Rules Versus Discretion in Tax Policy

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Abstract

The current fiscal climate is predicated on the notion that revisions to the tax code would be forthcoming every four years, i.e., corresponding to the presidential election cycle. While the depth of the adjustments is usually unknown, the probability that adjustments will happen is substantial. Yet it is the depth and the direction of the adjustment that has real effects. Businesses, large and small, face a burden; but as has been documented by previous research, small businesses bear a disproportionate share of the burden imposed by all federal regulations, including tax regulations. Small business associations identify taxes as the single most important issue facing small businesses. Unexpected shifts in the tax rate and structure only exacerbate the already difficult circumstances involved in running a small business. Now in addition to the uncertainties inherent in operating a small business, business owners must make allowances for unknown changes in the tax code while making plans that extend beyond the next presidential election cycle. There is an inherent problem here that, when explicitly stated, can be quite worrisome: the time horizon that a small business adopts when making plans is longer than the certainty period afforded by the election cycle. Therefore, every possible outcome would be less than optimal.

The advantages of a policy-making system based on rules rather than discretion have long been debated in the economics literature. Kydland and Prescott (1977) formalized the debate as it applies to macroeconomic policy. Their work and the literature that it generated has led to formal propositions favoring rules that constrain changes in monetary policy. The present paper extends the analysis in the rules-versus-discretion literature to evaluate the proper role of rules in tax policy. Unexpected tax rates, a consequence of discretionary tax policy, are detrimental to the sustainability of economic progress. An empirical investigation of the effects of unexpected tax rates in the American states supports the theoretical findings. Explicitly agreed upon rules limit the range within which tax rates can vary, and consequently restrict their volatility. With uncertainty reduced over a sufficiently long time horizon, optimal plans can be implemented at both the public and private levels.

1. Introduction

The advantages of a policy-making system based on rules rather than discretion have long been debated in the economics literature (Friedman 1948, 1960). Kydland and Prescott (1977) formalized the rules versus discretion debate as it applies to macroeconomic policy, and a rich analytical approach to the issue followed (Barro and Gordon 1983a, 1983b, Barro 1986, Cukierman and Meltzer 1986). The rules-versus-discretion literature in macroeconomics has led to formal propositions such as favoring policies that restrict the discretion of the monetary authority to prevent it from taking advantage of the expectational Phillips curve trade-off. The present paper extends the Barro-Gordon (1983a) framework to evaluate the proper role for rules in fiscal policy. The gist of the analysis is the distinction between expected and unexpected tax rates; unexpected tax rates are a direct result of discretionary fiscal policy and their presence is distortional with respect to resource allocation.

Twenty of the American states have special rules governing tax or spending increases. A typical example is a statute that requires proposed tax increases to be approved by a two-thirds majority in the state legislature rather than by a simple majority. Rules that constrain government spending and the tax authority do not have universal support. Rules limit policy flexibility required to respond to emergencies, economic fluctuations, and changing fiscal demands by the voters. More broadly, rules may choke off adequate revenue flows over time, and consequently, the debate on rules versus discretion in fiscal policy shifts into a debate over the appropriate size of government. In this paper, I seek to refocus the rules versus discretion debate over tax policy.

Friedman (1948, 1960) initiated the rule-versus-discretion debate. Friedman argued for rules; the policymaker did not have a good knowledge of the economy, and was not aware of the timing and magnitude of the effects of policy. Kydland and Prescott (1977) drastically changed this view of rules versus discretion by looking at rules as a form of commitment. Commitments are forms of binding contracts, and delineate *ex ante* the actions the policymaker will take.

The rational expectation hypothesis introduced formally by Muth (1961) became part and parcel of macroeconomic analysis in the mid-1970s, largely through the work of Lucas and Prescott (1971), Sargent (1973), and Sargent and Wallace (1975). The rational expectation framework treats economic agents as rational if expectations on average equal the true value of the variable being forecast. On average, $E[X] = X$, where $E[\bullet]$ is the mathematical expectation and X is the actual value in the future of the variable being forecast. Agents make mistakes, but do not err systematically; the policymaker is therefore unable to surprise the public systematically or routinely. This simple aspect of the rational expectation hypothesis revolutionized macroeconomics, and theories based on the rational expectation hypothesis were catapulted to the forefront of macroeconomic policy debates.

The most familiar application of the rational expectation framework in macroeconomics is to monetary policy, which, in turn, determines the future rate of inflation.[1] Economic agents can be

[1] Kochin (1974) uses the rational expectation hypothesis in a different framework. He argues that consumers anticipate future taxes implied by present deficits, and that, consumption expenditures, given disposable income, vary in such a way as to offset substantially the effects of government deficits. He operationalizes the above

surprised in one period, but would immediately learn and adjust their expectations for future periods. Adjusting expectations leads to an equilibrium exhibiting high inflation rates and no tangible benefits because the unanticipated inflation rate is zero.

The rules-versus-discretion literature existing prior to the Kydland and Prescott paper put more emphasis on the policymaker, his/her omniscience, and benevolence. Proponents of rules based their arguments on either imperfect knowledge of the timing and magnitude of the effects of policy or on the policymaker's questionable motives (Friedman 1948, 1960). The rational expectation framework in monetary policy led to the formalization of the rules versus discretion topic by Kydland and Prescott (1977).[2] Kydland and Prescott treat rules as binding contracts that explicitly specify a set of future actions. To avoid having a rigid system, these rules can be made contingent upon some set of exogenous variables that are observable by everyone. The rules are significant in the sense that they constrain the policymaker's policy choice set.

Kydland and Prescott (1977) use the following example to clarify the purpose and the importance of the rules versus discretion concept. Patents encourage invention, but also restrict the supply of goods, i.e., through the monopoly right granted to the inventor. If the policymaker arbitrarily changes patent policy from one period to the next, previously issued patents will be annulled while new ones are still being issued. Such a policy inhibits new inventions, because potential inventors correctly perceive that newly issued patents are also likely to become worthless in the future. If the policymaker's goal is to maximize the welfare of the community, he/she should issue new patents to encourage invention, and annul previously issued patents to increase output and lower prices. The optimal policy is time-inconsistent and the time-consistent policy is sub-optimal. A policy π_t is time-consistent if for each time period *t*, the optimal policy maximizes the social objective function, taking as given previous decisions, and that future policy decisions (π_s for $s > t$) are similarly selected (Kydland and Prescott, 1977, p. 475). Were the policymaker constrained by or committed to a rule enforcing patent law, for example, potential inventors' incentives would be restored.

The "novelty" in the Kydland and Prescott approach resides in the process underlying economic agents' decision functions. Current decisions by economic agents depend in part upon expectations of

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hypothesis by testing whether the correlation between the federal deficit and consumption is negative. Kochin finds that "...consumers seem...to have taken some account of the future taxes implied by current deficit spending...They have tended to spend less and save more" (p.393).

[2] Kydland and Prescott (1977) were primarily responding to the conclusions of optimal control theory (Strotz 1955, Denardo 1967, Pollack 1968, and Peleg and Yaari 1973). In optimal control theory, the decision selected is best, given the current situation and given that decisions will be similarly selected in the future (Kydland and Prescott, 1977, p. 473). This scheme of thought is optimal and can lead to a useful planning device in situations where current outcomes depend solely upon current and past policy decisions and upon the current state. Kydland and Prescott (1977) argue that planning based on optimal control theory will not maximize the social objective function because "current decisions of economic agents depend in part upon their expectations of future policy actions. Only if these expectations were invariant to the future policy plan selected would optimal control theory be appropriate" (p.474).

future policy actions; these expectations are in turn derived from observed policy actions.[3] Economic agents look into both the present and their expectation of the future to make rational decisions in the present. The informational basis on which agents make decisions is thus not limited to one period. Expectations of future policy actions help shape current decisions. Yet the process leading to the formation of these expectations originates from the observation of current and past policy actions.

Barro and Gordon (1983a, b) and Barro (1986) build on the Kydland and Prescott (1977) paper to develop a theory of the behavior of the monetary authority based on reputational equilibria. They argue that reputation plays a role because of the repetitive nature of the relationship between a policymaker and a population of rational economic agents. Reputation works as a self-enforcing or implicit constraint on policymaking decisions. Barro and Gordon (1983a) identify three distinct outcomes based on reputation: *cheating*, *rules*, and *discretion*. Their analysis is developed from the perspective of minimizing the "cost function" of the monetary authority. They conclude that the *cheating* equilibrium results in the lowest cost, the *rules* equilibrium is second lowest, and *discretion* yields the highest cost.

The result that the cheating equilibrium is preferable to the rules equilibrium is a consequence of two assumptions in their model. (i) "The monetary authority's objective reflects the preferences of the representative private agent," and (ii) the punishment period for cheating lasts one period. Assumption (i) boils down the problem to one involving one entity minimizing a cost function. If the population expects zero inflation next period, they argue that it pays for the community if the monetary authority cheats. Under cheating, Barro and Gordon find that the monetary authority's costs are negative, i.e., net benefits are positive. The costs faced by the representative agents are also negative. Costs under the rules equilibrium are zero. They argue that future reprisals from adjusted expectations are discounted.

It is clear from the outset that assumption (ii) precludes the reaching of the rules equilibrium. A relatively recent account of the literature (see C.A.E. Goodhart 1991, pp.353-384) fails to point out the possible problems in the Barro-Gordon (1983a) model. Having a one period punishment period violates the rational expectation hypothesis in effect in their model. For the punishment period to last only one period, the memory span of the agents must be one period. Yet rationality entails that mistakes are not made in a systematic manner; a memory span ranging over more than one period is thus required. If the punishment period is greater than one period, the model founders.

There is also a missing link in the derivation of some of the behavioral hypotheses. They argue that cheating benefits both the monetary authority and the representative agent because they have the

[3] This literature assumes that the policymaker is benevolent to reduce the degree of difficulty that would arise from a principal-agent problem. The conclusions that Kydland and Prescott (1977) reach consequently depend on this assumption. hey argue that a rule is preferable to discretion not because the policymaker is evil or "stupid," but because discretion allows the policymaker to apply the optimal policy, given the current situation. Discretion fails to maximize the social objective function because economic planning is not a game against nature, but one involving rational agents. Rational economic agents, unlike nature, have the ability to evaluate changes in their environment and respond.

same goals. It is contradictory to argue as they do that adjusted expectations impose a cost on the monetary authority. Why would agents want to punish the monetary authority if deviating from the rule benefits everyone? It would be rational for the representative agent to encourage the policy-maker to deviate from the rule continuously. The logic of the assumption implies that the monetary authority ends up colluding with the economic agents, and cheats systematically. That, however, is not a sustainable equilibrium; a policy based on consistently introducing an unexpected component to the existing inflation rate cannot be beneficial over time. The concept of rules becomes blurry in this context, but the presence of rules is necessary. If it were beneficial to break the rule, it would not be as beneficial to do without the rule. Only rules present the representative agent with a basis for forming expectations, and deviations pay mainly when the outcome deviates from what is expected.

The remainder of the paper is organized as follows: section 2 presents a model of the choice problem facing the tax authority, and defines the costs attached to his/her choices. Section 3 explicitly uses the rational expectation hypothesis to demonstrate that unexpected tax rates are relevant to the evaluation of the effects of tax policy. Section 4 summarizes the research and provides policy recommendations.

2. Model of the Tax Authority's Choices and Decisions

The Barro-Gordon model and other models in the rules-versus-discretion literature attribute omniscience and benevolence to the policymaker. The policymaker in the present study is called the tax authority. His or her actions will be generically referred to as “its” actions. The analysis concentrates on the tax authority's calculus when deciding on the best way to raise the revenues needed to satisfy its allocation problem. By channeling *more* resources to those most productive in increasing its probability of reelection, the tax authority not only gets closer to the "perfect mix," but may also increase the aggregate consumption level in the economy. It is thus possible to reduce the tax authority's allocation problem to one that maximizes only one function: *the probability of being reelected*.

The probability of reelection (P(e)) depends on two functions: the majority- and the opposition-generating functions. These two functions are expressed in term of political benefits and costs of taxes. Peltzman (1976), using a single-period model, identified the political broker's problem as consisting of maximizing the majority-generating function subject to the opposition-generating one. In the present context, within a framework that emphasizes expectations and lagged effects of tax policy, the tax authority maximizes the benefit function subject to the cost function in order to derive the tax rate that yields the maximum amount of benefits at the lowest possible costs. This solution defines the optimal tax rate from the standpoint of the tax authority.

The tax authority's problem is then reformulated in terms of minimizing a single function, the ‘net-cost function.’ Following the Barro and Gordon (1983a) model, the net-cost function is minimized under three different policy regimes: *discretion, rules, and cheating*. The optimal tax rate is derived under each regime, and the three solutions are compared with respect to the differential net costs the tax authority faces.

The approach here combines the methodologies of Barro-Gordon (1983a) and Peltzman (1976). Peltzman's model of the political broker helps identify the tax authority's choice problem, and the Barro-Gordon model provides the framework for comparing the costs faced by the tax authority under alternative policy regimes.

2.1. Expectation Formation

Suppose we start at time period *t*. Tax rates faced by taxpayers in period *t* are labeled current taxes (τ). While attempting to plan for the next period, *t+1*, rational taxpayers form expectations; the *expected tax rate* is labeled τ^e. The term $(\tau-\tau^e) = \tau^u$ is then the *unexpected tax rate*.

Assume that the taxpayer's best expectation for the tax rate in period *t+1*, based on all the information available in period *t*, is the current rate τ. Let I_t denote taxpayer's information set at time period *t*.[4] Note that this information set will only be complete at the end of period *t* because it is only then that all relevant information is available. Let $E\,|\,I_t[\cdot]$ stand for the mathematical expectation of $[\cdot]$ based on information set I_t. The above assumption is equivalent to:

(1) $E|I_t[\tau_{t+1}] = \tau_t$

Actually, $E\,|\,I_t[\tau_{t+1}] = (\tau^e)_{t+1}$ and equation (1) can therefore be expressed as:

(1') $(\tau^e)_{t+1} = \tau_t$

The following process describes the formation of expectations:

(2) $\tau_{t+1} = E|_t[\tau_{t+1}] + \nu_t$

(2') $\tau_{t+1} = (\tau^e)_{t+1} + \nu_{t+1},$

(2'') $\tau_{t+1} = \tau_t + \nu_{t+1}$

Where τ_t is the tax rate that prevailed in period *t* and u_{t+1} is the discrepancy in period *t+1* between the current tax rate (τ_{t+1}) and the expected one $(\tau^e)_{t+1}$, with $(\tau^e)_{t+1} = \tau_t$. ν_t is a sequence of normal independent variables with mean 0 and variance σ^2, $\nu_t \sim NI(0,\sigma^2)$. The unexpected tax rate in period *t+1*, $(\tau^u)_{t+1}$, becomes:

(3) $(\tau^u)_{t+1} = \tau_{t+1} - E|_t[\tau_{t+1}],$

(3') $(\tau^u)_{t+1} = \tau_{t+1} - (\tau^e)_{t+1},$

(3'') $(\tau^u)_{t+1} = \tau_{t+1} - \tau_{t\,=}\,\nu_{t+1}$

If tax rates are nonstationary, the process described by equations (1) – (3) is an appropriate representation of the stochastic path that they follow. Rational taxpayers, aware of the environment surrounding them, know that all the changes that affect the tax rate this period are permanent, and that they consequently need to be taken into account in forming an expectation of the tax rate in *t+1*.

[4] When a time series is nonstationary, it follows a random walk. In such a case, changes that affect the series in any particular period are permanent. As with any shock, these changes will consist of a transitory component and a permanent component. In non-stationary time series, the permanent component outweighs the transitory component, while the opposite occurs in stationary or trend-stationary series.

2.2. The Benefit Function

The benefits accruing to the tax authority from current taxes are straightforward. Taxes yield revenues that the tax authority collects and transfers. Transfers bring forth both votes and funds that increase the probability of reelection. The distinction between expected and unexpected tax rates is a central part of this analysis because the extent of the political benefits differs between the two. Specifically, unexpected tax rates are more advantageous to the tax authority than expected tax rates. Investment, locational and production decisions are made based on expected future tax rates; taxpayers use the expected tax rate in the calculus that determines whether particular ventures will be undertaken. Two factors explicitly affect these taxpayer decisions: the level of the tax rate, and the uncertainty attached to the observation of such level. The following illustrates the different effects of expected and unexpected taxes on the benefits for the tax authority.

At the actual end of time period *t*, based on the process described in equations (2) - (2"), taxpayers form an expectation $(\tau^e)_{t+1}$ for the tax rate in the next period and evaluate their alternatives. Once locational decisions are made and production processes started, taxpayers are locked in for some period of time. If the tax rate in the next period, τ_{t+1}, is greater than the expected rate $(\tau^e)_{t+1} = \tau_t$, the plans undertaken based on the expected rate become sub-optimal to the taxpayers, yet taxpayers cannot re-optimize instantaneously. The costs incurred in moving and setting up new production processes prior to the revelation of τ_{t+1} are sunk.[5] If the costs imposed by the tax differential are less than the costs incurred while moving or setting up new production processes (based on taxpayer expectation $(\tau^e)_{t+1}$) taxpayers have some incentives to pursue such activities even though they now yield a lower rate of return. The difference between actual and expected after-tax returns redounds to the tax authority.[6]

Taxpayers rationally devise plans every period to end up with a lower tax burden, but these plans are unavailable when the tax authority decides to use surprise taxation as a way to increase revenues. There is then an asymmetric information problem between the tax authority and taxpayers. As long as this asymmetry exists, independently of the rationality of the taxpaying public, the rational tax authority will take advantage of it-either to enhance its electoral prospects or to benefit the economy (by increasing the aggregate consumption level *C(t)*). The asymmetry present in this setting is inherent in policymaking in general, because the tax authority sets tax rates prior to their revelation to the public. The rationality of the taxpaying public limits the tax authority's possibility set, but not its first-mover advantage. The salient element is that the tax authority obtains more revenues when a tax increase is unanticipated than when it is anticipated.[7] Unexpected tax rates thus enter in the tax authority's benefit function, which is expressed as:

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[5] Taxpayers would decide to either move to another location or shut down if the costs imposed by the tax differential outweigh the costs resulting from the decision made *ex ante*.

[6] Collection costs are assumed away for the sake of simplicity. Including them does not add to the explanatory power of the argument.

[7] Consider for a moment that the surprise is in the opposite direction. If taxpayers face a rate in period *t+1*, $\tau_{t+1} < (\tau^e)_{t+1}$, the realization of plans differs from when $\tau_{t+1} - (\tau^e)_{t+1} = \upsilon_{t+1} = 0$. The only benefits that the tax authority

(4) $B = B(\tau^u, \tau^e), (\partial B/\partial \tau^u) > (\partial B/\partial \tau^e) > 0$

If there are no surprise taxes, $\tau^u = 0$, and the benefit function simplifies to:

(4') $B = B(\tau^e)$

2.3. The Cost Function

Revenue collection generates political opposition. Independently of the proportion of the population receiving transfers and of the productivity of the transfers in improving electoral probabilities, taxes lower the income of those who pay the taxes. The opposition to taxes costs the tax authority in either lost votes or by increasing the campaign costs necessary to maintain a given level of votes.[8] It now becomes possible to identify two groups in relation to the tax authority. The group of beneficiaries consists of those for whom transfers received outweigh the outlays caused by taxes. The ratio of benefits to taxes for this groups approaches infinity. The losers are the taxpayers who have a positive net tax burden-outlays caused by taxes are greater than the sum of windfalls caused by transfers; their benefits-to-taxes ratio approaches zero. Just as beneficiaries under the status quo organize to provide the tax authority with support, losers organize to defeat the current regime.

The losers increase their efforts to defeat the tax authority if they know that $\tau^u > 0$. It is only then that members of this group experience an unexpected addition to their already positive net tax burden. Note that the strategy of having τ^u positive in every period is not consistent. There exists a *trigger* tax rate τ^* such that once reached, rational taxpayers expect a maximum tax rate τ^m and reorganize their activities accordingly. The withdrawal of taxpayers from legal taxable activities, and growth in the underground parallel economy lead to a decrease in the pool of revenues available to the tax authority for transfers.[9] If taxpayers expect to face τ^m until the next election, and exit is an option, the tax authority would face a disappearing tax base and reduced economic activity. The cost function can be expressed as:[10]

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can derive from an unexpected decrease in tax rates come from the new beneficiaries--taxpayers who now face a lower tax burden. This decrease is rational if and only if the returns from the new beneficiaries are greater than the returns forthcoming from the previous transfer recipients. Note that people who now face a lower tax burden provide the new support, while support in period *t* came from the then-transfer recipients. There is thus an asymmetry in the way the tax authority can derive benefits--support.

[8] If the opposition organizes and campaigns against the tax authority, the resources needed for the tax authority to overcome such adversity and prevail in future elections will be greater than in the case where there is no opposition.

[9] In most less developed countries, tax rates have become so arbitrary that it no longer is beneficial for taxpayers to engage in legal activities. The sprouting of an underground economy is a testimony that taxpayers are responsive to changes in their fiscal environment.

[10] If the tax authority benefits more from unexpected tax rates, it has to be true that, barring the infusion of new taxpayers every period, the costs that the tax authority faces from setting unexpected tax rates are also greater than the costs that it faces when $t^u = 0$. Suppose that an unexpected increase in tax rates causes an increase in benefits (say by X). Abstracting from collection and administrative costs, the losers contribute to a considerable portion of X. Taxpayers' contribution would have been lower had X been zero. Their opposition to the tax authority is thus greater when $\tau^u > 0$ than when $\tau^u = 0$. Consequently, $\partial C/\partial \tau^u > \partial C/\partial \tau^e$.

(5) $C = C(\tau^u, \tau^e), (\partial C/\partial \tau^u) > (\partial C/\partial \tau^e) > 0$

In the absence of unanticipated taxes, the cost function becomes:

(5') $C = C(\tau^e)$

2.4. The Tax Authority's Decision

The benefit and cost functions are derived from the perspective of the tax authority, and they do not necessarily coincide with the interests of the representative taxpayer. The view taken here suggests that the tax authority has a first-mover advantage only because it happens to be the tax authority. There are no presumed guarantees that giving the tax authority the flexibility to use its discretion whenever it is deemed necessary would improve anyone's circumstances except its own-along with those of its supporters. Cukierman and Meltzer (1986) interpret the tax authority's first-mover advantage over the taxpaying public as the policymaker's sophisticated information set. They consider discretion synonymous with flexibility, and the policymaker seeks to maintain flexibility whenever its agenda differs from that of the representative agent. Yet for discretion to be an optimal policy path-one that maximizes social welfare, they point out, the policymaker has to either have the same information set as the representative taxpayer or be a benevolent policymaker. Under any other set of circumstances, discretion leads to a suboptimal outcome.

Given that the tax authority's goal is to maximize its probability of reelection, and that it has the first-mover advantage, consider:

(6) $P^e = P^e(B,C)$

where the functions B and C are the benefit and cost functions defined in (4)-(5) above. Expressing both functions in terms of tax rates, it becomes possible to define the following partial derivatives:

(7) $(\partial P^e/\partial B)(\partial B/\partial \tau) > 0, \quad (\partial P^e/\partial C)(\partial C/\partial \tau) < 0$

It follows that:

(8) $(\partial B/\partial \tau) > 0, (\partial C/\partial \tau) < 0$

Keeping the above in mind, it is possible to characterize the tax authority's problem in the following way:

(9) Maximize $B(\tau^u,\tau^e)$
subject to $C(\tau^u,\tau^e)$.

The first-order conditions require the ratio of the marginal benefits from unexpected taxes to expected taxes to be equal to the ratio of the marginal costs of unexpected taxes to expected taxes. Stated differently, it requires the ratio of marginal benefits to marginal costs of unexpected taxes to be equal to the ratio of marginal benefits to marginal costs of expected taxes.

The problem as stated by equation (9) is equivalent to minimizing one function: the "net-cost" function. The net-cost function takes into account not only the costs the tax authority faces, but also the benefits it derives from both current and unexpected tax rates. The net-cost function is thus a function of current tax rates and unexpected tax rates.[11] The functional form of the net-cost function in equation (10) is similar to the cost-of-inflation function in Barro and Gordon (1983a). Consider:

(10) $$C(\tau, \tau - \tau^e) = a\tau^3 - g\tau - b(\tau - \tau^e)$$

with a, b, g > 0. The first term, ($a\tau^3$), is the cost of current taxes. These costs are assumed to rise at an increasing rate with increases in the current tax rate τ. Revenue collection generates opposition, independently of the proportion of the population receiving transfers and of the productivity of the transfers in improving electoral probabilities. The term ($a\tau^3$) represents these costs, appropriately defined as a polynomial consisting of lagged effects of past taxes. Equation (10) takes the first term of this polynomial as representative of the costs of taxes at a particular point in time--the costs that the tax authority faces for current taxes are greater than those it faces for tax rates set in previous periods. The second term, $g\tau$, represents the benefits the tax authority derives from current tax receipts. The third term, $b(\tau - \tau^e)$, stands for the benefits arising to the tax authority from unexpected taxes. Given that the parameters a, b, and g are all positive, an increase in current taxes raises $C(\cdot)$ by the first term, but decreases it by the second. In contrast, an unexpected increase in taxes, on the other hand, lowers $C(\cdot)$ by also the third term. Note that while the increase in costs is assumed to be nonlinear, the decrease in costs caused by both current and unexpected tax rates is taken to be linear.

Given that the net-cost function will be minimized under different policy regimes, its expected value becomes of extreme significance. Depending upon the particular policy regime under consideration, certain terms in equation (10) will either cancel out or lose significance. The variations arise from the tax authority's assumptions about taxpayers' anticipations concerning the path of future tax rates. Following the methodology in Barro and Gordon (1983a), three equilibria are considered: *discretion*, *rules*, and *cheating*.

2.4.1. Discretionary Equilibrium

Suppose that the tax authority has total discretion to set tax policy. Taxpayers will undoubtedly have expectations, but such expectations are exogenous to the tax authority's solution for the optimal tax rate. Taxpayer expectations play a role in evaluating the costs the tax authority faces *given* the optimal tax rate. Taxpayer response will only affect the economy after tax rates have been determined.

The discretionary framework leads to an equilibrium in which the tax authority will satisfy some groups and frustrate others. The distinguishing feature of this equilibrium, however, is that it is not theoretically sustainable in an *n*-period game, given the rationality of taxpayers. Suppose that the tax authority uses its discretion to set tax policy in the first period. Taxpayers pay the price for the transfers made possible by such a move on the part of the tax authority. The response on the part of

[11] Note that the net-cost function in equation (10) below could be expressed as a function of τ^e and τ^u, but is instead defined in terms of τ and $(\tau - \tau^e)$. The choice of the current rate over the expected rate is motivated by the fact that the tax authority faces the costs of current rates at any point in time. The divergence between the expected and the current rate is embodied in the unexpected rate. The unexpected rate, in turn, is defined in equation (10) following the form it takes in equation (3') for computational convenience.

taxpayers is to shift away from taxable activities. As discretionary tax policy persists in subsequent periods, and taxpayers continue shifting away from taxable activities, the tax authority will not be able to provide as many transfers as it did in earlier periods. The shrinking tax base leads to a decrease in revenues available for transfers. In the long run, transfer recipients, if they keep receiving transfers, pay for most of the transfers they receive; but this outcome defeats the purpose of forming an interest group.[12] Facing a shrinking tax base that shows no signs of stabilizing in period i, $1 < i < n$, the tax authority sees no point in consistently using discretionary tax policy in period j, $i < j < n$. By backward induction, the tax authority would choose not to use discretion in the first period.

Keeping the above in mind, consider the expected value of the net-cost function under discretion:

(11) $$E[C^d(\tau,\tau-\tau^e)] = E[a\tau^3 - g\tau - b(\tau-\tau^e)]$$

The term $b\tau^e$ vanishes from equation (11) because taxpayers' expectations are exogenous to the tax authority's problem under discretion. Equation (11) becomes:

(11') $$E[C^d(\tau,\tau-\tau^e)] = a\tau^3 - g\tau - b\tau$$

Minimization of equation (14') with respect to τ yields the following:

(12) $$(\partial C^d/\partial\tau) = 3a\tau^2 - g - b = 0$$

The optimal tax rate under discretion, τ^d, is:

(13) $$\tau^d = [(g+b)/3a]^{1/2}$$

Given τ^d and rational expectations, taxpayers formulate a prediction of the tax rate based on the tax authority's calculus. The prediction is based on all the available information and knowledge. Suppose that taxpayers' expectation for the tax rate exactly equals τ^d. The tax authority's costs become:

(14) $$C^{*d} = a[(g+b)/3a]^{3/2} - g[(g+b)/3a]^{1/2} - b(0),$$

(14') $$C^{*d} = [(g+b)/3a]^{1/2}\,[(b-2g)/3]$$

2.4.2. Rules Equilibrium

Next consider an alternative policy regime which requires the tax authority to follow a commonly agreed-upon tax rule. Suppose that there are enough incentives to lead to an agreement concerning the setting of tax policy. If the tax authority is constrained to act under an explicit set of rules (known to taxpayers and assuming taxpayers have rational expectations), the equality between the expected tax rate and the current tax rate will hold in every period. The unexpected tax rate, under such regime, vanishes from the analysis. What can be expected in such a regime?

Consider the expected value of the net-cost function under rules:

(15) $$E[C^r(\tau,\tau-\tau^e)] = E[a\tau^3 - g\tau - b(\tau-\tau^e)]$$

The term $b(\tau-\tau^e)$ drops out because $\tau = \tau^e$ under rules. Equation (15) becomes:

(15') $$E[C^r(\tau,\tau-\tau^e)] = a\tau^3 - g\tau$$

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[12] Interest groups form to attract resources from non-organized entities. If paying for the majority of the transfers that they receive was a viable alternative, interest groups would rationally elect to economize on all the expenses they incur while lobbying by not soliciting. The absence of a population to provide a pool of resources to b e extracted defeats the purpose of interest-group politics.

Minimization of (18') with respect to τ yields:

(16) $(\partial C^r/\partial \tau) = 3a\tau^2 - g = 0$

and the optimal tax rate under rules, τ^r, is:

(17) $\tau^r = [g/(3a)]^{1/2}$

Given τ^r, the net-cost function faced by the tax authority takes the following value:

(18) $C^{*r} = a[g/(3a)]^{3/2} - g[g/(3a)]^{1/2}$,

(18') $C^{*r} = -[g/(3a)]^{1/2}\,[(2g)/3]$

It is possible at this point to draw some preliminary conclusions.[13] Based on the two regimes analyzed above, the following inequalities hold:

(19) $\tau^r < \tau^d$,

(20) $C^{*r} < C^{*d}$

Upon investigating the outcomes of two policy regimes, the model so far favors rules over discretion. Drawing such a conclusion, however, is premature. The analysis of the cheating equilibrium is warranted in order to arrive to a definite theoretical conclusion.

2.4.3. Cheating Equilibrium

Suppose that the situation above is the *status quo,* i.e., the economy is in equilibrium under rules. A rules equilibrium involves an agreement between the tax authority and the population of taxpayers-or their representatives-that the agreed-upon explicit rule is a binding constraint. Based on experience, all taxpayers believe that the commitment is credible. Suppose now that the tax authority decides to use its discretion in setting tax policy in period *t+1*. Upon revelation of τ_{t+1}, taxpayers realize that $\tau_{t+1} > \tau_t$ (1+x), x being the anticipated increase called for by the rule; the optimality of plans for *t+1* is thus threatened. What can we say about the reaction in *t+2*?

Taxpayers in this model do not easily forget, nor do they easily forgive. The party responsible for the sub-optimality of their plans-the tax authority-pays for deviating from the agreed-upon rule. When punishing the tax authority, taxpayers expect τ^d and invest more in opposition to the tax authority. The analysis at this point takes a path different from that chosen by the traditional rules-versus-discretion literature. By having the punishment period last only one period (see Barro and Gordon, 1983a), both the tax authority and the population of taxpayers use the same strategy: a derivative of *tit-for-tat*.[14] It would be theoretically useless to attempt to determine the optimal length of the punishment period in this analysis, because elections are held periodically and one would expect

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[13] The sign of C^{*r} appears counter-intuitive at first, but is actually quite meaningful. The optimal tax rate is the rate that minimizes the net-cost function. In other words, it is a global minimum because benefits are explicitly subtracted from the net-cost function. A negative C^{*r}, hence, only tells us that benefits outweigh costs given the optimal tax rate.

[14] tit-for-tat is a well-known strategy in game theory. It consists of cooperating until the other player defects; from that point on, the first player uses a strategy similar to that used by the second. Barro and Gordon (1983a) allow economic agents to punish the policymaker for one period. Intuitively, if deviation from the rule occurs at *t+1*, punishment also occurs at *t+1*. At the beginning of period *t+2*, economic agents are ready to trust the policymaker anew (see page 118).

taxpayer opposition to materialize at the voting booth. It is only upon electing a new tax authority that a commitment to rules will regain popularity.

Consider the expected value of the net-cost function under cheating:

(21) $E[C^c(\tau,\tau-\tau^e)] = E[a\tau^3 - g\tau - b(\tau-\tau^e)]$

The expected tax rate here is τ^r. Equation (21) becomes:

(21') $E[C^c(\tau,\tau-\tau^e)] = a\tau^3 - g\tau - b\tau + b\tau^r$

and from equation (17), $\tau^r = [g/(3a)]^{1/2}$. The expected value of the net-cost function under cheating is:

(21") $E[C^c(\tau,\tau-\tau^e)] = a\tau^3 – (g+b)\tau + b(g/a)^{1/2}$

The last term in equation (24"), $b(g/3a)^{0.5}$, reflects the fact that the *status quo*-prior to cheating- is the rules equilibrium. In the rules equilibrium, $(\tau^e)_{t+i} = (\tau_{t+i-1})$ and expectations are endogenous in the tax authority's problem. The optimal tax rate under rules is $\tau^r = (g/3a)^{0.5}$; this is the rate taxpayers expect to have in *t+1*. Minimization of (24") with respect to τ yields the following:

(22) $(\partial C^c/\partial\tau) = 3a\tau^2 – (g+b) = 0$

The optimal tax rate under cheating, τ^c, is:

(23) $\tau^c = [(g+b)/(3a)]^{1/2}$

and the corresponding cost function is:

(24) $C^{*c} = a[(g+b)/(3a)]^{3/2} – (g+b)[(g+b)/(3a)]^{1/2} + b[g/(3a)]^{1/2}$,

(24') $C^{*c} = -[(g+b)/(3a)]^{1/2}\ [(g+b)(2/3)] + b[g/(3a)]^{1/2}$

equivalently:

(24") $C^{*c} = -(1/3)[(g+b)/(3a)]^{1/2}\ [(b+2g)/(3)]$

Note that while the optimal tax rate is the same under both discretion and cheating, the costs faced by the tax authority are different. The difference arises from taxpayer expectations. Once cheating occurs, the rational tax authority, aware of its surrounding circumstances and of the consequences of its actions, knows that the expected tax rate until the next election is $\tau^d = \tau^c = [(g+b)/3a]^{0.5}$ and not $\tau^r = (g/3a)^{0.5}$. Consequently, the only alternative left is to conform to expectations and allow the discretionary tax rate to prevail.[15] This conclusion differs from the one in section 2.2. The difference

[15] Note that the tax authority sets the discretionary rate more out of optimizing, given its circumstances, rather than its willingness to conform to expectations. More specifically, consider the tax authority's problem in the period following that in which it cheated, i.e., t+2:

(1) $E[C(\tau,\tau-\tau^e)] = a\tau^3 - (g+b)\tau + b[(g+b)/3a]^{0.5}$.

(2) $\partial C/\partial\tau = 3a\tau^2 - (g+b) = 0 \Rightarrow \tau = [(g+b)/3a]^{0.5}$.

Based on the objective net-cost function in (1), costs are now computed for two expected rates, $t^r = (g/3a)^{0.5}$ and $t = [(g+b)/3a]^{0.5}$.

(3) $C(\tau^r) = -(g/3a)^{0.5}[b + (2/3)g] + b[(g+b)/3a]^{0.5}$,

(4) $C(\tau) = -[(g+b)/3a]^{0.5}[(2/3)(g+b)] + b[(g+b)/3a]^{0.5}$.

Given that a, b, g > 0, $C(t) < C(t^r)$. The second term being the same in both equations, the above inequality results. The tax authority rationally chooses to use the discretionary rate *once* deviation from the agreed-upon rule occurs.

arises from the fact that the argument in section 2.2. pertains to the case where we have discretion from period 1 to period n. Here, we had rules prior to period 1, cheating in period 1, and discretion from period 2 forward.

Considering the conclusions of all three regimes, the following inequalities hold:[16]

(25) $\tau^r < \tau^d$,

(26) $\tau^r < \tau^c$,

(27) $C^{*r} < C^{*c} < C^{*d}$

Unlike the Barro-Gordon conclusion, the cheating equilibrium is not first best; the expected tax rate under rules here is $\tau^r = (g/3a)^{0.5}$. The rules equilibrium is first best whether the tax authority minimizes its own net-cost function or maximizes some social objective function. Costs under discretion are greatest; consider:

(28) $C^{*d} - C^{*c} = \{(4/9)\,[(g+b)/(3a)]^{1/2}\,(b-g)\} > 0$ iff $g \leq b$

2.5. Regime Comparison and Summary

From equation (27) above, it is clear that the rules equilibrium is the least costly regime available to the tax authority. This result raises an interesting question: why are tax regimes in most countries discretionary? The fact that most countries today have opted for the freedom of discretion in the conduct of fiscal policy requires further explanation. If *r* is the tax authority's discount rate, it is possible to solve for some *r*, say r^d, such that the discounted costs of rules outweigh the discounted costs of cheating and discretion. Cost minimization, thus, does not exclusively explain the observed behavior of the tax authority. If factors other than costs influence the choice of regime, additional constraints have to be imposed upon the tax authority.

To summarize, the analysis demonstrates that when abstracting from discount rates, it is theoretically in the tax authority's best interest to follow rules to procure the revenues needed to finance the optimal consumption level in each period. Rules make up a sustainable equilibrium. Upon introducing discount rates, the fact that discretion appears to be the prevailing regime around the world stops being perplexing. For discount rates high enough, the tax authority rationally chooses discretion over rules. The rule equilibrium stops being inherently sustainable at this point. ***Rules are thus***

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[16] The following parts of the inequality in equation (27) are evident:
$C^{*r} < C^{*d}$ and $C^{*r} < C^{*c}$.

Comparing C^{*c} and C^{*d} involves further investigation. Consider:

$C^{*c} = -(1/3)[(g+b)/3a]^{0.5}[(b + 2g)/3]$,
$C^{*d} = [(g+b)/3a]^{0.5}[(b - 2g)/3]$.

<u>Case 1</u>: If *b ³ g/2*, $C^{*d} \underline{>} 0$ Þ $C^{*d} > C^{*c}$.

<u>Case 2</u>: If *b £ g/2*, the quantity $(b - 2g) \underline{<} 0$ and $C^{*d} \underline{<} 0$. Yet the inequality between the two cost functions is preserved. C^{*c} is more negative than C^{*d}, hence $C^{*c} < C^{*d}$.

sustainable if and only if the discount rate r^r equals zero. [17] For any other discount rate greater than zero, explicit constraints, i.e., rules have to be imposed on the tax authority for tax policy to follow a determinate path. Explicit constraints are needed for rules to prevail. The power that taxpayers have by periodically going to the voting booth prevents the tax authority from setting prohibitive tax rates.[18] In countries where dictatorships prevail, discretionary tax policy leads to prohibitive tax rates; the size of the underground economy in most developing nations and the fiscal problems they face are the ultimate effects of consistently pursuing abusive discretionary tax policy.[19]

3. Empirical Evidence

Let τ_t denote the marginal tax rate in period *t*, defined as:[20]

(29) $\tau_t = \Delta REVPC_t / \Delta YPC_t$

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[17] Suppose that rules prevail in period *i*, $1 < i < n$, and the tax authority decides to follow rules in period *j*, $i < j < n$. The same reasoning would apply to the setting of rules in period *n-1*, and eventually period *n*. If there are sufficient incentives in period *n* to follow rules, by backward induction, the tax authority chooses to follow rules in the first period. *The rules equilibrium is thus sustainable*. What happens to this conclusion when discount rates enter the tax authority's calculus? Is there a discount rate r^r, such that rules are preferred to discretion from period *1* to period *n*?

The tax authority prefers rules to discretion from period *1* to period *n* if and only if:

(1) $PV(C^{*r})_{1..n} \leq PV(C^{*d})_{1..n}$.

Let *r* be the discount rate, and *q* be the discount factor *(q = 1/(1+r))*. Substituting,

(2) $[1/(1-q)][(-2/3)(g/3a)^{0.5}(g)] \leq [1/(1-q)][((g+b)/3a)^{0.5}((b-2g)/3)]$.

Simplifying and rearranging:

(3) $q \geq 1$.

In terms of r^r:

(4) $r^r \leq 0$.

In effect, the tax authority, given any discount rate greater than 0, would rationally opt for an outcome other than rules.

[18] Cukierman and Meltzer (1986) view the periodicity of elections under a different light. They argue that an incumbent policymaker, in an attempt to get reelected, sets policy instruments to increase welfare by the end of its term whether or not the implemented policy involves substantial losses in the period after the election. "The welfare loss is directly traceable to the existence of periodic elections" (pp.368).

[19] There is, to be sure, a variety of other reasons that lead to the dismay found in most developing countries. An explicit elaboration on the subject is beyond the scope of this study.

[20] The marginal tax rate is also computed following the method in Koester and Kormendi (1989). In order to end up with a series of tax rates, the following regression was run for 32 incremented sample periods, i.e., 41-51, 42-52,..., 81-91:

$REVPC_t = a + b_t YPC_t + \varepsilon_t$,

where b_t is the marginal tax rate. b_t illustrates how much of the variation in the revenues series is explained by the income series. The problem with this methodology with respect to both the unit-root test and the search for auto-regressive roots, is that the time periods overlap. Because each two consecutive b_t's span over nine common years, an inherent correlation in the b_t's and the ε_t's that may lead to concluding erroneously that the tax rates series contains roots and that it follows a random walk. The nature of the stochastic process that the above-computed series follows will not be examined.

where $\Delta REVPC_t$ stands for the first difference in real tax revenues per capita in period *t*, and ΔYPC_t denotes the first difference in real personal income per capita in period *t*. τ_t thus measures the one-period change in tax revenues arising from a one-period change in personal income. This measure of the marginal tax rate differs from conventional measures for a variety of reasons. Traditionally, marginal tax rates have been available in various government publications. In addition, recent empirical studies of tax rates have suggested other methods to compute marginal tax rates (for examples, see Koester and Kormendi (1989), Barro and Sahasakul (1986), and Feldstein and Metcalf (1987)). The main advantages of the present method are that not only does it encompass changes in all revenues, but it also bypasses the complications of numerous tax brackets and tax exemptions.[21]

3.1. Data and Results

The nature of the stochastic process that tax rates follow is important because it reveals additional information about the formation of taxpayer expectations. If shocks are permanent, the best predictor of next period's tax rate is the current tax rate. Evidence that tax rates follow a random walk gives applied relevance to the assumption made in section 2; namely that a taxpayer's best expectation for the tax rate in period *t+1*, based on all the information available in period t, is the rate in period *t*. Another consequence of finding that tax rates follow a random walk is that the tax rate series does not have a finite variance. With infinite variances, the Gauss-Markov theorem fails to hold, and Ordinary Least Squares estimates fail to yield consistent parameter estimators. Detrending would not make the tax rate series stationary; only first differencing will yield stationary series (Pindyck and Rubinfeld, 1991 p. 460).[22]

The study uses data for the 48 contiguous American states (Alaska and Hawaii are excluded from the sample). The tax revenue and personal income series are arranged annually for the years 1951 to 1991. τ_t is computed following equation (29).

The search for auto-regressive roots is based on the ARIMA procedure. The procedure consists of first identifying the series, i.e., seeing how many auto-regressive roots it contains.[23] The number of

[21] The method described in equation (29) does not differentiate between different types of taxes. In the numerator of equation (29), we have the annual change in all revenues. Intuitively, taxpayers are mainly concerned with the income left after *all* taxes have been taken out. The practicality of using this method rather than the one described in Koester and Kormendi (1989) is that it allows for a yearly tax rate for each state--while the Koester and Kormendi method allows for one tax rate for each state over the sample.

[22] If tax rates do not follow a random walk, an alternative specification of the tax path would be called for.

[23] It is possible that the identifying phase shows moving averages. By definition, a moving average process of

auto-regressive roots determines the level of differencing required to make the series stationary. The goal is to see if auto-regressive roots exist; if they do, the ADF test will determine if the τ_t series is stationary.

Both the identification and the estimation phases of the ARIMA procedure led to the same conclusion for most states: in 46 of the 48 American states, an ARIMA (*1, 1, 0*) is an appropriate estimate of the process that the τ_t series follows. Moving averages could neither be identified nor fitted to the tax rate series. The numbers in parentheses above are equivalent to saying that one auto-regressive root was identified, and that one order of differencing is consequently required to obtain a stationary series. Because the τ_t series has one root, the application of the ADF test is warranted. The null hypothesis that the data series follows a random walk, could not be rejected in all but two states (South Carolina and West Virginia).

These results provide strong evidence that the best expectation for next period's tax rate is the current tax rate, based on all the information available in the current period. Building on this result, the unexpected tax rate is thus the difference between the tax rate in period *t* and the tax rate in period *t-1*, which is the expected rate as shown in equations (3) to (3'') in section 2. The dichotomy between expected and unexpected tax rates remains a central part of the analysis.

3.2. Significance of Unexpected Tax Rates

Suppose that X is the variable of interest (X can be income per capita, state tax revenues, etc.). Let equation (30) delineate the effect of tax rates on X:

(30) $$X_t = \alpha + \beta_t \tau_t + \varepsilon_t$$

τ_t in equation (30) above is subsequently replaced by the expression $\tau_t = \tau_{t-1} + (\tau^u)_t$ (from equation (3'') in section 2):

(31) $$X_t = \lambda + \delta\tau_{t-1} + \gamma\tau^u + \nu_t$$

where ν_t is assumed to have the same properties as ε_t.

Whether unexpected tax rates are relevant to the analysis of the effects of tax policy rests on both the statistical significance and the magnitude of γ in equation (31). Let the null hypothesis in this case state that the unexpected tax rate is irrelevant, i.e., Ho: $\gamma = 0$. If Ho is rejected, expected tax rates

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order *q* is a process by which a variable is generated by a weighted average of random disturbances going back *q* periods. In case moving averages are identified in addition to auto-regressive roots, we end up with a mixed auto-regressive-moving average process of order (*p,q*), denoted **ARMA**(*p,q*).

should lose much of their significance. When both the unexpected and the expected components of the tax rate series are taken into account, expected tax rates are not anticipated to have much explanatory power relative to unexpected tax rates because they already figure in taxpayers' information sets. In terms of equation (31), it is expected that $\gamma > \delta$.

Equation (31) is estimated using six separate dependent variables. These are:
Real Income per Capita (YPC);
Real State Expenditures per Capita (EXPC);
Real Tax Revenue per Capita (REVPC); and
growth rates in the above three variables.

3.3. Results

Tables 1 through 3 provide the regression results from estimating equation (31). In order to capture intra- and inter-state information, pooling the data in the sample tests the null hypothesis. To depict the relevance of the unexpected component of taxes, the independent variables are limited to the tax rate variables and variables controlling for both linear and non-linear time trends. Table 1 controls for both t and t^2, while Tables 2 and 3 control for t, t^2, and t^3 (i.e., Tables 1 and 2 differ only with respect to the number of non-linear trend variables included in the regressions). Table 3 reports the results for the growth rates in the dependent variables.[24]

In Table 1, there is a consistently significant negative correlation between τ_t and the dependent variables. Increases in the marginal tax rate lead to decreases in both the level and the growth rate in real income per capita. The negative correlation between τ_t and expenditures is justified via the correlation between taxes and revenues. In the second equation run for each of the dependent variables, the expected and the unexpected components of the marginal tax rate are entered as separate variables. In this case, the correlation between the unexpected tax rate and the dependent variables is significant and consistently negative. The equation using income per capita as a dependent variable displays a relatively weak negative correlation with the expected tax rate, τ_{t-1}.

[24] The rationale behind deciding to use only difference terms runs as follows. Given that an **ARIMA**(*1*,*1*,*0*) fits 46 of the 48 American states, differencing once renders the tax rate series stationary. It is often argued that a variety of macroeconomics series is nonstationary (see Nelson and Plosser (1982) for an example). Differencing income and the other dependent variables once is consequently somewhat justified. A systematic investigation of the particular series is certainly required prior to asserting that they do follow random walks. For the purpose of the present section, however, taking the first difference of the dependent variables is equivalent to looking at their growth rates (all variables are in logs except the time trends).

When the same equation is run using the first difference in income per capita (e.g., the growth rate in income per capita), the coefficient on the expected tax rate is consistently positive.[25]

The results in Table 2 are consistent with those in Table 1, with the only difference being that the coefficient estimates on the expected tax rate (τ_{t-1}) are consistently positive. The significance of τ_{t-1} is lower in the equations involving the dependent variables in levels than in the equations using the growth rates. The unexpected tax rate is consistently negative and significant at the 1 percent level. Both τ_{t-1} and $(\tau^u)_t$ are considerably more significant in the equations containing the growth rates in the dependent variables. As in Table 2, τ_t decreases real income per capita in both levels and growth rates; the correlation between expected taxes and the three variables remains positive in this case; and unexpected tax rates are again negatively correlated with all three dependent variables in levels and first-differenced.

All variables in Table 3 are difference terms, and the reported equations control for t, t^2, and t^3. In Tables 1 to 3 a significant negative relationship is identified between τ_t and the dependent variables.[26] The unexpected component is consistently negative and significant at the 1 percent level. The magnitudes of the coefficients on the unexpected tax rate variables are consistently greater than the coefficients on the expected tax rate variables. With respect to equation (31), $\gamma > \delta$. Note that by construction, the independent variable in each equation (1) in Table 3 is the first difference of the actual marginal tax rate. Yet based on equation (3") in section 2 and the results of the ADF test, that first difference corresponds to the unexpected marginal tax rate. The unexpected tax rate is on the right-hand side of all equations in Table 3.

These facts lead to two main conclusions. First, the coefficient on the unexpected component does not vary across different specifications for the same dependent variable. The statistical significance of the unexpected component also changes very little. The coefficient estimates on the unexpected tax rate variable are robust. Second, the sign on the expected component-the second difference in the actual marginal tax rate-is positive but insignificant in all instances. These two conclusions lead to

[25] This result suggests that although income per capita may be negatively affected by expected tax rates, the strength of the correlation decreases with respect to time, thus the positive correlation between expected tax rates and the growth rate in income per capita.

[26] It may at first seem counter-intuitive to find that there is a negative correlation between tax revenues per capita and marginal tax rates, but it is helpful to keep in mind that the marginal tax rate used here is the effective marginal tax rate, computed using equation (29). A negative correlation means that once all taxes have been taken into account, the conventional positive correlation between tax rates and tax revenues disappears.

the statement that whether investigated in levels or difference terms, the unexpected marginal tax rate is a relevant variable. The null hypothesis, Ho: $\gamma = 0$, is rejected at the 1 percent level of significance in all equations in Tables 1, 2, and 3. There is no systematic positive relationship between τ_t and tax revenues.

Finally, a recurrence in the results is worth emphasizing: the sign on the expected tax rate component is positive across all three tables with one exception (the equation involving the levels in real income per capita in Table 1). Based on the stochastic process of expectation formation, the expected tax rate in the current period is the tax rate that prevailed in the previous period. The sign on the expected component is positive because its value becomes part of taxpayers' information sets. Once incorporated in taxpayers' information sets, the expected tax rate helps them figure out their expected tax burden for the period to come. Taxpayer memory is long-lasting; further lags on expected components remain positive. When the expected tax rate (τ_{t-1}) figures in taxpayers' information sets, all further lags also implicitly figure in the information sets because further lags are factored in τ_{t-1}.

3.4. Summary

Unexpected tax rates are relevant to the evaluation of the effects of fiscal policy and the strength of the case against the use of discretion in the domain of fiscal policy rests on the ability to distinguish between expected and unexpected taxes, and on the validity of this distinction. An investigation of the nature of the process that state-tax-rate series follow is undertaken to see if the data support the assumed process of expectation formation.

An **ARIMA**(*1,1,0*) fits the tax rate series in all 48 contiguous American states. Differencing once is consequently required to achieve stationarity. The ADF test asserts that in 46 of the 48 states the auto-regressive root identified above is a unit root, meaning that shocks to the state-tax-rate series are permanent. The τ_t series computed based on equation (29) follows a random walk in 46 of the American states. This evidence thus supports the assumed process of expectation formation formalized by equations (1) to (3) in section 2. A taxpayer's best expectation, based on all the available information at the end of period *t* for the tax rate next period corresponds to the tax rate that prevailed in time period *t*. The implications of the conclusion that the tax rate series follows a random walk are cogent to the analysis. Shocks lead to permanent effects rather than transitory effects. This observation mandates a major reconsideration of the effects of tax policy in general and fiscal fine-tuning in particular. Fiscal fine-tuning involves a series of continuous shocks to the path that the tax rate series follows. The inherent permanency of the shocks to a non-stationary series can lead the economy farther away from any chosen "optimal point." Repeating this action over a given period, as is implied by fiscal fine-tuning, introduces both instability and uncertainty concerning current and future economic conditions. Uncertainty about current economic conditions affects current investment decisions, which in turn help define future economic conditions. Uncertainty and instability in the present thus help perpetuate uncertainty about future economic conditions.

The empirical issue is whether unexpected tax rates are relevant to the evaluation of the effects of tax policy. The findings strongly indicate that unexpected tax rates are relevant in the determination of the effects of tax policy.

4. Conclusion

The rules-versus-discretion debate has come a long way since the 1940s. Friedman (1948, 1960) argued in favor of rules in an attempt to alter the interventionist spirit of pro-Keynesians. The development of optimal control theory gave a new meaning to interventionism. In response, the macroeconomics literature (Kydland and Prescott 1977, Barro and Gordon 1983a, 1983b, and Barro 1986), through the adoption of the rational expectations hypothesis, presented formal propositions favoring the restriction of the monetary authority's discretion. The macroeconomics literature demonstrated that rules constitute the underpinning arguments in favor of preventing the monetary authority from taking advantage of the expectational Phillips curve.

The above framework suggests that the rules-versus-discretion debate is relevant to tax policy, and deals with issues not related to arguments about the appropriate size of government. This study extends the Barro-Gordon (1983a) framework to evaluate the proper role for rules in fiscal policy. The method suggested in this study emphasizes the importance of the unexpected changes in tax rates, and recognizes that they are a direct consequence of discretionary fiscal policy. A theoretical model is developed to demonstrate that an "infinitely lived" policymaker would favor rules that resist unforeseen changes in future tax rates. Rules are proven sustainable. Upon introducing discount rates (e.g., a finite term for the policymaker), this study demonstrates that it is rational for the tax authority to favor a discretionary regime over rules. In that setting, the rules equilibrium is no longer inherently sustainable. Hence the call for explicit binding constraints.

The empirical investigation using U.S. state data investigates the stochastic process that the marginal tax rate series follows, and tests the hypothesis that unexpected tax rates are relevant to the evaluation of the effects of tax policy. An **ARIMA**(*1,1,0*) fits the tax rate series in all 48 contiguous American states. The ADF test determines that in 46 out of the 48 states the identified auto-regressive root is a unit root, meaning that shocks to the state-tax-rate series are permanent. This finding also upholds the process of expectation formation outlined in section 2, i.e., the best available estimate of next period's tax rate is the current period's rate. The hypothesis that unexpected tax rates are irrelevant to the evaluation of tax policy is rejected at the 1 percent level of significance in all instances.

It is therefore best to aim for increased predictability in the fiscal system. An increase in predictability over time leads to economic stability. Economic stability in most cases encourages economic growth, and countries experiencing positive growth rates tend to be politically stable. But increased predictability is not an outcome that the tax authority would voluntarily adopt, given any discount rate greater than zero. Specific binding rules have to limit the tax authority's policy set, in order to reach an equilibrium based on rules. In an attempt to verify the validity of the claims in this study, empirical tests are currently being run, yielding the preliminary conclusion that the states with fiscal rules in place fare better than those without rules. The majority of the states with rules have amended their constitutions to place limits on either the spending or revenue side, with the added constraint that a super majority is needed to deviate from the rule. It is plausible to think that the same rules could be implemented at the federal level, eliminating the tax dimension from presidential campaign rhetoric. Explicitly agreed-upon rules would limit the range within which tax rates vary, and consequently restrict their volatility. With uncertainty reduced over a sufficiently long time horizon, optimal plans could be implemented at both the private and public level.

Consider that the "typical" business plan is one that spans 5 to 10 years. Business owners, large and small present these plans based on a given set of assumptions about the economic environment they operate in. Small business researchers and advocates have continuously argued and suggested that federal regulations top the priority lists of small businesses, mainly regulations introducing changes to the existing fiscal structure. Federal regulations in general have been shown to disproportionately burden small business. The optimality of current plans can only be enhanced by increased predictability of the fiscal structure that small business owners will face as their plans unfold. Explicit binding constraints would guarantee that certain data, while known to all economic agents, would also be valid in periods outside the scope of the election cycle. Explicit binding constraints are required simply because the least costly outcome is not inherently sustainable, as Note 17 attests, in their absence.

Table 1: **SIGNIFICANCE TESTS FOR $(t^{u})_t$ --Controlling for *t*, and t^2**

(Absolute value of T-Ratios in parentheses)

		INDEPENDENT VARIABLES			Buse Raw-Moment R^2
		t_t	t_{t-1}	$(t^{u})_t$	
DEPENDENT VARIABLES:					
YPC_t					
	(1)	-.039 (4.91)			.76
	(2)		-.0002 (0.028)	-.032 (4.32)	.75
D**YPC_t**					
	(1)	-.27 (14.08)			.09
	(2)		.095 (4.43)	-.32 (14.66)	.10
$REVPC_t$					
	(1)	-.02 (3.84)			.78
	(2)		.00015 (0.031)	-.019 (4.07)	.77
D**$REVPC_t$**					
	(1)	-.18 (13.59)			.09
	(2)		.066 (4.44)	-.22 (14.63)	.10
$EXPC_t$					
	(1)	-.019 (3.81)			.78
	(2)		.003 (0.64)	-.019 (4.06)	.76
D**$EXPC_t$**					
	(1)	-.18 (13.71)			.09
	(2)		.062 (4.22)	-.22 (14.62)	.10

Table 2: **SIGNIFICANCE TESTS FOR $(t^{u})_{t}$ --Controlling for t, t^2, and t^3**

(Absolute value of T-Ratios in parentheses)

		INDEPENDENT VARIABLES			**Buse Raw-Moment R^2**
		t_t	t_{t-1}	$(t^{u})_{t}$	
DEPENDENT VARIABLES:					
YPC_t					
	(1)	-.038 (5.21)			.77
	(2)		.0041 (0.58)	-.034 (4.99)	.76
D**YPC_t**					
	(1)	-.27 (13.74)			.09
	(2)		.10 (4.70)	-.31 (14.51)	.10
$REVPC_t$					
	(1)	-.019 (3.97)			.78
	(2)		.0023 (0.52)	-.021 (4.56)	.76
D**$REVPC_t$**					
	(1)	-.18 (13.12)			.09
	(2)		.072 (4.78)	-.21 (14.46)	.10
$EXPC_t$					
	(1)	-.018 (3.96)			.78
	(2)		.0055 (1.23)	-.019 (4.59)	.76
D**$EXPC_t$**					
	(1)	-.18 (13.19)			.09
	(2)		.069 (4.59)	-.21 (14.40)	.10

Table 3: **SIGNIFICANCE TESTS FOR $(t^{u})_{t}$ --Controlling for t, t^2, and t^3**

ALL VARIABLES ARE DIFFERENCE TERMS

(Absolute value of T-Ratios in parentheses)

		INDEPENDENT VARIABLES		**Buse Raw-Moment R^2**
	Dt_t	Dt_{t-1}	$(t^{u})_{t}$	
DEPENDENT VARIABLES:				
D**YPC**$_t$				
(1)	-.29 (13.86)			.09
(2)		.031 (1.47)	-.29 (13.95)	.09
D**REVPC**$_t$				
(1)	-.20 (13.75)			.09
(2)		.021 (1.42)	-.20 (13.84)	.09
D**EXPC**$_t$				
(1)	-.20 (13.8)			.09
(2)		.021 (1.39)	-.20 (13.88)	.09

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