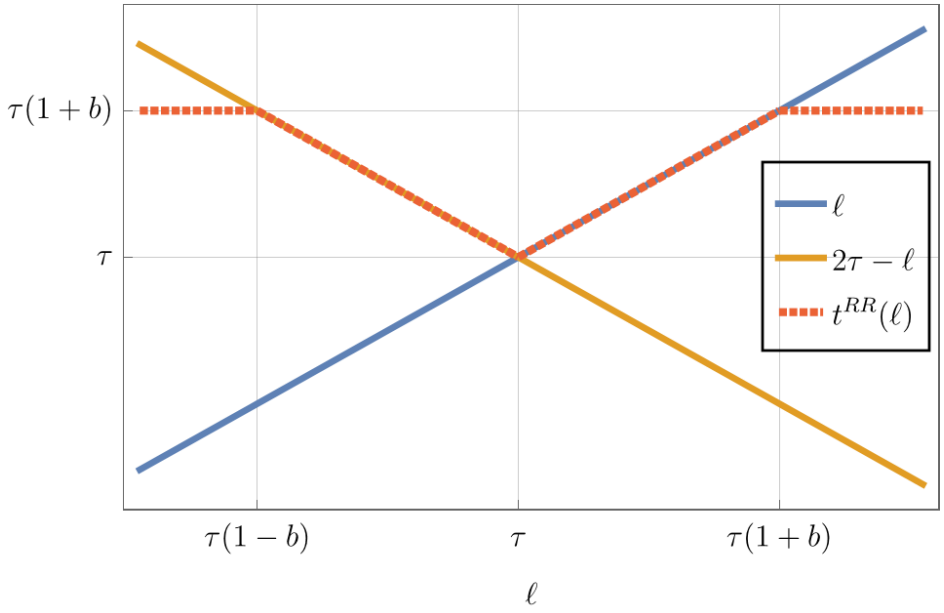
The evolution of the limit from one period to the next is defined by $\ell'(t,\ell)$ as a function of this period's chosen policy and the current limit. In most states, current policy dictates that $\ell'(t,\ell) = t$, where this year's policy determines next year's limit.

3.1 Romer-Rosenthal Equilibrium

First, I consider when it is possible for the typical static agenda-setter result to extend to the dynamic context. I show that the equivalent of a static Romer-Rosenthal (R-R) equilibrium can only exist in situations in which the actors heavily discount future payoffs.

In a static R-R model, when the level of spending preferred by the voter exceeds the limit, the official proposes a level such that exceeds the voter's preferred level such that the voter is indifferent between it and spending at the limit in that period. This equilibrium is sustained because the voter realizes that were the voter to reject the proposal, the official would set spending at the limit. In standard R-R models the official is a budget maximizer while ours is not, so in the equivalent equilibrium in this model, the official will propose their optimum when possible and

Figure 2: Romer-Rosenthal Equilibrium Policy



Note: The limit ℓ is shown on the horizontal axis. $t(\ell)$, the orange dashed line represents the equilibrium policy function.

the resulting policy function is

$$t^{RR}(\ell) = \begin{cases} \tau(1+b) & \text{if } \ell \leq \tau(1-b) \\ 2\tau - \ell & \text{if } \tau(1-b) < \ell \leq \tau \\ \ell & \text{if } \tau < \tau < \tau(1+b) \\ \tau(1+b) & \text{if } \tau(1+b) \leq \ell \end{cases} \tag{2}$$

Figure 2 describes the Romer-Rosenthal equilibrium in the context of this model. The orange dotted line shows the equilibrium policy, $t(\ell)$.

Proposition 1. *When $\ell' = t$, an equilibrium that follows the static Romer-Rosenthal Equilibrium in which the policy function follows Equation 2 exists only if $\beta \leq 1/2$.*

Proof: See Appendix A.1

The static R-R equilibrium only exists when the official discounts future years so much that they value this year's policy choice more than the sum of all future years. When this condition does not hold the R-R equilibrium breaks down. Following a failed referendum, when β exceeds 0.5,

they would prefer to set spending below the limit rather than at the limit. Doing so will generate a lower limit for the following year which will result in the voter being willing to approve a larger override the following year.

After noting this first result, I turn to a particular utility function to make more progress on these questions. Specifically, I assume a quadratic distance preference such that $u(t;\tau) = -(t-\tau)^2$.

3.2 Dynamic Equilibrium

Next, I show that even when the R-R equilibrium does not hold, there is an equilibrium. This equilibrium is characterized by higher spending in many situations than exists under the R-R equilibrium. The official can even extract overrides from the voter when the limit exceeds the voter's optimal level. The high level of spending is sustained because the official can credibly threaten to choose levels of spending that are less than the limit in the event that their override proposal were rejected.

Proposition 2. *With quadratic distance preferences and $\beta > 1/2$, there exists an equilibrium in which $t(\ell)$ is no less than that under the R-R equilibrium and exceeds it for at least some ℓ.*

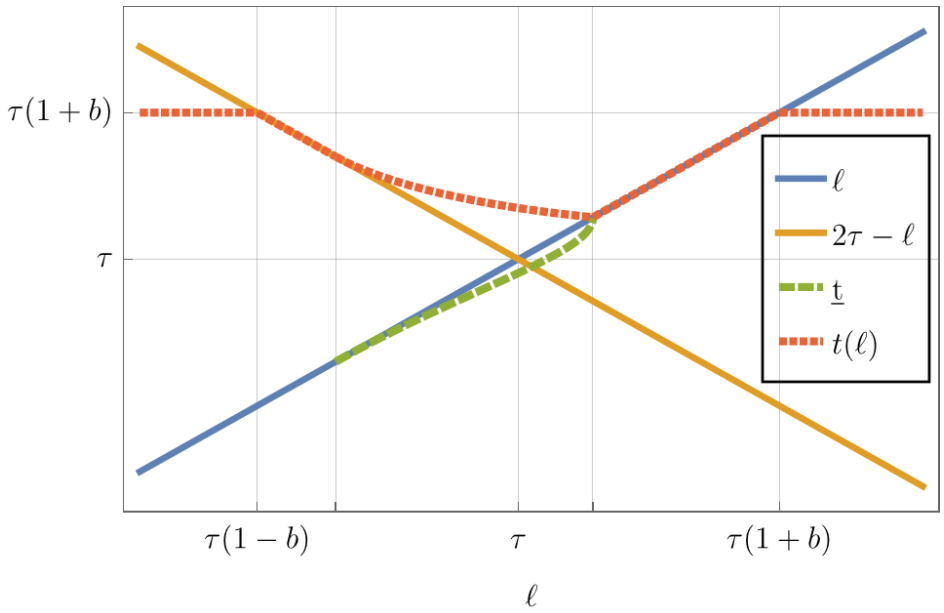
Proof: See Appendix A.2

The complete policy function $t(\ell)$ can be solved for analytically and is shown in the proof in Appendix A.2. The proof proceeds by first showing the existence of a $\underline{t}(\ell)$ function that, were the official to credibly threaten to adopt it after failed override, would make the voter indifferent between it and approving an override for $t(\ell)$. Next, it shows that, given the equilibrium $t(\ell)$ function, the official is willing to choose this $\underline{t}(\ell)$ after a failed referendum when the limit is ℓ. Lastly, it shows that the offical prefers $t(\ell)$ to any other level that the voter would be willing to approve in an override.

Figure 3 describes this equilibrium. The limit, ℓ, is shown on the horizontal axis. The orange dotted line describes the spending policy that will be adopted for any possible limit. The green dashed line describes the policy that the official threatens they would adopt were a referendum to fail, $\underline{t}(\ell)$. The voter is indifferent between this policy once, followed by a new policy, $t(\underline{t})$ the following year. Because in all cases, $t(\underline{t}) = t(t(\underline{t}))$ this policy would then be a steady state.

The official is able to threaten a policy below the limit even though in the short term they prefer

Figure 3: Dynamic Equilibrium Policy



Note: The limit ℓ is shown on the horizontal axis. $t(\ell)$, the orange dashed line represents the equilibrium policy function. $\underline{t}(\ell)$, the green dashed line represents the policy choice that the official would after a failed referendum if the limit were ℓ.

the policy to be set at the limit because it will enable them to get larger policies in the future. After a failed referendum, the official is indifferent between all policy levels in the range $[\tau-\tau b(4\beta-3),\ell]$. This is because, the higher their policy choice today, the lower the policy they will be able to extract from the voter in the following period. This difference is exactly compensated by the difference in their payout today.

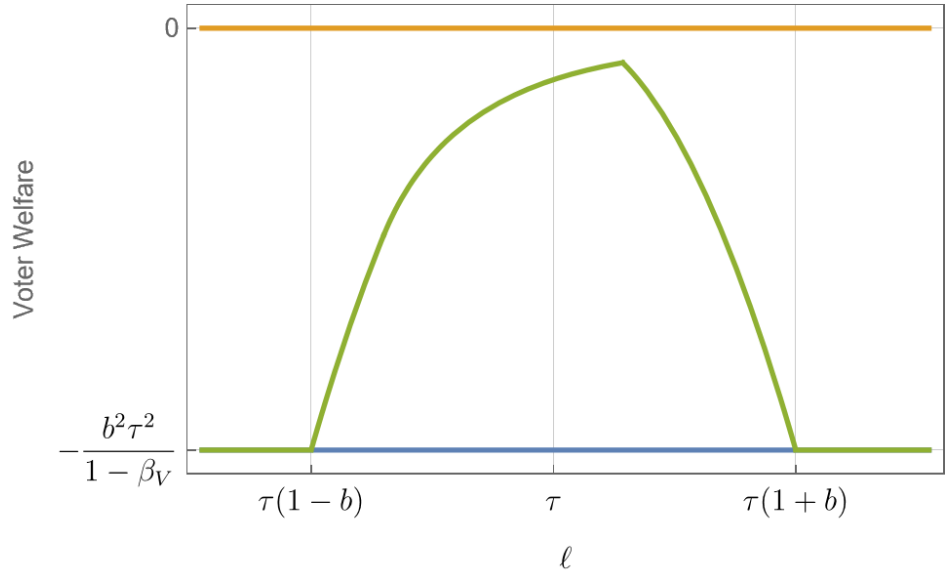
3.3 Optimal Dynamic Limits

I next consider at what level the limit should be set to best serve the voter. Limits on local governments are created at one point in time and then allowed to evolve over time. What level should limit designers be aiming for to maximize the welfare of voters?

Under the R-R equilibrium, the voter is best served by a limit that is set at their optimal value, such that $\ell = \tau$. Then, the official will set the policy at the limit, and the voter will experience their preferred policy. However, in the dynamic equilibrium, if the limit is set at the voter's optimal level, the official can extract spending that exceeds the voter's optimal. So what limit is best for the voter?

Proposition 3 shows that the optimal limit for the voter exceeds their preferred level of spending.

Figure 4: Voter Welfare from Varying Initial Limits



Note: The green curve represents the voter's discounted welfare of a limit set at ℓ. The orange line at zero represents the voter's welfare if the policy were set at the voter's optimum each year, and the blue line at $-b^2\tau^2/(1-\beta_V)$ represents the voter's welfare if the policy were set at the official's optimum each year. The distance between the blue and green lines represents the benefit to the voter of a limit when the initial limit is set at ℓ and evolves thereafter.

It is preferable to make the limit higher in order to reduce the power of the official.

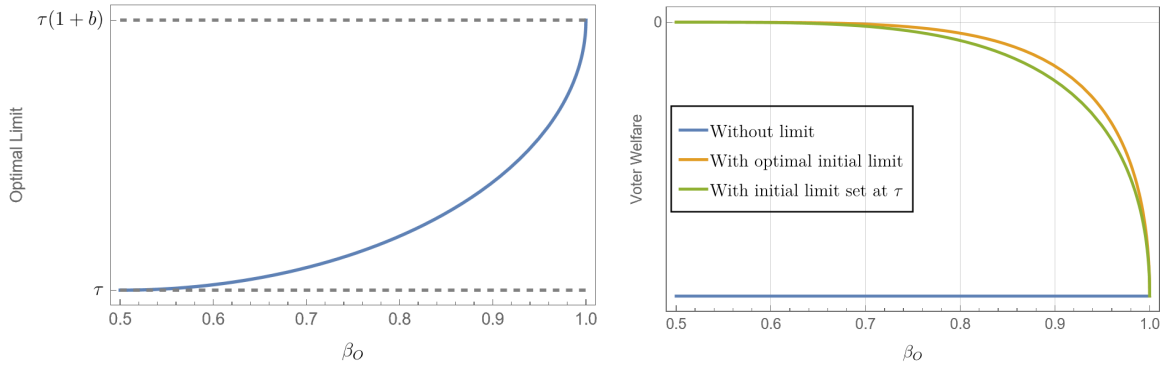
Proposition 3. *With quadratic distance preferences and $\beta > 1/2$, the limit that maximizes the voter's discounted stream of payouts exceeds is equal to $\tau(1+b) - 2b\tau\sqrt{(1-\beta)\beta})$, which exceeds τ.*

The proposition states that the optimal level to set the limit at exceeds the voter's optimal when β exceeds $1/2$. How much it exceeds the voter's optimal is increasing in β. When the official's discount rate approaches one, the optimal limit approaches the official's optimal value as the limit ceases to have any value.

4 Conclusion

This paper analyzes the gold standard property tax limitation device present in the United States, the levy limit. Levy limits are in effect in 30 states and in many cases these limits are binding more often than they are not. These limits are necessarily dynamic – they must evolve from one year to another according to a set of rules. The typical rule is that next year's limit is equal to this year's policy.

Figure 5: Optimal Limits and Voter Welfare with Varying Discount Rates



a) Optimal Limit b) Voter Welfare

Note: panel a) shows the optimal limit at varying levels of the official's discount rate, β_O. Panel b) shows the voter's welfare at varying levels of β_O under three different scenarios. When there is no limit the official chooses their preferred level every year.

This paper shows that an official who prefers higher spending can take advantage of the dynamic structure of the limit to extract higher spending. The voter will even approve an override referendum when the limit that the official would be bound to if it failed is already higher than the voter's preferred level of spending. This result suggests that levy limits may not be as effective in restraining taxes.

The model has several of interesting results.

The limit is more effective when the official cares much more about current policy outcomes than future outcomes. This suggests there may be some upside to politicians who are excessively concerned about taking credit for current policies over those that occur after they are gone. They may not be able to credibly threaten to punish the voter for rejecting their proposal.

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A Proofs

A.1 Proof of Proposition 1

Proof. In an R-R Equilibrium I must have that

$$t(\ell) = \begin{cases} \tau(1+b) & \ell \leq \tau(1-b) \\ 2\tau - \ell & \tau(1-b) \leq \ell \leq \tau \\ \ell & \tau \leq \ell \leq \tau(1+b) \\ \tau(1+b) & \tau(1+b) \leq \ell \end{cases} \tag{3}$$

For a R-R equilibrium to exist, the official would need to choose ℓ were a referendum to fail whenever $\ell \leq \tau(1+b)$. Given $t(\ell)$ above, this requires that for all $\ell \leq \tau(1+b)$, ℓ is a solution to

$$\underset{t \in [\tau(1-b),\ell]}{\arg\max} \quad u(t;\tau(1+b)) + \frac{\beta}{1-\beta} u(t(t);\tau(1-b)) \tag{4}$$

It suffices to show that the objective function, which is continuously differentiable over the relevant range, is increasing in t for all $t < \tau$. First note that the first derivative of the objective function is

$$u'(t) - \frac{\beta}{1-\beta} u'(t(t)). \tag{5}$$

There are two possible cases. First consider when $t > \tau$. In this case $t(t) = t$ and the derivative is equal to $u'(t)/(1-\beta)$ which since $t < \tau(1+b)$ is greater than zero. Second consider when $t < \tau$. In this case $t(t) = 2\tau - t$ and for the derivative to be greater than zero requires that

$$\frac{u'(t;\tau(1+b))}{u'(2\tau - t;\tau(1+b))} \geq \frac{\beta}{1-\beta}. \tag{6}$$

Since u is concave by assumption, the expression on the left hand side is not less than one and thus $\beta \leq 1/2$ is sufficient to satisfy it. It is also necessary that β is no greater than $1/2$, since when $t = \tau$ the left hand side is equal to one.

□

A.2 Proof of Proposition 2

Proof. An equilibrium with

$$t(\ell) = \begin{cases} \tau(1+b) & \text{if } \ell \leq \tau(1-b) \\ 2\tau - \ell & \text{if } \tau(1-b) < \ell \leq \tau - \tau b(2\beta - 1) \\ \tau(1+b) - \sqrt{\frac{1-\beta}{\beta}\left(\tau^2\left(4b^2\beta - (1+b)^2\right) + \ell(2\tau(1+b) - \ell)\right)} & \text{if } \tau - \tau b(2\beta-1) < \ell < \tau(1+b) - 2b\tau\sqrt{\beta(1-\beta)} \\ \ell & \text{if } \tau(1+b) - 2b\tau\sqrt{\beta(1-\beta)} \leq \ell < \tau(1+b) \\ \tau(1+b) & \text{if } \ell \geq \tau(1+b) \end{cases} \tag{7}$$

exists if the following conditions hold. First, there exists a $\underline{t}(\ell)$ function, such that the voter is at least as well off if the policy is set at $t(\ell)$ as they would be with $\underline{t}(\ell)$. Second, the official is willing to choose $\underline{t}(\ell)$ after a failed referendum when the limit is ℓ. Third, the official prefers $t(\ell)$ to any other that the voter would be willing to approve.

First, I show that for all ℓ, there is a $\underline{t}$ in the range $[\tau(1-b),\ell]$ such that the voter is indifferent between the policy being set at $\underline{t}$ and $t(\ell)$.

This requires that

$$-(\underline{t}-\tau)^2-\frac{\beta_V}{1-\beta_V}(t(\underline{t})-\tau)^2=\frac{-(t(\ell)-\tau)^2}{1-\beta_V} \tag{8}$$

Define as F the function that equals zero when this condition is satisfied.

$$F(\underline{t};\ell)=-(\underline{t}-\tau)^2-\frac{\beta_V}{1-\beta_V}(t(\underline{t})-\tau)^2+\frac{(t(\ell)-\tau)^2}{1-\beta_V} \tag{9}$$

Note that given the $t(\ell)$ function,

$$F(\underline{t};\ell)\leq-(\underline{t}-\tau)^2-\frac{\beta_V}{1-\beta_V}(t(\underline{t})-\tau)^2+\frac{\tau^2b^2}{1-\beta_V} \tag{10}$$

Then I have that

$$F(\tau-\tau b(4\beta_V-3);\ell)\leq\frac{-1}{1-\beta_V}(\tau b(4\beta_V-3))^2+\frac{\tau^2b^2}{1-\beta_V} \tag{11}$$

Since $\beta_V\geq\frac{3}{4}$, this is no more than 0 for all values of ℓ.

Next I show that $F(\ell)\geq 0$. This is equivalent to showing that

$$(t(\ell)-\tau)^2\geq(\ell-\tau)^2 \tag{12}$$

$t(\ell)$ is always at least as far from τ than is ℓ. This is clearly satisfied with equality in the portions of the $t(\ell)$ function that follow the R-R equilibrium. When $t(\ell)$ deviates from the R-R equilibrium, $t(\ell)$ exceeds what it would be under the R-R equilibrium and hence is further from τ than ℓ is.

Thus, I have that $F(\tau(1-b);\ell)\leq 0$ and $F(\ell;\ell)\geq 0$. Since $F(\underline{t};\ell)$ is a continuous function of $\underline{t}$, by the intermediate value function $F(\underline{t};\ell)=0$ must have a solution on the range $[\tau-\tau b(4\beta-3),\ell]$. The function $\underline{t}(\ell)$ is implicitly defined by this equation.

Next I show that, following a failed referendum when the limit is ℓ, the official would be willing to select $\underline{t}(\ell)$ as the policy. This requires that for all ℓ, $\underline{t}(\ell)$ is a solution to the problem

$$\max_{a\leq\ell}-(a-\tau(1+b))^2-\frac{\beta}{1-\beta}(t(a)-\tau(1+b))^2 \tag{13}$$

I treat each partition of the domain of ℓ provided by the $t(\ell)$ in tern. For $\ell<\tau(1-b)$, $t(\ell)=\tau(1-b)$ I have the problem

$$\max_{a\leq\ell}-(a-\tau(1+b))^2 \tag{14}$$

whose objective function is increasing in a and the voter will choose ℓ following a failed referendum.

For $\tau(1-b)<\ell\leq\tau-\frac{1}{2}b(\beta-\frac{3}{4})$ for which $t(\ell)=2\tau-\ell$ I have the problem

$$\max_{a\leq\ell}-(\tau(1+b)-a)^2-\frac{\beta}{1-\beta}(a-\tau(1-b))^2 \tag{15}$$

The objective function is increasing in a and the official will choose ℓ following a failed referendum.

For $\tau - \frac{1}{2}b(\beta - \frac{3}{4}) < \ell < \tau(1+b) - bt\sqrt{(1-\beta)}$ I have the problem

$$\max_{a \leq \ell} -(a - \tau(1+b))^2 - \frac{\beta}{1-\beta}(t(a) - \tau(1+b))^2 \tag{16}$$

Note that this objective function is equal to $-4b^2\tau^2$ and thus all $a \in [\tau - \tau b(4\beta - 3), \ell]$ are solutions to the problem. Since $\underline{t}$ is in this range, it is a solution to the official's problem following a failed referendum.

For $\tau(1+b) - b\tau\sqrt{1-\beta} \leq \ell < \tau(1+b)$, I have that $t(\ell) = \ell$ and the official's problem reduces to

$$\max_{a \leq \ell} -\frac{1}{1-\beta}(a - \tau(1+b))^2 \tag{17}$$

Since $a \leq \ell < \tau(1+b)$ the objective is increasing in a and the official will choose ℓ following a failed referendum.

For $\ell \geq \tau(1+b)$, I have that $t(\ell) = \tau(1+b)$. The official will choose $\tau(1+b)$ after a failed referendum.

Lastly, I show that for all ℓ, $t(\ell)$ solves the problem

$$\begin{aligned} &\max_{t} \frac{-1}{1-\beta}(t - \tau(1+b))^2 \\ &\text{s.t.} -(\underline{t}(\ell) - \tau)^2 - \frac{\beta}{1-\beta}(t(\underline{t}(\ell))) - \tau)^2 \leq \frac{-1}{1-\beta}(t - \tau)^2 \end{aligned} \tag{18}$$

Again, I take the partitions of ℓ given by the $t(\ell)$ function. For cases when $t(\ell) = \tau(1+b)$, the objective function is maximized unconditionally. When $t(\ell) = 2\tau - \ell$ and when $t(\ell) = \ell$, for any $t' > t(\ell)$ the constraint fails. Since the official's payout is increasing in t they will choose $t(\ell)$.

Now consider the intermediate case when if $\tau - \tau b(4\beta - 3) < \ell < \tau(1+b) - b\tau\sqrt{(1-\beta)}$. Since for all ℓ in this range, $t(\ell) > \tau$ I have that the right hand side of the constraint is increasing in t and the voter will not approve spending higher than $t(\ell)$ which I have already shown satisfies the constraint. Since $t(\ell) < \tau(1+b)$ the objective is increasing in t and thus the official will choose $t(\ell)$. □