A Positive Theory of Tax Reform*

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Abstract

The political impediments to reform and the forces allowing its success are studied in a model where the tax base and statutory rate are separate instruments of tax policy. The model predicts that big bang reforms—large changes in the tax code–may be easier to enact than marginal reforms. Preferences over the tax base face a tipping point where even the beneficiaries from tax exemptions support reform. At such a "reform moment", tax reform is Pareto improving. Politically feasible tax reform occurs when fiscal needs are large, but may nonetheless involve reductions in marginal tax rates. There is strategic complementary in lobbying for tax exemptions, resulting in multiple equilibria. Evidence from tax-base changes in a panel of OECD countries supports a number of the main predictions.

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1 Introduction

In an era of fiscal austerity, questions of tax reform have once again taken center stage. In recent U.S. debates, both political parties expressed support for reform.[1] During the debt crisis in Southern Europe, calls to reform the tax systems of Spain, Portugal, Italy, and Greece could be heard. Tax reform has been one of the most contentious issues facing the current Indian parliament. Why has the passage of reform been so difficult? Why do inefficient tax systems persist? Are there economic or political conditions that are particularly propitious for tax reform?

I propose a tractable model where a government meets its revenue needs through a choice of not only the tax rate, but also the tax base. Given that many tax reforms involve changes in the tax base, the study of these two dimensions is central to the discussion in this paper. In the model, the policy maker may benefit specific groups through tax exemptions. All agents and goods are identical ex-ante and there is no economic rationale for such exemptions. A broader tax base is more efficient, as it removes a wedge between the prices of taxed- and tax-exempt goods. In political equilibrium, certain goods may nevertheless be exempt from taxation. The rents from tax exemptions are large and concentrated, while their costs are diffuse. If a special interest benefits from a tax exemption, it will attempt to secure a tax break despite its inefficiency. This phenomenon is familiar from our understanding of special interest politics.[2]

The novelty is the study of the general equilibrium implications of the inefficient policies that result. While a tax exemption increases the *relative* demand for a good, the resulting inefficiencies reduce *aggregate* demand. The model yields a simple expression that quantifies the general equilibrium losses borne directly by the beneficiaries of tax exemptions. When inefficiencies in the tax code reach a critical point, even the beneficiaries themselves are willing to forgo their tax breaks in favor of tax reform: the elimination of *all* tax exemptions.

Importantly, no (small) special interest would forgo its tax break in isolation. The rents from a single exemption are large, but the general equilibrium gains from its elimination are negligible. At the same time, a broad coalition

[1]Specifically, broadening the tax base was central in the tax policy platforms of both presidential candidates in 2012. See http://www.whitehouse.gov/economy/reform/tax-reform/ and http://www.ontheissues.org/2012/mitt_romney_tax_reform.htm

[2]See Grossman and Helpman (2002), for example.

of special interests may agree collectively to give up their tax breaks for tax reform. Marginal reforms are therefore politically difficult, while "big bang" reforms are feasible via a grand bargain. I study the (minimum) coalition size that would collectively forgo its tax exemptions for the enactment of tax reform. I show that the size of this coalition is decreasing in the government's need to raise revenues. The scope for tax reform is therefore greater when the government wishes to raise more revenues.

I explore political equilibrium in a simple lobbying framework. The insights of the model are robust to a variety of collective choice frameworks, but lobbying captures succinctly the conflict between special- and general-interests, central to the politics of tax reform. Any citizen is free to lobby the government at a fixed cost. Lobbyists bearing this cost are then represented equally in the policy maker's objective function. I show that there are strategic complementarities in lobbying choice. The tax base narrows when more lobbyists seek tax breaks. Attaining the same revenues with a narrower base requires higher statutory tax rates on all other citizens. More lobbying therefore makes tax breaks more valuable, in turn giving greater incentive to lobby. As in other settings, strategic complementarities may lead to multiple equilibria. In one equilibrium, the tax base is comprehensive and citizens do not lobby for tax breaks. In the other equilibrium, lobbyists enter the political fray and secure tax breaks if public good needs are small. However, there is a critical level of public goods, above which special interests forgo their exemptions in favor of tax reform.

The model has a number of predictions on the politics of tax policy. First, tax reform is more likely when revenue needs are high. Using data on corporate tax legislation in a panel of OECD countries, I show in section 4 that legislation to broaden the tax base is indeed associated with high public consumption and several other variables suggestive of fiscal strain.

Second, there is a tipping point that triggers tax reform. When it is reached, policy changes discretely rather than gradually or on the margin. In this setting, a reform-minded policy maker would be advised to propose a "big bang" reform that takes on numerous special interests at once, rather than gradually picking off individual interests. This provides a counterpoint to theories of gradualism in reform (e.g. Dewatripont and Roland, 1992) and much of the political economy literature of reform, where small or gradual policy changes are typically easier to enact.[3] In appendix B, I give a historical

[3]There is also a long tradition in public economics that assumes that the tax system

overview of a number of recent tax reforms in OECD countries. Many of these were large changes rather than tinkering on the margin of the tax code. The Tax Reform Act (TRA) of 1986 in the United States, for example, lowered the top marginal income tax rate from 50% to 28%. As Birnbaum and Murray (1987) write:

> "Congress was a slow and cumbersome institution that usually made only piecemeal, incremental changes. Tax reform proposed something very different: a radical revamping of the entire tax structure." *Kindle Loc. 504.*

Third, tax reform typically involves a broadening of the tax base and a *reduction* in marginal tax rates. A decrease in marginal rates may seem surprising when public good needs are large. But not so if one recognizes that the change in the tax base is discrete and large in a "big bang" tax reform. This frees revenues to decrease marginal tax rates–politically necessary to compensate losers from reform. This prediction contrasts with normative theories of the tax base, where the tax base and tax rates increase in tandem. In section 4, I show empirically that base-broadening reforms are associated with cuts in statutory tax rates. Birnbaum and Murray (1987) suggest that this combination was central to the politics of tax reform in the U.S.:

> "Merging the lower rates of the supply-siders with the base-broadening of the liberal tax reformers was the glue that held the 1986 tax bill together... The ability of this unholy alliance to stick together throughout an arduous process... was the key to success." *Kindle Loc. 162.*

Fourth, at a reform moment of this sort, tax reform obtains unanimous support–even from the very special interests vying for tax breaks.

A large literature has studied the political forces shaping tax policy.[4] Homing in on tax *reform* is motivated by a number of observations, which help highlight this paper's contribution. First, the landmark tax reforms of recent decades involved changes in not only statutory tax rates, but also the

can only be altered on the margin due to political constraints. See Dixit (1975), Feldstein (1976), and more recently Golosov, Tsyvinski, and Werquin (2014).

[4]See Alt et al (2009) and Persson and Tabellini (2002) for comprehensive literature reviews and Castanheira et al (2012) for discussions of the politics of tax reform.

tax base. Broadening the tax base was one of the main objectives of the Tax Reform Act of 1986 in United States. Value-Added-Tax reforms in Canada and Sweden, both enacted in 1991, involved significant increases in the tax base. The 2000 corporate tax reform in Germany similarly involved a substantial broadening of the base. In existing theories of the political economy of taxation, the tax base is typically exogenous and usually comprehensive. The large normative literature building on Mirrlees (1971) has individuals each taxed at a distinct rate and it is difficult to distinguish the tax base from a continuum of statutory rates. Given the prominence of the tax base in reform proposals, a model that makes such a distinction may contribute to our understanding of the politics of taxation.

Second, the existing literature focuses primarily on vertical discrimination in taxation. In, contrast, much of the discourse surrounding tax reforms concern horizontal equity. For example, the TRA in the U.S. was explicitly designed to be neutral in its impact on vertical income distribution. This paper intentionally abstracts from questions of vertical equity and sharpens the discussion on horizontal inequities in the tax code.

Finally, the tax system changes in leaps and bounds. The tax base remains unchanged over long periods, with some tinkering with statutory rates and tax exemptions within the existing tax system. These are punctuated with occasional reforms that change the tax system more substantially. This paper explores the politics of these reform moments.

The paper also relates to the literature on the politics of economic reform.[5] A common thread in this literature is the tension between particularistic interests and overall economic efficiency. This tension is present in this paper as well, but it differs in its general equilibrium setting. General equilibrium allows us to assess the individual losses and general equilibrium gains from tax reforms. This provides new insights, such as the complementarity in special interests' lobbying incentives. It also provides a prediction that contrasts with most existing studies of the political economy of reform: the political benefit of big bang reforms.

The paper relates more generally to the large literature on the role of special interest politics, the nexus between political and economic power, and public choice mechanisms, among other explanations for "political failures"

[5] See Acemoglu and Robinson (2000); Alesina and Drazen (1991); Fernandez and Rodrick (1991); and Jain and Mukhand (2003).

of this sort.[6] Tax reform is just one instance of policy reform albeit one where we can cast light on the persistence of inefficient policy more generally. Illustrating these general points through the lens of tax policy has a number of advantages. First, the dead-weight losses of inefficient tax policies are readily assessed in a familiar public finance context, as are the benefits of tax provisions targeted to special interests. Second, tax policy is a popular vehicle for targeting special interests in practice. The Congressional Budget Office (CBO, 2013) estimates that the United States Treasury forgoes over one third of potential individual income tax revenues through "tax expenditures". This sum is similar in magnitude to all discretionary spending in the U.S.[7] Given the sums involved, it is of independent interest to understand the politics of tax expenditures.[8]

The remainder of the paper is organized as follows. Section 2 describes the economic environment and derives citizens' policy preferences. Section 3 describes the political model and equilibrium. Section 4 provides some supportive evidence from corporate tax legislation in OECD countries. Section 5 concludes. Proofs are in the appendix. The appendix also provides a narrative history of recent tax reform in major economies and relates these experiences to the model's predictions. Robustness checks and extensions can be found in the online appendix.

2 The Economy

This section outlines the economic structure of the model, how the economy responds to tax policy, and citizens' resulting policy preferences. The economic structure builds on a normative literature of the optimal tax base: Yitzhaki (1979), Wilson (1989), and Slemrod and Kopczuk (2002). Citizens have CES preferences over the consumption of a measure-one continuum of goods varieties. Income is taxed at a statutory tax rate τ, but some goods are deductible from taxation. The measure of exempt goods is given by $1-f$, so that f is a measure of the tax base. This gives two clear dimensions to

[6] See Grossman and Helpman (2002); Acemoglu and Robinson (2001); and Besley and Coate (1998), respectively, as examples.

[7] GAO estimates: http://www.gao.gov/key_issues/tax_expenditures/issue_summary

[8] Tax expenditures are not a uniquely U.S. phenomenon. Tax expenditures in Australia and Italy are estimated at 8% of GDP, 6% in the U.K., and 4% in Spain, for example. Source: Tyson (2014).

tax policy: statutory rates and the tax base.[9]

The model that follows differs from the aforementioned papers by adding three general equilibrium components, each of which is essential to the discussion. First, competition in the goods market is monopolistic. This gives producers profits increasing in the demand for their product. Producers therefore have a vested interest in securing a tax break for their variety.

Second, production is endogenous, using elastically-supplied labor as an input. This contrasts with the endowment economy studied in Yitzhaki (1979) and others. Endogenous output creates feedback from tax policy to aggregate demand and back to firms' profits. A narrow tax base increases the labor wedge, thus lowering output and aggregate demand. The tension between the rents provided by individual breaks and the aggregate-demand costs of a narrow tax base are central to the analysis.

Finally, while the existing literature is normative, the analysis here is positive, with policy set due to political factors. In this section, we take policy as given; the political determinants of policy are then studied in section 3.

2.1 Model Setup

Agents and Preferences The economy consists of a continuum of identical citizens of unit measure indexed by $j \in [0,1]$. Each citizen is a worker, consumer, entrepreneur, and citizen–terms that I will use interchangeably. The citizen values streams of consumption x^j and hours worked h^j according to the function

$$u^j = x^j - \frac{\left(h^j\right)^{1+\frac{1}{\eta}}}{1+\frac{1}{\eta}}. \tag{1}$$

Citizens' Income Each hour worked pays a wage of w units of the consumption good. Consumer j also earns profits π^j from a *single* firm she owns; it is one of a unit measure of firms indexed by $i \in [0,1]$. Firms' indexes match their owners'. The non-diversified ownership structure is somewhat stark, as is the assumption that all citizens derive positive profit income. As I discuss in section 2.2, any other ownership structure can be easily accommodated in this framework.

[9] The model is isomorphic to one where a statutory consumption tax is applied to a measure f of goods and $1-f$ goods are exempt. The chosen formulation maps more directly to major tax exemptions in the U.S.

Consumption and Intermediate Goods Each firm produces a single intermediate good variety, sold at a price of $p(i)$. Let $x^j(i)$ denote consumer j's demand for variety i. Households bundle individual varieties through a CES aggregate to give consumption x^j of

$$x^j = \left[\int_{i=0}^{1} \left(x^j(i)\right)^{\frac{\varepsilon-1}{\varepsilon}} di\right]^{\frac{\varepsilon}{\varepsilon-1}},$$

with $\varepsilon \geq 1$ giving the elasticity of substitution across varieties.

Tax Policy Public good needs are exogenously given as g and the government must raise sufficient tax revenues to finance them.[10] I show in the online appendix that the model's results are robust to an endogenous demand for public goods. Tax policy consists of two instruments: the tax rate τ and the tax base f. Personal income $wh^j + \pi^j$ is taxed at a uniform rate τ. However, varieties of intermediate goods in $i \in [f, 1]$ are fully deductible from income taxation.[11]

Given that intermediate goods are identical (e.g. in their price elasticity of demand), there is no economic rationale to provide a tax exemption to any specific variety. The theory of uniform commodity taxation, harking back to Ramsey (1927), suggests that a social welfare maximizer would set $f = 1$. Moreover, unlike the literature on the optimal tax base, I assume no administrative costs to tax enforcement.[12] Any deviation from a complete tax base is therefore due political, rather than economic, forces.

This tax structure is a simple way to capture realistic features of the tax code, namely that tax exemptions can be individually targeted to special interests, but also that such exemptions tend to provide a discrete, rather than a marginal, benefit to their recipients. It is not essential that deductible

[10] The public good is assumed to be a specific variety: $i = 1$. The government purchases this good from firm $i = 1$ at a price of 1, which I will later show to be the market price of the good in the absence of government intervention. In other words, the government does not exploit its market power to affect the public good's price, nor can the firm exploit its position as the monopolistic provider of the public good to charge an unusually high markup. The assumption that the government purchases a specific variety is for analytical convenience, but does not affect any of the insights delivered by the model.

[11] Identifying tax exempt goods as those with higher i indexes is for notational convenience and without loss of generality.

[12] Allowing for administrative costs would not alter the model's results and would unnecessarily obfuscate the political motivations for a narrow tax base.

goods qualify for a 100% tax refund. Allowing for a continuum of tax breaks would muddle the distinction between the tax base and the tax rate. In the online appendix, I allow the tax system to be determined endogenously, with a policy maker who can set the size of exemptions freely, and show that the main insights do not rely on full exemption. In any case, administrative factors may limit the number of existing tax brackets in practice: see Hettich and Winer (1984) for a discussion.

Modeling the tax base in this way mirrors the main "holes" in the U.S. income tax base. The largest tax exemptions include mortgage interest deduction ($67 billion in fiscal year 2014) and exclusion of employer provided health insurance ($195 billion in fiscal year 2014).[13] Income used for the purchase of these goods is (partially) deductible from income taxation.

Budget Constraint and Consumer Choice Given tax policy $\{\tau, f\}$, the consumer's budget constraint is given by

$$\underbrace{\int_{i=0}^{1} p(i)\, x^j(i)\, di}_{\text{Consumption Expenditure}} \leq \underbrace{(1-\tau)\left(wh^j + \pi^j\right)}_{\text{After-tax income}} + \underbrace{\tau \int_{i=f}^{1} p(i)\, x^j(i)\, di}_{\text{Tax deduction}} \tag{2}$$

Consumer choice is then to maximize (1) through a choice of varieties $\{x^j(i)\}_{i=0}^{1}$ and labor supply h^j, subject to (2).

Consumption Bundle and Demand for Varieties Consumer demand for individual varieties is given by

$$x^j(i) = \left((1-\tau(i))\frac{p^c}{p(i)}\right)^{\varepsilon} x^j,$$

where $\tau(i)$ is the statutory rate τ for all goods in the tax base $i \in [0, f)$ and zero for all tax-exempt goods $i \in [f, 1]$. p^c is the after-tax consumer price index

$$p^c \equiv \left(\int_{i=0}^{1} \left(\frac{p(i)}{1-\tau(i)}\right)^{1-\varepsilon} di\right)^{\frac{1}{1-\varepsilon}}. \tag{3}$$

[13]GAO estimates. See http://www.gao.gov/key_issues/tax_expenditures/issue_summary

Firms Each firm i has a technology that transforms $h(i)$ units of labor into $zh(i)$ units of good i. Firms are identical in their productivity; firms with heterogeneous productivities are studied in the online appendix. Each firm faces a fully competitive labor market, but a monopolistically competitive (Dixit and Stiglitz, 1977) goods market. Monopolistic competition aides our analysis in two ways. First, firms' profits are decreasing in the tax on their variety, so that tax exemptions are redistributive. Second, firms' profits are proportional to the demand for their varieties, so that firms benefit from higher aggregate demand, allowing for a general equilibrium demand externality.

Each firm hires workers at the market wage w and sells its intermediate good at price $p(i)$. Profit maximization gives the standard result that prices are set at a constant markup $\mu \equiv \frac{\varepsilon}{\varepsilon-1}$ over marginal costs: $p(i) = \mu \frac{w}{z}$.

Normalizing the producer price (identical for all firms) to one, the consumer price index (3) can be written as $p^c = \frac{1}{1-\hat{\tau}}$, where $\hat{\tau}$ is the effective tax rate defined as

$$1 - \hat{\tau} \equiv \left[f(1-\tau)^{\varepsilon-1} + (1-f) \right]^{\frac{1}{\varepsilon-1}}.$$

The effective tax rate is equal to the labor wedge. It is useful to anticipate at this point that raising one unit of revenues via an increase in the statutory tax rate τ will always increase $\hat{\tau}$ by more than raising the unit of revenues via an expansion of the tax base f. Thus increases in tax rates are less efficient than broadening the tax base.

Finally, firms' profits are directly proportional to demand for their varieties: $\pi(i) = \frac{\mu-1}{\mu} x(i)$.

Government The government collects tax revenues

$$\rho = \tau \left(wh + \pi - \int_{i=f}^{1} p(i)\, x(i)\, di \right), \tag{4}$$

which are income tax revenues net of deductions. The government uses these revenues to supply the public good, so that $\rho \geq g$.

Labor Supply and Consumption Workers' first order condition for the supply of labor gives

$$h = h^j = \left(\frac{z(1-\hat{\tau})}{\mu} \right)^{\eta}. \tag{5}$$

Consumer j's consumption can now be written as

$$x^j = (1-\hat{\tau})\left(wh^j + \pi(j)\right). \tag{6}$$

2.2 Indirect Utility

The utility of citizen j is given by (1). h^j is determined by (5) and x^j is given by (6), so that the indirect utility of a citizen $j < 1$ can be described by

$$u^j = \left(\frac{z(1-\hat{\tau})}{\mu}\right)^{\eta+1}\left(\frac{1}{1+\eta} + (\mu-1)\frac{(1-\tau(j))^{\varepsilon}}{(1-\hat{\tau})^{\varepsilon-1}}\right).^{14} \tag{7}$$

This indirect utility function can be separated into two easily-interpretable terms. The first reflects the utility of the citizen in her role as worker; the second, in her role as entrepreneur. The model can thus be easily adapted to other assumptions regarding the distribution of ownership, monopoly rents, and income in society. The assumption that every citizen owns a firm can be easily altered, as can the assumption that workers do not share in the monopoly rents of their employers.

The first term,

$$u^W \equiv \frac{1}{1+\eta}\left(\frac{z(1-\hat{\tau})}{\mu}\right)^{\eta+1}$$

is the utility of citizen j as a worker. It gives the utility of consumption from labor income net of the dis-utility of supplying this labor: $wh - \frac{h^{1+\frac{1}{\eta}}}{1+\frac{1}{\eta}}$. It is immediately apparent that all workers derive the same utility. In addition, the effects of tax policy on this component of utility is entirely captured by the effective tax rate $\hat{\tau}$. We will see that raising a unit of revenues by increasing the statutory tax rate τ increases the effective tax rate $\hat{\tau}$ by more than raising revenues through a broadening of the tax base f. Workers therefore always prefer the broadest possible tax base.

[14] Although μ is a function of ε, I treat the two as separate parameters in what follows. This is without loss of generality as it leaves $\mu = \frac{\varepsilon}{\varepsilon-1}$ as a special case. De-linking markups from the elasticity of substitution is readily obtained in a model with a two-tiered CES with the markup deriving from the elasticity of substitution between closely-substitutable varieties within industries whose goods are substitutable with an elasticity of ε. De-linking the two parameters allows separate comparative statics for the two.

The second term

$$\pi(j) = (\mu - 1) \underbrace{\left(\frac{z(1-\hat{\tau})}{\mu}\right)^{\eta+1}}_{\text{Aggregate Demand}} \underbrace{\frac{(1-\tau(j))^{\varepsilon}}{(1-\hat{\tau})^{\varepsilon-1}}}_{\text{Relative Demand}} \tag{8}$$

gives profits or the utility of citizen j in her role as entrepreneur. Profits from the total sales of variety j are affected by both aggregate and relative demand. The term labeled as aggregate demand is familiar from the utility of workers, as it is proportional to total consumption. Aggregate demand is decreasing in the effective tax rate.

The term $\frac{1-\hat{\tau}}{1-\tau(j)}$ is the relative price of good j. Thus $\left(\frac{1-\tau(j)}{1-\hat{\tau}}\right)^{\varepsilon-1}$ is the relative demand for good j. This is the only term in citizens' preferences where the statutory tax rate and the tax base appear separately from the effective tax rate. A higher statutory tax rate τ increases the relative price of and lowers the relative demand for goods that are in the tax base. It lowers the profits of "taxed" firms: those that do not have a tax exemption.[15] The tax base f determines whether a specific product is sheltered from taxation.

These two terms highlight how firms benefit from tax exemptions, but also bear a cost, through general equilibrium channels. The value of securing an individual tax exemption can be gleaned from a comparison between the profits of a firm with, to one without, a tax exemption. Relative demand for the product of the "exempt" firm is higher by a discrete margin. Accordingly, this firm's profits are higher by a discrete amount. Entrepreneurs have a strong incentive to secure a tax exemption.

For a given revenue need, the effective tax rate is minimized, however, by relying on the broadest possible tax base. Aggregate demand is therefore harmed by a narrow tax base. The aggregate demand term in (8) demonstrates that entrepreneurs internalize, to some extent, the costs of their tax exemptions. However, the aggregate demand cost of any single tax exemption is infinitesimal, while the benefits to its recipient are not. No citizen would unilaterally forgo her own tax benefit. The aggregate demand channel does leave scope, however, for a group of citizens to benefit from collectively forgoing their tax exemptions.

Consumers and taxed firms are always harmed by taxation. In contrast, exempt firms may benefit from a higher effective tax rate. A higher effective

[15] Profits of all firms are taxed. I use the term "taxed firms" as shorthand for firms whose goods are not tax deductible.

tax rate decreases aggregate demand, but also increases the average price level, without altering exempt goods' prices. A higher $\hat{\tau}$ thus increases the relative demand for exempt goods. The aggregate demand cost of taxation outweighs its relative demand benefit if and only if $\eta + 1 > \varepsilon - 1$.[16]. More generally, citizens attitude to taxation, before considering the government's budget constraint, can be summarized in the following Lemma.

Lemma 1 *All citizens prefer a lower tax rate and a narrower base if*

$$(1 - \hat{\tau})^{\varepsilon - 1} > (\mu - 1)(\varepsilon - \eta - 2). \tag{9}$$

The lemma ranks utilities, not policy preferences, which would incorporate the trade-off between the need to raise public revenues and the cost of taxation. Lemma 1 shows, however, that even in the absence of greater revenue needs, tax-sheltered citizens may prefer higher effective tax rates. This may occur only if $\varepsilon - 1 > \eta + 1$, i.e. if relative demand dominates aggregate demand in determining the profits of tax-sheltered firms.

The possibility that tax-sheltered firms may prefer higher levels of taxation may have some interesting implications, but these go beyond the scope of this paper and needlessly complicates analysis. In all that follows, I therefore restrict attention to parameter values such that all citizens dislike higher taxes. Formally, I assume that (9) holds. Let us define this region of the state space as one where citizens are *tax averse* and maintain this assumption throughout the remainder of the analysis.[17]

[16]This echoes the result in Auerbach (1985) that the relative magnitudes of own- and cross-elasticities are critical in determining the excess burden of taxation.

[17]Citizens disliking taxes is appealing a-priori, but also holds for realistic parameterizations. To see what it would take to violate (*9*), let us set η to the lower-end of its estimated range at $\eta = 0.3$, where (*9*) is less likely to hold. The parameter ε is the elasticity of substitution between varieties of goods. In our case, the relevant elasticity is that between taxed and tax-exempt goods. While some differentiated taxation exists between narrowly defined products, the more relevant elasticity would appear to be between broader categories, such as food items vs. housing vs. automobiles. I therefore set $\varepsilon = 2$, following Broda and Weinstein (2006). With these parameters, the effective tax rate $\hat{\tau}$ would need to exceed 41% to violate (9). To put this in further perspective, with a tax base of $f = 80\%$–almost certainly an overestimate for the U.S., based on CBO estimates (CBO, 2013)–this implies average statutory tax rates τ exceeding 60%. This tax rate is on the higher bound of those observed across the world, and moreover exceeds the peak of the Laffer curve, given the aforementioned parameter values and the assumed tax base.

2.3 Policy Preferences

Revenues Preferences over policy must take the government's budget constraint into account. The logarithm of tax revenues $\rho(\tau, f)$ in (4) is given by

$$\log(\rho(\tau, f)) = \log \tau + \log f + \eta \log(1-\hat{\tau}) + (\varepsilon - 1)\log\left(\frac{1-\tau}{1-\hat{\tau}}\right) + \zeta(z, \eta, \varepsilon), \tag{10}$$

where $\zeta(z, \eta, \varepsilon)$ is a term that does not contain the tax instruments f and τ. An increase in either the tax base or the tax rate brings a direct proportional increase in tax revenues, as captured by the first two terms in (10). The remaining terms reflect changes in taxable income due to household incentives. First, an increase in the effective tax rate decreases revenues proportionally to the elasticity of labor supply: the standard disincentive effect of labor taxation. But it is the effective rather than the statutory tax rate that determines the labor wedge.

Tax revenues are further affected by revenue efficiency, captured by the term $\frac{1-\tau}{1-\hat{\tau}}$: the ratio of the statutory and the effective net-of-tax rates. Revenues are decreasing in the wedge between the prices of taxed goods and the CPI, captured by this ratio. A larger wedge makes it more attractive to avoid taxation by purchasing tax-deductible goods. The effect is increasing in the elasticity of substitution across goods: ε.

Figure 1 plots the government's budget constraint for a number of g values.[18] Each curve plots in $\{f, \tau\}$ space a set of tax base and rate combinations that provide the same revenues. The curves are downward sloping as broadening the base allows the government to decrease statutory rates without losing revenues. Moving from left to right, these equi-revenue curves are increasing in the revenues they generate.

[18]In this and all subsequent figures, the following parameter values are used. The Frisch elasticity of labor supply is set at $\eta = 0.5$, an elasticity in the neighborhood of recent studies using microeconomic data. The elasticity of substitution across varieties is set to $\varepsilon = 2$, following Broda and Weinstein (2006). The relevant elasticity is that between taxable and tax exempt goods, which are typically in broad product classifications such as health care, housing, or basic foodstuffs. The markup is set to $\mu = 1.1$, as is common in the macroeconomics literature. I state explicitly when results depend on parameter values. The chosen values–while empirically relevant–are primarily for graphical convenience.

Policy Preferences of Citizen j We can now solve for the policy preferences of a citizen given an exogenously-determined need for revenues g. Obviously, the citizen prefers the good he produces to be tax exempt. Taking the tax status of the good produced by citizen j's firm as given, we ask how the citizen wishes to raise tax revenues from the remainder of the tax base. The preferred policy of citizen j is given by

$$\max_{\tau,f} u^j$$
$$\text{s.t. } \rho(\tau, f) \geq g.$$

An interior policy choice satisfies the optimality condition:

$$MCPF^{\tau}(j) = MCPF^{f}(j),$$

where

$$MCPF^{\tau}(j) \equiv -\frac{\partial u^j}{\partial \tau} / \frac{\partial \rho}{\partial \tau} \qquad \text{and} \qquad MCPF^{f}(j) \equiv -\frac{\partial u^j}{\partial f} / \frac{\partial \rho}{\partial f},$$

are the marginal costs of public funds when a unit of tax revenues is raised by increasing the tax rate and broadening the tax base, respectively. This optimality condition is intuitive: the citizen wants both policy instruments to be used until the marginal costs of raising an additional unit of revenues using the two instruments are equalized.

However, as the following proposition states, the solution to the maximization problem is always a corner solution at $f = 1$. Citizens prefer raising revenues by broadening the base than by increasing tax rates as long as this does not affect their own tax status. As citizens are identical, except for the tax status of the good they produce, we use E to denote any citizen producing a tax-exempt good and T to denote any citizen whose product is in the tax base.

Proposition 1 *All citizens prefer raising taxes by broadening the base rather than increasing rates, keeping their own tax status constant:* $MCPF^{\tau}(j) > MCPF^{f}(j)$*, for any* $j \in \{E, T\}$ *and any* $\{f, \tau\}$. $f = 1$ *is the preferred policy of all citizens, keeping their own tax status constant.*

This implies directly that a social welfare planner–putting an equal weight on the preferences of each citizen–would always set $f = 1$.

The intuition for this proposition is straightforward. Broadening the tax base lowers the statutory tax rate, i.e we shift down and to the right along an equi-revenue curve in figure 1. This affects all citizens positively through a decrease in the effective tax rate $\hat{\tau}$. The lower effective tax rate follows from the uniform commodity taxation result: Lower statutory rates reduce the wedge between taxed and exempt goods.

If a citizen could set policy in a dictatorial way, she would choose $f \cong 1$ while maintaining a tax exemption for herself. Obviously, it is impossible to have a complete tax base of $f = 1$ without eliminating individual tax exemptions. This tension between a desire for a broad tax base on one hand and for individual exemptions on the other, are central to the politics of tax reform.[19]

This tension is illustrated in figure 2, which plots utility along equi-revenue curves. The horizontal axis shows values of the tax base f, but keep in mind that a broader tax base gives a lower statutory tax rate, as in figure 1. The vertical axis gives utility with the dashed line showing the utility of an exempt citizen and the solid line giving the utility of a taxed citizen. Looking at the utility function in (7), it should come as no surprise that exempt citizens obtain discretely higher utility. Proposition 1 states that the these two curves are always upward sloping: citizens prefer the broadest possible base. It follows that every citizen's ideal policy is given at the right-most X marker: Set the broadest possible tax base, while retaining her own tax exemption.

The Value of a Tax Exemption We now turn to a result that will be central in the politics of tax reform, studied in section 3. Namely, a citizen's willingness to pay for a tax exemption is decreasing in the tax base. This can be seen graphically in figure 2, where the willingness to pay for a tax exemption at a tax base f is the distance between the utility of the exempt (dashed curve) and the utility of the taxed (solid curve). This gap narrows as one moves from left to right in the figure, meaning that the value of a tax break is decreasing in the tax base. This is a general feature of the model, as described in the following proposition.

[19] I must credit Senator Russel Long for having stated this proposition much more eloquently–if less rigorously–when he noted that the political ramifications of the tax reform debate amounted to "Don't tax you, don't tax me, tax that fellow behind the tree!" (Cited in Mann, 2003 pp. 333).

Proposition 2 *The individual value of a tax exemption is*
1) Decreasing in the tax base f
2) Increasing in revenue needs g
3) Increasing in ε

The proposition also states that a citizen's willingness to pay for a tax break is increasing in required public good funding g. This can be seen in figure 3, which shows a similar comparison between the utility of taxed- and exempt-citizens for several values of g. The curves further to the bottom of the figure reflect higher values of public expenditure. As can be seen, the gap between the utility of the exempt and the taxed is larger for curves representing higher public expenditure, so that citizens' willingness to pay for a tax exemption is increasing in g.

The intuition for these results is straightforward. For a given amount of revenues, a broader tax base allows a decrease in statutory tax rates τ. The value of a tax exemption is proportional to the statutory tax rate, as can be seen in (7). The value of a tax exemption is therefore decreasing in the tax base.[20]

Similarly, for a given tax base, an increase in g necessitates an increase in the statutory tax rate τ. This increases the relative cost of being in the tax base and thus increases the value of a tax exemption. A higher elasticity of substitution ε makes consumers more reactive to tax exemptions and makes it more attractive for a firm to obtain one.

A corollary of proposition 2 is that there are strategic complementarities in willingness to pay for tax exemptions. The larger is the existing number of tax exemptions, the narrower is the tax base. A narrower tax base increases citizens' willingness to pay for exemptions. In section 3, we will see how these strategic complementarities lead to multiple equilibria in lobbying for tax breaks.

The Reform Tipping Point f^R. Citizens prefer the broadest possible tax base on one hand, but prefer to retain their own exemptions, on the other. Obviously, these two objectives are at odds with each other. We now ask when the desire for a broader tax base outweighs the parochial interest for an individual tax break. A tax exemption provides a discrete gain for its

[20] The broader tax base also reduces the effective tax rate $\hat{\tau}$, which further amplifies this effect.

beneficiary, while the gains from its elimination are infinitesimal. A citizen would never unilaterally forgo a tax exemption. However, when inefficiencies in the tax code reach a critical point, beneficiaries from tax breaks are willing to forgo their exemptions in favor of tax reform: the elimination of *all* tax exemptions. This is illustrated in figure 2 with the marker labeled f^R: the tipping point for reform. At a tax base narrower than f^R ($f < f^R$), exempt citizens are strictly better off reforming the tax system: eliminating all tax exemptions. Thus a tax base narrower than f^R provides an opportunity to reform the tax system in a Pareto-improving way. Citizens, including the exempt, are made better off by following the path along the right-pointing arrow in figure 2. The value of tax exemptions increases roughly linearly in tax rates, while the resulting dead-weight losses are convex. A critical tax base f^R exists, below which the latter force dominates the former.

The following proposition states that existence of a critical tax base f^R is a more general result: it exists for any parameter values.

Proposition 3 *For any feasible revenue need $g > 0$, there is a cutoff tax base $f^R \in (0, 1)$ so that exempt citizens prefer tax reform of $f = 1$ to another tax base f, if and only if $f < f^R$.*

There are two separate factors that might determine the reform-triggering tax base f^R: feasibility and preferences. Which of the two is binding depends on parameter values. First, the revenue need g might exhaust the government's fiscal capacity at the tax base of $f = f^R$. That is, revenues of g require taxing at the revenue-maximizing tax rate at this tax base. As revenues at this point are increasing in f, no policy $f < f^R$ is feasible. Exempt citizens are therefore forced to choose a tax base that is broader than f^R.

Second, and more interestingly, there is a critical tax base at which exempt citizens are exactly indifferent between tax reform and their own tax exemptions, as in figure 2. The exempt strictly prefer tax reform if $f < f^R$ and strictly prefer a tax base of f for all $f > f^R$.

Big Bang vs. Piecemeal Reform Should economies eliminate the rents to entrenched interests in one fell swoop, or is a more gradual approach desirable? Dewatripont and Roland (1992) ask what a reform-minded leader ought to do when faced with special interests: workers that must be compensated when exiting a restructured industry. This is obviously a very different context from the one studied here and they conclude that gradualism is preferable, because it allows the government to screen workers for the value they place on remaining in the existing industry and thus reduces the total compensation required.

A different conclusion arises from this model. Looking again at figure 2, imagine that current policy has a tax base of $f = f^R$ (or any value of $f < f^R$). A reform-minded leader wishing to maximize general welfare wants to eliminate all special provisions in the tax code and set $f = 1$. Now consider the merits of gradualism or more ambitious reform in this context. At the "big bang" extreme, the reformer removes all tax exemptions at once. This is represented by the rightward-pointing arrow in figure 2. By the definition of f^R, special interests are no worse off under reform than under the status quo; reform is Pareto improving. Special interests are compensated directly by the general equilibrium benefits from reform and there are no losers in need of compensation.

At the gradualist extreme, the reformer could eliminate one tax exemption at a time. Compensating the first special interest is costly, with the cost represented by the downward-pointing arrow in figure 2. The total cost of reform, when removing tax exemptions one at a time and compensating losers sequentially, is the area between the two curves in figure 2 to the right of $f = f^R$. This is obviously larger than the zero cost incurred under a big bang reform. The ultimate payoffs from reform are not path dependent. But if the policy maker cannot commit to follow through with this gradual reform, special interests may nevertheless demand compensation along a gradual reform path.

Central to this result is the general equilibrium nature of this framework and its implications for Pareto-improving reform outlined in proposition 3. One typically thinks of reform as being welfare increasing. It is the distributional consequences that stand in the way of reform, with losers utilizing some form of political power to block its enactment. By setting the agenda appropriately as a choice between a large "big bang" change and the status quo, a reform-minded politician may be able to obtain broad support for reform without needing to compensate losers.

Naturally, the exact details of the policy process will be crucial in determining how the agenda is set and whether reform is feasible. A study of politics is the subject of section 3.

Revenues and Tax Reform The tipping point for reform f^R plays an important role in the politics of tax reform. It is the critical tax base below which special interests can be persuaded to forgo tax exemptions. Conversely, $1 - f^R$ is the largest number of exemptions that can be allocated to special interests before these interests are collectively harmed by the porous tax system. What then determines the value of f^R?

The focus in this section will be primarily on the effects of government fiscal needs as an impetus for tax reform. It seems plausible that support for tax reform increases with the revenue needs of the government. Raising higher revenues on a narrow base may be more difficult and might require more distortionary taxation. This is precisely what we see in figure 3, which shows the utility of taxed and exempt citizens for a number of values of g. As before, the tax base is on the horizontal axis and solid lines give the utility of taxed citizens and dashed lines give the utility of exempt. Each pair of curves corresponds to a specific value of g, with higher values of g lower in the figure. As before, the value of f^R is represented with an X: this is the tax base at which the utility of the exempt is equal to the utility of the taxed under a reform of $f = 1$. As can be seen in the figure, f^R is increasing in g.

The following proposition formalizes this result. It states that f^R is increasing in g for sufficiently high values of g or ε.

Proposition 4 *If public good needs g are sufficiently high, the cutoff tax base for reform f^R is increasing in g. In addition, f^R is increasing in g for values of ε sufficiently high.*

The proposition gives a result for high values of g, meaning that we can say with confidence that high (enough) values of g will lead to higher values of f^R. The second part of the proposition states that for values of ε sufficiently high, f^R is increasing in g over the entire range. Note that both these conditions are *sufficient* but neither of them is *necessary*. In fact, I was unable to find a counterexample where f^R was not strictly increasing in g.

Computational analysis further affirms that f^R is increasing in g for the entire range of feasible values of the public good and for a broad range of parameter values. This is illustrated in figure 4 that shows the cutoff tax base f^R as a function of public goods g for a number of parameter values. The horizontal axis gives values of g, while the vertical axis gives the corresponding values of f^R. The solid line plots results with parameter values as in the previous figures ($\varepsilon = 2$ and $\eta = 0.5$). The line marked with circles shows a lower value of the elasticity of substitution across varieties ($\varepsilon = 1$: the Cobb Douglass case). f^R is increasing in both elasticities η and ε. Higher elasticities make it easier to avoid taxation by substituting consumption from taxed to exempt goods or by substituting consumption with leisure. This requires higher statutory tax rates at any given tax base, increasing the inefficiency of taxing at a narrow base. This reduces the number of tax exemptions that are sustainable before their efficiency costs exceeds their value. Accordingly, f^R decreases with the lower value of ε.

The line marked with x gives a higher Frisch elasticity of labor supply ($\eta = 1$), leading to higher values of f^R for similar reasons. Finally, the line marked with squares decreases the markup (to $\mu = 1.05$ from the benchmark value of $\mu = 1.1$). Citizens benefit from tax exemptions through higher profits, which are leveraged by the size of markups. A lower markup decreases the private value of a tax break relative to the efficiency losses caused by exemptions. We'd therefore expect f^R to be decreasing in the markup μ, as is indeed the case. In all parameter configurations–and a large range of other parameter values–f^R is increasing in g.

3 Politics

We now turn to policy determination and consider political forces preventing or driving tax reform. The economic setting of the previous section and its resulting payoffs call attention to the conflict between general and special interests. In addition, lobbying appears to have played an important role the political history of tax reform; Birnbaum and Murray (1987) give a blow-by-blow account of the role of lobbies in resisting and then resigning themselves to the 1986 TRA. A model of lobbying is therefore a natural setting to explore the politics of this conflict. A lobbying model also highlights the power of special interests to secure tax exemptions and as such pits the odds against reform. It underscores the tipping point where even special interests show restraint in vying for exemptions. The lobbying model is admittedly and intentionally simple, but one that captures political insights that would emerge in more involved settings. I discuss below the importance of each simplifying assumption in detail and show results from a number of other political frameworks (median voter, probabilistic voting, legislative politics) in the online appendix.

Setup The lobbying game proceeds in three stages. In the first stage, the value g of public goods is still unknown. At a later stage, g will be drawn randomly from a probability distribution function $\gamma(g)$, whose support includes only feasible values of g. With this information in mind, all citizens decide simultaneously whether to lobby. If citizen j chooses to lobby, she faces a fixed cost of ϕ_j, measured in units of consumption. For expositional ease, assume that this cost is the same for all citizens $\phi_j = \phi \; \forall j$, but results are robust to any distribution of fixed costs across citizens. One can think of this cost as a monetary "pay to play" fee, a minimal lobbying effort required to gain access to politicians, or a fixed cost to special-interest-group organization. For the time being, imagine that the fixed cost is pure waste rather than a transfer to politicians. I later consider the fixed cost as a price set by a politician. Let L denote the measure of citizens who have chosen to lobby.

In the second stage, public good needs g are revealed. A policy maker chooses a feasible policy $\{\tau, f\}$ and allocates tax exemptions to a measure $1-f$ of goods. Policy must satisfy the government's budget constraint $\rho \geq g$ and is set to maximize the aggregate utility of the L lobbyists. The policy maker puts equal weight on the utility of each lobbyist and zero weight on the preferences of non-lobbyists. Intuitively, citizens who have borne the fixed cost of lobbying are "at the table" of the policy discussion, while others' voices are not heard. The government must set the same policy for all lobbyists and cannot discriminate among them. If no citizens lobby, the policy maker chooses a policy that maximizes social welfare (leading to a default policy of $f = 1$).

In the third stage, policy is implemented, citizens choose consumption baskets and labor supply and realize payoffs; firms choose production levels and hire workers to maximize profits.

Policy Determination Given Lobby Size The model is solved via backward induction. In the third stage, citizens face policy $\{f, \tau\}$. A measure f of goods is taxed and $1-f$ are exempt. The payoffs of taxed and exempt citizens are given by (7) and were discussed extensively in the previous section.

Entering the second stage, public good demand g is observed. The policy maker maximizes the joint utility of the measure L of lobbyists subject to the government's budget constraint. Given that the policy maker may not discriminate among lobbyists, the government can either exempt the entire lobbying coalition and set $f = 1 - L$ or exempt no one and set $f = 1$.

It follows directly from proposition 3 that the policy maker chooses to exempt the coalition if and only if $L \leq 1 - f^R$. More lobbyists necessitate a tax base narrower than f^R and lobbyists themselves are better off under tax reform $f = 1$. This is as demonstrated in figure 2.[21]

The Costs and Benefits to Lobbying In the first stage, each citizen decides whether to lobby. Citizen j's lobbying strategy consists of a probability of lobbying as a function of the measure of citizens who enter, L. Denote the probability that citizen j lobbies if a measure L of citizens lobbies as $q^j(L)$. A Nash equilibrium is a set of lobbying probability functions $\{q^j(L)\}_{j=0}^{1}$ such that the resultant measure of lobbyists is consistent with the entry probability of individual lobbyists. An equilibrium value of L is therefore a solution to the fixed point $L = \int_{j=0}^{1} q^j(L)\, dj$.

To understand citizens' incentives to lobby, consider the expected cost and benefit of lobbying. The cost is straightforward and is captured by the fixed cost ϕ. In studying expected benefits, consider first the benefit citizen j obtains from being in the lobbying coalition if a value g is realized in the second stage. We'll use $B(L, g)$ to denote the benefit to lobbying as a function of the number of lobbyists at a public good level of g. This is shown in figure 5 for two different values of g. The figure gives the benefit to lobbying (before deducting the fixed cost to entry) as a function of L. The benefit is given by the difference between lobbyists' and other citizens' utilities. If $L \leq 1 - f^R$, lobbyists obtain tax exemptions and the tax base will be $f = 1 - L$. Accordingly, for all $L \leq 1 - f^R$, the curve gives the difference between the utility of the exempt and of the taxed at the corresponding tax base: $u^E - u^T$. As can be seen from the figure, this benefit is increasing in L. This follows from proposition 2 and is precisely a mirror image of the net benefits to a tax exemption from figure 2. It is a mirror image because a larger lobbying coalition L translates one to one into a narrower tax base f.

If $L > 1 - f^R$, the policy maker will implement tax reform $(f = 1)$. If reform is passed, lobbyists don't receive tax exemptions and there is no benefit to lobbying. This is represented by the discrete downward jump to zero in the benefit to lobbying in Figure 5.

[21] If $L = 1 - f^R$, the policymaker and lobbyists are indifferent between setting $f = 1 - L$ and $f = 1$. Given that payoffs are the same in both cases, the tie breaking rule does not affect citizens' choices in the first stage of the game.

The benefit to lobbying changes with public goods as could be expected from our analysis in section 2. A high value of g shifts the curve upwards. This follows from proposition 2 and was shown in figure 3: The value of a tax break is increasing in g. However, f^R is also increasing in g, as shown in figures 3 and 4 and discussed in proposition 4. As g increases, the cutoff $1 - f^R$–where the benefit of lobbying goes to zero–therefore shifts to the left in figure 5. With greater public good needs, there is a greater incentive to secure a tax exemption. On the other hand, with greater public good needs, a smaller number exemptions can be sustained: Higher values of g make reform more desirable and therefore decrease the maximal sustainable number of lobbyists.

Figure 6 shows the cost and *expected* benefit of lobbying for an individual citizen, if L other citizens lobby. The two horizontal lines correspond to two values of the entry cost ϕ. Expected benefits are represented by the inverted-U-shape curve and are simply an integral over the benefit function for all values of g: $E_g \{B(L,g)\} = \int_g B(L,g)\,\gamma(g)\,dg$.

The figure shows the expected benefits of lobbying for a specific PDF function (normally distributed around a mean value of g) and the curve may differ depending on the distribution. Specifically, other distributions might have multiple peaks rather than the single peak shown in the figure. But two features of this curve hold for any distribution and are central to the description of equilibrium.

First, this curve is initially increasing (increasing at $L = 0$). For any feasible value of g, expected benefits in the neighborhood of $L = 0$ are simply a weighted average of the benefits of a tax exemption $u^E - u^T$. The benefits of a tax exemption are decreasing in f for all g (proposition 2). As $f = 1 - L$ in the second stage of the political game, expected benefits are increasing in L for any g at $L = 0$.

Second, for L sufficiently high, the expected benefit of lobbying is zero. If L is sufficiently high, then $L > 1 - f^R$ for all g. In this case, the expected benefit of lobbying is zero. The general shape of expected benefits of lobbying as a function of number of lobbyists is therefore as shown in figure 6. The function is increasing for low values of L and ultimately decreasing to zero. The function has at least one peak (but may have multiple peaks and therefore is not generally inverted-U-shaped).

The value of $L = 1 - med\left(f^R\right)$, indicated with a cross in the figure gives the number of entering lobbyists that leads to reform with 50% probability in the second stage of the game. $med\left(f^R\right)$ gives the median value of f^R (f^R

evaluated at the median value of g). Higher values of g occur with probability $\frac{1}{2}$ and lead to higher values of f^R. In these cases $L > 1 - f^R$ and the policy maker opts for tax reform in the second stage. Lower values of g occur with probability $\frac{1}{2}$, give $L < 1 - f^R$, and lead to $f = 1 - L$ in the second stage.

Equilibrium Number of Lobbyists Figure 6 illustrates how equilibrium is determined. Considering first the low lobbying cost, the unique equilibrium number of lobbyists is indicated with a circle, where the costs and expected benefits of lobbying are equal. Given that all citizens are identical, we cannot pin down the equilibrium identity of lobbyists, but their number is uniquely determined. If L were smaller, the expected value of lobbying would exceed its costs. This could not constitute an equilibrium, as some citizens could profitably deviate by increasing their lobbying probability $q^j(L)$ at that value of L. If L were larger, the cost of lobbying would exceed its expected value. Some citizens could profitably deviate by decreasing their lobbying probability.

There is a large set of lobbying probability functions that support an equilibrium, but all of them would have a fixed point at the unique value of L represented with a circle in the figure. For example, one equilibrium is symmetrical with all citizens choosing $q(L) = L^*$, where L^* is the equilibrium measure of lobbyists. Another equilibrium has a measure L^* of citizens lobbying with probability one and the remainder lobbying with probability zero.

For the low lobbying cost, equilibrium unfolds as follows. A measure L^* of citizens lobbies in the first stage. In the second stage, the value of g is drawn, with a corresponding value of f^R. If $L^* < 1 - f^R$, the equilibrium tax base is $f = 1 - L^*$ with tax breaks going to all lobbyists. If $L^* > 1 - f^R$, the equilibrium tax base is $f = 1$: tax reform. With the low lobbying cost shown in the figure, L^* exceeds $1 - med\left(f^R\right)$: The probability of tax reform is greater than 50%. A large number of citizens nevertheless lobbies because the cost of lobbying is low. They are willing to incur the lobbying cost to secure a tax break if exemptions are allocated.

This points to a more general result. Lower fixed lobbying costs lead to more lobbying but to a *higher* probability of tax reform. It is hardly surprising that lower fixed costs encourage entry. The latter result may be counterintuitive at first glance as one might think that more lobbying would necessarily lead to a more a porous tax base. But lower lobbying costs democratize the lobbying process and more citizens are represented at the table when tax breaks are allocated. When budgetary conditions allow (g is sufficiently low), tax exemptions are distributed liberally and the tax base is narrow. However, the large number of organized citizens puts high demands on the tax system. Even moderate public good needs induce tax reform. At the extreme, as lobbying costs approach zero, L approaches 1, and tax reform always passes. If all citizens lobby, they all receive equal weight, and policy is as a social planner would choose.

There are two equilibria in the higher lobbying cost scenario, indicated with squares in figure 6. The right-most of the two parallels the equilibrium in the low lobbying cost case. The cost of lobbying equals its expected benefits at this point. In the high lobbying cost scenario, an additional equilibrium exists at $L = 0$. If no other citizens lobby, the cost of lobbying exceeds its expected benefits and no individual citizen wishes to lobby.[22] Multiple equilibria are not a curiosity of this specific lobbying framework, but a more general feature of the economic setting. As noted in proposition 2 and shown in figure 2, the payoff from a tax exemption is decreasing in the tax base. This leads to strategic complementarity in lobbying for tax breaks. The larger the number of lobbyists, the larger are the returns to lobbying for other citizens. This strategic complementarity is the source of multiple equilibria in this setting.

Finally, if the cost of lobbying were so high so as to exceed its expected benefit everywhere, the unique equilibrium would be $L = 0$ and therefore $f = 1$.

Modeling Assumptions I make a number of simplifying assumptions in the discussion above, but the model is robust to more general specifications. I introduced uncertainty in public good needs to smooth citizen's preferences. Discrete jumps in preferences pose problems for equilibrium existence and introducing uncertainty is one way to avoid them.

The fixed cost to lobbying is a reasonable, but critical, assumption. As mentioned earlier, with no fixed costs all citizens will lobby and $f = 1$ is always the unique equilibrium. Our main political concern is the conflict between special and general interests and the fixed cost allows us to make

[22]The remaining intersection between the cost and expected benefit curves is not an equilibrium. With this measure of lobbyists, a citizen could deviate by increasing her lobbying probability and the expected benefits of lobbying would exceed its cost.

this distinction.

The model can be easily adapted to allow variable lobbying costs in addition to fixed costs. For example, the model would have similar results if lobbyists faced an additional cost proportional to the policy benefits they receive. An extension of this sort would merely shift rents from lobbyists to the policy maker and induce less citizens to lobby, but would not change results qualitatively.[23]

I presented results assuming that all citizens face the same lobbying cost $\phi_i = \phi$. A model with heterogeneous lobbying costs could help pin down the equilibrium identity of lobbying citizens, but would not change the qualitative nature of aggregate outcomes. Not surprisingly, citizens with lower lobbying costs would be more likely to lobby.

A model with heterogeneous fixed costs nests as a special case the possibility that a some groups are organized for political action, while others are not. This is a common assumption in special interest models such as in Grossman and Helpman (2002). This is easily accommodated in our setting by giving a zero fixed entry cost to the organized group and an infinite cost to everyone else. Allowing for less extreme versions of cost heterogeneity has the advantage of pinning down the equilibrium number of lobbyists, rather than by assumption. The interested reader is referred to the online appendix for a model with heterogeneity in political organization.

Equal policy weights for all lobbyists is a reasonable benchmark given that all citizens are identical ex ante. If weights were unequal, the benefits of lobbying would depend on these weights and differ across citizens. Citizens would then vary in their willingness to lobby and we might be able to pin down the identity of citizens in the lobbying coalition. Aggregate results would remain qualitatively similar. In the online appendix I analyze a more general case with arbitrary policy weights on citizens.

The assumption that the policy maker cares only about lobbyists and puts zero weights on other citizens is stark, but not crucial, as long as the policy maker puts a greater weight on the preferences of lobbyists. A policy maker concerned with general welfare will obviously be more likely to pass reform, reducing the incentive to lobby somewhat. Otherwise, results are qualitatively the same.

[23]In a menu auction as in Grossman and Helpman (2002) there would be no entry into lobbying, however. As is well-known, in their setting a models of taxation with a continuum of agents give all rents to the policy maker.

The default that the policy maker maximizes social welfare if no one lobbies arises endogenously if the policy maker puts some weight on social welfare. The assumption can be therefore be viewed as a limiting case as the weight on non-lobbyists goes to zero. An appeal of this assumption is that it avoids discontinuities in the value of lobbying. Other default policies would lead to a discrete jump in the return to lobbying at $L = 0$. If the default policy were different, e.g. a status quo inherited from an earlier period, most results nevertheless go through. However, the no-lobbying equilibrium is eliminated under certain default policies. If the default policy is sufficiently bad (has a narrow base), the benefits of lobbying at $L = 0$ could exceed its costs and citizens would bear the fixed cost to lobbying to avoid the unfavorable status quo. In these conditions, the $L = 0$ equilibrium is eliminated and the equilibrium with a at the rightmost square in figure 6 is unique.

The fixed cost to lobbying is pure waste rather than a transfer to a politician. One could alternatively think of ϕ as a price set by a politician. The high value of ϕ in figure 6 is plotted so as to maximize political contributions. A politician would choose this price and attempt to coordinate lobbyists on the lobbying equilibrium. This point is such that a marginal decrease in ϕ loses a measure of ϕ revenues from existing lobbyists: equal to the lobbying contribution gained from the last lobbyist to enter.[24]

To simplify analysis I assumed that the policy maker cannot discriminate between members of the lobbying coalition and must offer a policy that provides them with identical outcomes. This is a natural assumption if the lobbying coalition is a cohesively organized group that promises equal treatment to its members. Results are generally the same if the policy maker can discriminate between lobbyists.[25]

Finally, I show in the online appendix that the model's results hold up if the policy maker can choose to allocate partial deductions, if government

[24] This is also the outcome if the politician holds an all-pay auction and chooses the number of allocated lobbying slots to maximize revenues. I thank Roger Lagunoff for this insight.

[25] For example, if we allow the policy maker to provide tax exemptions to a random subset lobbyists, there is a small region $L > 1 - f^R$ where lobbyists would choose to have a lottery that allocates tax exemptions to a subset of lobbyists, rather than passing full reform. This small intermediate region involves a gradual transition to $f = 1$ as L increases rather than the sharp one in the baseline model. The value of lobbying then declines less sharply to zero as L surpasses f^R, but all other insights remain intact.

spending is endogenous, and if firms have heterogeneous productivities.

4 Evidence from Corporate Tax Reforms

In this section, I provide evidence from tax base changes in OECD countries that is consistent a number of the model's predictions. A main prediction is that tax reform occurs when the government faces high revenue needs (proposition 4). A second prediction is that tax reform is a "big bang" move from a narrow tax base of f^R to a broader base. I provide qualitative historical evidence that tax reforms did in fact involve significant changes in the tax system in appendix B. One testable implication of a big bang reform is that it frees up sufficient revenues to allow a reduction in statutory tax rates.

These two predictions are explored using data on corporate taxation collected by Kawano and Slemrod (KS, 2012). These data document legislative changes to the corporate tax base in 30 OECD countries from 1980 to 2004. The data include both high-income and emerging economies and episodes of rising and declining corporate tax rates. KS document changes in the tax base including changes in the generosity of investment credits, loss carry-forward rules, depreciation allowances, and others. I define a dummy variable *reform* that takes on a value of one if the tax base was broadened by any of the KS measures. In the reported regressions, I focus only on the tax base for domestic corporations as questions of international taxation go beyond the scope of this paper. The results are nevertheless robust to including international tax legislation as well.

Corporate taxation was not the main source of tax revenues for countries in the sample. However, data on the breadth of the income tax base or VAT base for a large sample of countries is not readily available. It is nevertheless interesting to explore whether the model's predictions are supported in the available corporate tax data.

Corresponding to the theory, I measure public revenue needs by a single variable g: in this case government consumption as a percentage of GDP (source: World Bank).[26] In a dynamic context, however, government can de-link current revenue needs from public good provision by borrowing. As I discuss below, using government revenues as a percentage of GDP (source:

[26]While total government spending might be a more comprehensive measure of fiscal strain, the panel data coverage of this variable is much smaller.

OECD), or debt to GDP (source: World Bank debt tables) leads to broadly similar results. These latter variables may better represent accumulated fiscal pressures rather than current spending needs. Naturally, all these variables may be affected by the tax reform itself or other common factors and are meant to be no more than suggestive. One obvious control (not reported) is GDP itself. Controlling for GDP growth does not alter results (and the coefficient on GDP growth is insignificant throughout).

The narrow focus on corporate taxation gives the government other (and larger) bases from which to draw revenues. It is therefore useful to have a measure that homes in on the fiscal strain to the corporate sector. I use the statutory tax rate as another measure of the fiscal needs of the government (or the degree to which the government relies on corporate taxation for its fiscal needs.)

Results are shown in table 1. The first column of the gives the result from an OLS regression of the *reform* dummy on government consumption as a fraction of GDP and shows that base-broadening reforms generally occur when spending is higher. Column 2 adds the corporate tax rate at the year of reform and shows that governments broaden the corporate tax base when existing tax rates are high. This too, is as could be expected from the theory: reform occurs when revenue needs are high and when the tax base is narrow, requiring higher statutory rates. This second regression also includes the *change* in the statutory corporate tax rate in the year of the reform. The negative coefficient suggests that the corporate tax rate is cut simultaneously with the increase in the tax base.

The fact that the tax base and statutory tax rates move in opposite directions is not an obvious accounting identity. If fiscal pressures are large, the government may be forced to increase both dimensions of tax policy simultaneously. This is in fact what normative theories of the tax base, such as Yitzhaki (1979) and the literature that follows, would suggest. There, the tax base is narrow because of the administrative cost of enforcing a broader base. The optimal tax base equalizes the marginal cost of enforcing taxes with the marginal dead-weight losses due to the narrow tax base. In this normative literature, a government facing financing pressures would bear both these costs on the margin and increase the statutory rate while enforcing a broader tax base. The fact that statutory tax rates are cut when the government legislates a broader tax base suggests that a different force is at play here. The result is consistent with the theory proposed in this paper, where the government needs the lower statutory tax rates to compensate losers from the base-broadening reform.

Conceptually, we are less interested in the cross-sectional aspect of the data, as our theory has more to say about when a given country passes reform than which country is more likely to pass reform measures. Indeed, country-specific factors may confound our results. The same political dysfunctionality that makes it hard for a country to pass reform may make it harder for the government to raise revenues more generally. Similarly, a country unable to broaden the tax base may be forced to rely on higher statutory rates. The remaining columns therefore include country fixed effects. Column 3 shows that the results survive the inclusion of country fixed effects. The next two columns show that the results are robust to a probit specification (column 4), and inclusion of year (column 5) fixed effects.

Finally, in column 6, I replace government consumption with government revenues as a percentage of GDP (with country and year fixed effects). The results are robust to measuring fiscal strain in this way. The results are similar when using debt to GDP to measure fiscal strain, although in this case the result is statistically significant with year, but not country, fixed effects. This suggests that public indebtedness is a better predictor of which country will enact reform than when a specific country broadens its tax base. The result is nevertheless broadly consistent with the theory.

Certainly, one should be wary of simple correlations of this sort; I make no causal claims; and there may certainly be bias due to omitted variables. The corporate tax base is only a part of the tax code, and many of the landmark tax reforms described in the appendix focused on income or sales taxes. These correlations are nevertheless suggestive that the theory presented in this paper is broadly consistent with a set of carefully-documented reforms.

5 Concluding Remarks

The enactment of tax reform is a highly political process. Reformers' desire to bring about a simpler, more efficient, and "fairer" tax system is often stonewalled because of the distributional consequences of such change. This paper proposes a tractable model of the political economy of tax reform. When revenue needs are low, they can be met more easily with narrow tax bases. Special interests focus on securing parochial tax benefits, each of which has a only minor implications for overall efficiency, but combined may bring significant dead-weight losses. Greater revenue needs are more costly to fund with a narrow tax base. Special interests become increasingly willing to forgo their own tax breaks in favor of efficiency as revenues increase. A tipping point arrives when tax reform is feasible.

Politically feasible reform, however, may not be etching at the margin of the tax code, but a significant overhaul of the tax system. This contrasts with the common view that small changes entail smaller political costs than bigger ones do. The general equilibrium benefits are small if only one special interest is confronted. But forging a grand bargain where a number of special interests is targeted simultaneously may improve efficiency sufficiently to compensate all losers.

I hope this study will stimulate further interest in formal analysis of the political economy of tax reform. Social choice in this model is through a simple lobbying model. Extensions including voting models and more general political preferences are explored in the online appendix. But this is admittedly not the final word on the rich legislative processes involved in the passage of tax reform. I have no doubt that more could be said on the role of special interests in determining the tax code. Of particular interest is the collective action problem involved in "big bang" reforms studied here. Much has been written about the collective action problem *within* special interest groups (see Olsen, 1971, for example), but a large reform may require coordination *across* special interests as well. This paper illustrates why all special interests might agree to forgo their tax benefits collectively, but not individually. This obviously creates a free-rider problem that may be worthy of further inquiry. Agenda setting and framing of policy choices may give politicians a central role in coordinating special interests towards the common good.

I have assumed that changes in the tax base come about only through policy. In addition, in this setting, a tax reform induced by a shock (to revenues, for example) is reversed once the shock subsides. Casual observation suggests that the tax base erodes through a qualitatively different process than its expansion. The private sector devotes much energy to minimize payments under a given tax code, and much of the depreciation of the tax base occurs due to individual, rather than collective decisions. It may be interesting to consider active tax avoidance, and how this feeds back into the political process that determines tax policy.

A narrow tax base causes labor misallocation, with excessive production of tax-exempt goods. The model highlights that this affects the labor wedge, but has no effect on aggregate productivity, as firms are all equally productive. The impacts of misallocation on total factor productivity is a growing field of macroeconomic inquiry.[27] The framework studied here may help shed light on the political determinants of misallocation and thus indirectly on questions of economic development. The online appendix introduces firms with heterogeneous productivities as a step in that direction. Introducing capital as a factor of production may also be of interest.

In a world increasingly open to trade and capital flows, there may be international implications as well. The importance of the aggregate demand channel favoring tax reform might be diminished in a small open economy. The demand for an open economy's goods is determined partly by tax policy elsewhere. In addition "tax competitiveness" may be a separate pressure for tax reform in such a setting, particularly with respect to corporate taxation.

Finally, I have ignored considerations of vertical equity in this analysis. This omission was intentional, to emphasize political forces, rather than equity considerations, driving redistribution. A study of the interaction between vertical and horizontal equity may also prove fruitful.

References

[1] Acemoglu, Daron and James A. Robinson, 2000. "Political Losers as a Barrier to Economic Development," *American Economic Review*, vol. 90(2), pages 126-130, May.

[2] Alesina, Alberto and Allan Drazen, 1991. "Why Are Stabilizations Delayed?," *American Economic Review*, vol. 81(5), pages 1170-88, December.

[3] Alt, James, Ian Preston and Luke Sibieta, 2009. "The Political Economy of Tax Policy." In: *Dimensions of Tax Design: The Mirrlees Review.* Oxford, UK: Oxford University Press.

[4] Auerbach, Alan J., 1985. "The theory of excess burden and optimal taxation," in: Alan J. Auerbach and Martin Feldstein (ed.), *Handbook of Public Economics*, edition 1, volume 1, chapter 2, pages 61-127 Elsevier.

[5] Birnbaum, Jeffery H. and Alan S. Murray, 1987. *Showdown at Gucci Gulch.* New York: Random House.

[27] See Restuccia and Rogerson (2013) for a literature review.

[6] Besley, Timothy and Stephen Coate, 1998. “Sources of Inefficiency in a Representative Democracy: A Dynamic Analysis,” *American Economic Review*, vol. 88(1), pages 139-56, March.

[7] Broda, Christian and David E. Weinstein. 2006. “Globalization and the Gains from Variety” *The Quarterly Journal of Economics*, Vol. 121, No. 2, pp. 541-585.

[8] Castanheira, Micael, Gaetan Nicodème, and Paloa Profeta, 2012. “On the Political Economics of Tax Reforms: Survey and Empirical Assessment.” Working paper.

[9] Congressional Budget Office, 2013. “The Distribution of Major Tax Expenditures in the Individual Income Tax System,” Congressional Budget Office report, May.

[10] Dewatripont, Mathias and Gerard Roland. 1992.“Economic Reform and Dynamic Political Constraints,” *The Review of Economic Studies*, Vol. 59, No. 4, pp. 703-730

[11] Dixit, Avinash K., 1975. “Welfare effects of tax and price changes,” *Journal of Public Economics*, vol. 4(2), pages 103-123, February.

[12] Dixit, Avinash K., and Joseph E. Stiglitz , 1977. “Monopolistic Competition and Optimum Product Diversity,” *American Economic Review*, vol. 67(3), pages 297-308, June.

[13] Feldstein, Martin, 1976. “On the theory of tax reform,” *Journal of Public Economics*, Elsevier, vol. 6(1-2), pages 77-104.

[14] Fernandez, Raquel and Dani Rodrik, 1991. “Resistance to Reform: Status Quo Bias in the Presence of Individual-Specific Uncertainty,” *American Economic Review*, vol. 81(5), pages 1146-55, December.

[15] Golosov, Michael, Aleh Tsyvinski and Nicolas Werquin, 2014. “A Variational Approach to the Analysis of Tax Systems,” Mimeo: Yale University.

[16] Grossman, Gene M. and Elhanan Helpman, 2002. “Special Interest Politics,” Cambridge, MA: The MIT Press.

[17] Hettich, Walter and Stanley Winer, 1984. "A Positive Analysis of Tax Structure," *Journal of Public Economics*

[18] Jain, Sanjay and Sharun W. Mukand, 2003. "Redistributive Promises and the Adoption of Economic Reform," *American Economic Review* 93(1), pages 256-264, March.

[19] Kawano, Laura and Joel Slemrod (2012) "The Effect of Tax Rates and Tax Bases on Corporate Tax Revenues: Estimates with New Measures of the Corporate Tax Base," mimeo.

[20] Mann, Robert T., 2003. *Legacy to Power: Senator Russell Long of Louisiana*. Bloomington, IN: iUniverse.

[21] Mirrlees, James A., 1971. "An Exploration in the Theory of Optimum Income Taxation," *The Review of Economic Studies*38(2), pages 175-208.

[22] Olsen, Macur. 1971. *The Logic of Collective Action: Public Goods and the Theory of Groups,* 2nd edition, Harvard University Press: Cambridge, MA.

[23] Persson, Torsten and Guido Tabellini, 2002. *Political Economics: Explaining Economic Policy* Cambridge, MA: The MIT Press.

[24] Ramsey, Frank P., 1927. "A Contribution to the Theory of Taxation," *The Economic Journal* 37(145).

[25] Restuccia, Diego and Richard Rogerson, 2013. "Misallocation and Productivity," *Review of Economic Dynamics*, 16(1).

[26] Slemrod, Joel and Wojciech Kopczuk, 2002. "The optimal elasticity of taxable income," *Journal of Public Economics*, vol. 84(1), pages 91-112, April.

[27] Wilson, John Douglas, 1989. "On the Optimal Tax Base for Commodity Taxation," *American Economic Review*, vol. 79(5), pages 1196-1206, December.

[28] Yitzhaki, Shlomo, 1979. "A Note on Optimal Taxation and Administrative Costs," *American Economic Review*, vol. 69(3), pages 475-80, June.

A Appendix: Proofs

Throughout, let

$$T(j) \equiv 1 - \tau(j); \qquad \hat{T} \equiv 1 - \hat{\tau}; \qquad \theta \equiv \frac{1-\tau}{1-\hat{\tau}} \leq 1.$$

We use the superscript T to denote a citizen who produces a taxed good and E to denote a citizen with a tax exemption.

A.1 Lemma 1

Exempt Citizens Owners of exempt firms have

$$\frac{d \log u^E}{dy} = \frac{\partial \log u^E}{\partial \hat{T}} \frac{\partial \hat{T}}{\partial y}, \tag{11}$$

for $y \in \{f, \tau\}$. Noting that

$$\frac{\partial \log u^E}{\partial \hat{T}} = \frac{\frac{1}{\hat{T}} + \frac{(\mu-1)(\eta+2-\varepsilon)}{\hat{T}^{\varepsilon}}}{\frac{1}{1+\eta} + \frac{\mu-1}{\hat{T}^{\varepsilon-1}}} > 0,$$

with the inequality following from assumption (9). Noting further that $\frac{\partial \hat{T}}{\partial f} < 0$ and $\frac{\partial \hat{T}}{\partial \tau} < 0$, then $\frac{\partial u^E}{\partial \tau} < 0$ and $\frac{\partial u^E}{\partial f} < 0$ both hold. In the case of exempt citizens, we have a stronger result than stated in the proposition: (9) is both a sufficient and necessary condition for these citizens dislike tax increases, either by broadening the base or increasing statutory rates.

Taxed Citizens For an owner of a taxed firm,

$$\frac{d \log u^T}{dy} = \frac{\partial \log u^T}{\partial \hat{T}} \frac{\partial \hat{T}}{\partial y} + \frac{\partial \log u^T}{\partial y}.$$

The first term captures the effects of taxes through the effective tax rate, and the second captures the direct effects of the tax changes.

Given that $\frac{\partial \log u^T}{\partial f} = 0$, as f doesn't appear independently of $\hat{\tau}$ in utility (7), and that $\frac{\partial \hat{T}}{\partial f} < 0$, taxed citizens dislike increases in the tax base iff

$$\frac{\partial \log u^T}{\partial \hat{T}} = \frac{\frac{1}{\hat{T}} + \frac{(\mu-1)(\eta+2-\varepsilon)}{\hat{T}^{\varepsilon}} T^{\varepsilon}}{\frac{1}{1+\eta} + (\mu - 1) \frac{T^{\varepsilon}}{\hat{T}^{\varepsilon-1}}} > 0,$$

which holds under assumption (9).

As for statutory taxes:

$$\frac{d \log u^T}{d\tau} = -\frac{\frac{1}{\hat{T}} + (\mu - 1)(\eta + 2 - \varepsilon)\, \theta^{\varepsilon - 1} \left(1 - f\theta^{\varepsilon - 1}\right)}{\frac{1}{1+\eta} + (\mu - 1) \frac{T^{\varepsilon}}{\hat{T}^{\varepsilon-1}}} < 0$$

Taxed citizens also prefer a lower tax rate.

A.2 Proposition 1

Using (10), we have

$$\frac{d \log \rho}{d\tau} = \frac{1}{\tau} - \frac{\varepsilon - 1}{T} + \frac{\eta - \varepsilon + 1}{\hat{T}} \frac{\partial \hat{T}}{\partial \tau} \quad \text{and}$$
$$\frac{d \log \rho}{df} = \frac{1}{f} + \frac{\eta - \varepsilon + 1}{\hat{T}} \frac{\partial \hat{T}}{\partial f}.$$

Using marginal utilities from (11), it can be shown that for exempt citizens,

$$MCPF^{\tau}(E) > MCPF^{f}(E) \tag{12}$$

is equivalent to

$$1 - \tau - (\varepsilon - 1)\tau - (1 - \tau)^{\varepsilon} < 0,$$

if assumption (9) holds. This latter inequality holds for all $\tau > 0$, so that exempt firms always prefer tax base increases to tax rate increases, as long as this does not change their tax status.

Turning to taxed citizens, it is easy to show that

$$\frac{\partial u^T}{\partial \tau} / \frac{\partial u^T}{\partial f} > \frac{\partial u^E}{\partial \tau} / \frac{\partial u^E}{\partial f},$$

i.e., citizens whose firms bear the brunt of taxation find increases in statutory taxes even more costly relative to base-broadening measures than do citizens with tax exemptions. It then follows directly that $MCPF^{\tau}(T) > MCPF^{f}(T)$, i.e. taxed citizens also prefer broadening the base to increasing statutory rates.

If $MCPF^{\tau}(j) > MCPF^{f}(j)$ for both the taxed and the exempt, it must be the case that the optimal tax base for every citizen is $f = 1$, keeping the tax status of the citizen in question unchanged.

A.3 Proposition 2

Define

$$U^{j}(f,g) \equiv \max_{\tau} \left\{ w^{j}(f,\tau) + \Lambda(\rho(f,\tau) - g) \right\}, \tag{13}$$

giving the utility of a citizen j if the tax base is f and the statutory rate is chosen to raise g units of revenues.

At a tax base of f and public good needs of g, the individual value of a tax exemption is equal to

$$\Delta^{E}U(f,g) \equiv U^{E}(f,g) - U^{T}(f,g):$$

the difference between the utility of the exempt and the taxed.

The value of a tax break and f Applying the envelope theorem to (13)

$$\frac{\partial U^{j}(f,g)}{\partial f} = \frac{\partial \rho(f,\tilde{\tau}(f,g))}{\partial f} \left(MCPF^{\tau}(j) - MCPF^{f}(j) \right),$$

where $\tilde{\tau}$ is the statutory tax rate that raises g units of revenues when the tax base is f. Then

$$\frac{\partial \Delta^{E}U(f,g)}{\partial f} < 0$$

iff

$$MCPF^{\tau}(T) - MCPF^{f}(T) > MCPF^{\tau}(E) - MCPF^{f}(E).$$

With some derivation, it can be shown that this is equivalent to

$$\frac{\partial \log u^T(f,\tau)}{\partial \hat{T}}\left[\frac{\partial \hat{T}}{\partial f}\frac{\partial \rho(f,\tau)/\partial \tau}{\partial \rho(f,\tau)/\partial f}-\frac{\partial \hat{T}}{\partial \tau}\right]-\frac{\partial \log u^T}{\partial \tau}>$$
$$\frac{\partial \log u^E(f,\tau)}{\partial \hat{T}}\left[\frac{\partial \hat{T}}{\partial f}\frac{\partial \rho(f,\tau)/\partial \tau}{\partial \rho(f,\tau)/\partial f}-\frac{\partial \hat{T}}{\partial \tau}\right].$$

This inequality holds because

$$\frac{\partial \log u^T(f,\tau)}{\partial \hat{T}}>\frac{\partial \log u^E(f,\tau)}{\partial \hat{T}}, \tag{14}$$

while

$$\frac{\partial \hat{T}}{\partial f}\frac{\partial \rho(f,\tau)/\partial \tau}{\partial \rho(f,\tau)/\partial f}-\frac{\partial \hat{T}}{\partial \tau}>0,$$

and

$$\frac{\partial \log u^T}{\partial \tau}<0. \tag{15}$$

Therefore the value of a tax break is decreasing in f.

The value of a tax break and g Applying the envelope theorem to (13)

$$\frac{\partial U^j(f,g)}{\partial g}=\Lambda=MCPF^\tau(j).$$

Then

$$\frac{\partial \Delta^E U(f,g)}{\partial g}>0$$

iff

$$MCPF^\tau(T)>MCPF^\tau(E),$$

which is equivalent to

$$\frac{\partial \log u^T(f,\tau)}{\partial \hat{T}}\frac{\partial \hat{T}}{\partial \tau}+\frac{\partial \log u^T(f,\tau)/\partial \tau}{\partial \hat{T}/\partial \tau}>\frac{\partial \log u^E(f,\tau)}{\partial \hat{T}},$$

which holds because (14), (15) and $\frac{\partial \hat{T}}{\partial \tau}<0$ hold.

The value of a tax break and ε Using (7), the value of a tax exemption can alternatively be written as

$$\Delta^E U(f,g) = \left(\frac{z\hat{T}}{\mu}\right)^{\eta+1} (\mu-1)\frac{1-T^\varepsilon}{\hat{T}^{\varepsilon-1}}.$$

Then

$$\frac{\partial \log\left(\Delta^E U(f,g)\right)}{\partial \varepsilon} = -\log\hat{T} - \frac{T^\varepsilon \log T}{1-T^\varepsilon} > 0,$$

because $\hat{T}$ and T are both smaller than 1.

The value of a tax break and η

$$\frac{\partial \log\left(\Delta^E U(f,g)\right)}{\partial \eta} = \log\left(\frac{\hat{T}z}{\mu}\right)$$

This is greater than zero if the equilibrium real after-tax real wage $(\hat{T}w)$ is greater than one, i.e. if aggregate demand is increasing in the Frisch elasticity.

A.4 Proposition 3

Put formally, we are stating that for any g, there exists a value $f^R \in (0,1)$, such that for all $\tilde{f} \leq f^R$

$$U^T(1,g) \geq U^E\left(\tilde{f}, g\right) \tag{16}$$

or

$$\rho\left(\tilde{f}, \tilde{\tau}\right) < g$$

for all $\tilde{\tau}$, where $U(f,g)$ is given by (13). In words, there exists a cutoff tax base f^R, below which exempt citizens are better off with tax reform at $f=1$ (at which they are taxed) than being at any feasible narrower tax base $\tilde{f} < f^R$.

The proof relies on the fact that the function $U^E(f,g)$ is increasing in f for all $f \in [0,1]$. In addition, at one extreme $(f=1)$, $U^E(1,g) > U^T(1,g)$, so that (16) is violated for sufficiently high values of f. This is true because a tax exemption gives positive utility, all else equal. At the other extreme, if

f is sufficiently low, $U^E(f,g)$ goes to zero, while $U^T(1,g) > 0$, so that (16) must hold. With $U^E(f,g)$ increasing and spanning values above and below $U^T(1,g)$, there must be a value of $f = f^R$ at which these two utilities are equal. Moreover, citizens are better off with tax reform if and only if $f > f^R$.

I now demonstrate that it is the case that for sufficiently low values of f, $U^E(f,g)$ goes to zero. This is because the slope of $U^E(f,g)$ becomes infinite as f changes, for sufficiently low values of f. In the proof of proposition 2, I showed that

$$\frac{\partial U^E(f,g)}{\partial f} = \frac{\partial \rho\left(f, \tilde{\tau}(f,g)\right)}{\partial f}\left(MCPF^{\tau}(j) - MCPF^{f}(j)\right) > 0.$$

For any feasible value of f, $\frac{\partial \rho}{\partial f}$ and $MCPF^f(j)$ are both strictly positive and finite. The numerator of $MCPF^{\tau}(j)$ is positive and finite, while its denominator goes to zero as f approaches its lowest feasible value. This last statement is true because the statutory tax rate must be set at its revenue-maximizing rate as f approaches its lowest feasible value. At the revenue maximizing rate, $\frac{\partial \rho(f,\tau)}{\partial \tau} = 0$, by definition. Thus $\frac{\partial U^E(f,g)}{\partial f}$ goes to infinity for sufficiently low values of f.

Below some threshold value of f it is of course the case that revenues of g are no longer feasible. It still remains the fact that no *feasible* policy exists with a narrower base that makes the exempt better off than under reform. (One might think of such cases as reform being induced due to feasibility rather than desirability to lobbyists.)

A.5 Proposition 4

It is easy to show that if f^R is determined by feasibility, i.e. f^R is the narrowest tax base at which g is feasible, then f^R is increasing in g. In this case, τ is set at its revenue-maximizing rate at f^R, given by

$$\frac{1-\bar{\tau}}{\bar{\tau}} = (\eta - \varepsilon) f \bar{\theta}^{\varepsilon} + \varepsilon, \quad \text{where} \tag{17}$$
$$\bar{\theta} = \frac{1-\bar{\tau}}{f(1-\bar{\tau}) + 1 - f}.$$

It is easy to show that at the revenue maximizing rate $\bar{\tau}$, tax revenues are increasing in f, so that an increase in g requires an increase in f^R to remain feasible.

If, instead, f^R is determined by preferences, f^R is defined by

$$u^E\left(f^R,\tau^R\right)=u^T\left(1,\tau^1\right), \tag{18}$$

where τ^R and τ^1 are the tax rates required to raise g in revenues, if the tax base is f^R and 1, respectively:

$$\rho\left(f^R,\tau^R\right)=\rho\left(1,\tau^1\right)=g \tag{19}$$

This last equation simply maps τ^1 onto g with τ^1 naturally increasing in g. We can therefore conduct comparative statics with respect to τ^1, taken as an exogenous parameter with results for g following. $\left\{f^R,\tau^R\right\}$ are defined implicitly by (18) and the first equality in (19). Conducting comparative statics using these two equations, we obtain that

$$\frac{\partial f^R}{\partial\tau^1}=\frac{MCPF_\tau^E\left(f^R,\tau^R\right)-MCPF_\tau^T\left(1,\tau^1\right)}{MCPF_\tau^E\left(f^R,\tau^R\right)-MCPF_f^E\left(f^R,\tau^R\right)}\frac{\partial\rho\left(1,\tau^1\right)/\partial\tau}{\partial\rho\left(f^R,\tau^R\right)/\partial f}.$$

As long as we are on the correct side of the Laffer curve, the marginal revenue terms are positive. Also, proposition 1 states that the difference in marginal costs of public funds in the denominator is positive. Therefore $\frac{\partial f^R}{\partial g}>0$ if and only if

$$MCPF_\tau^E\left(f^R,\tau^R\right)>MCPF_\tau^T\left(1,\tau^1\right). \tag{20}$$

I now argue that this condition must hold for g sufficiently high. With g sufficiently high, we can make $\left\{f^R,\tau^R\right\}$ be arbitrarily close to the peak of the Laffer curve, but with τ^1 still away from the Laffer curve peak at $f=1$. At the peak of the Laffer curve, marginal revenues are zero and $MCPF_\tau^E\left(f^R,\tau^R\right)$ goes to infinity. It must therefore be larger than the finite value of $MCPF_\tau^T\left(1,\tau^1\right)$. The inequality 20 holds and f^R is increasing in g.

The second part of the proposition states that f^R is increasing in g for values of ε sufficiently high. Condition (20) can be rewritten as

$$\frac{1+(\mu-1)(\eta+2-\varepsilon)/\hat{T}\left(f^R,\tau^R\right)^{\varepsilon-1}}{1+(\mu-1)(\eta+2)T^1} >$$
$$\theta\left(f^R,\tau^R\right)\frac{1-\frac{\tau^R}{1-\tau^R}\left[(\varepsilon-1)\left(1-f^R\theta\left(f^R,\tau^R\right)\right)+\eta f^R\theta\left(f^R,\tau^R\right)\right]}{1-\frac{\tau^1}{1-\tau^1}\eta}.$$

Recalling that $\mu \equiv \frac{\varepsilon}{\varepsilon-1}$, the left hand side of this equation can be made arbitrarily close to 1 for ε sufficiently high. The right hand side is always strictly less than one if $\varepsilon > \eta+1$. This is because $\theta < 1$, $\tau^R > \tau^1$ and $f^R < 1$. Thus for ε sufficiently large, this inequality holds and f^R is increasing in g. Note that these are both sufficient–not a necessary–conditions. The relationship appears to hold for any values of ε, μ, and η.

B Tax Reform in Recent History

In this appendix I contextualize the model in light of some historical experiences of tax reform in a number of countries.

United States The landmark tax reform of the past several decades in the United States was the Tax Reform Act of 1986. Its main objectives were to simplify the tax code, broaden the tax base and increase fairness, primarily considering horizontal equity–all features of tax reform as described in the theory. Revenue needs were perceived to be great at the time, with a federal budget deficit in excess of 5% of GDP that year. Some prominent Republican leaders, including Senate Majority Leader Robert Dole initially opposed revenue-neutral tax reform because they believed that deficit reduction should take priority (Birnbaum and Murray 1987, *Kindle Loc. 301*). This is consistent with the model, where high revenue needs trigger tax reform.

Nevertheless, reform was ultimately designed to be revenue-neutral, with significant reductions in marginal tax rates combined with base-broadening measures. Accounts of the political process suggest that a combination of reductions in tax rates and broadening the tax base were necessary for the enactment of the Tax Reform Act.

Support for the Tax Reform Act was bipartisan, passing the Senate 74 to 23 and the House of Representatives by 292-136.[28] The political process lead to compromise between uncommon political bedfellows. As Birnbaum and Murray (1987) state:

> "Merging the lower rates of the supply-siders with the base-broadening of the liberal tax reformers was the glue that held the 1986 tax bill together... The ability of this unholy alliance to stick together throughout an arduous process... was the key to success." *Kindle Loc. 162.*

The change in the tax code was significant, rather than marginal, with top marginal tax rates dropping from 50% to 28%. Again, Birnbaum and Murray (1987) write:

> "Congress was a slow and cumbersome institution that usually made only piecemeal, incremental changes. Tax reform proposed something very different: a radical revamping of the entire tax structure." *Kindle Loc. 504.*

It is interesting to contrast the 1986 experience with the 1981 Economic Recovery Act and the 1984 Deficit Reduction Act. These were two of a series of tax changes enacted during President Reagan's first term in office. Although the 1981 act was larger in its overall revenue implications than the 1986 reform—the latter was intended to be roughly revenue neutral—its main objective was to lower the overall tax burden rather than a wholesale reform of the tax system. The 1984 law was passed due to concerns over the government deficit (Romer and Romer, 2010). These smaller changes in the tax code correspond more closely to the predictions of Yitzhaki (1979) and Wilson (1989), as the tax rate and the tax base moved in the same direction. Alongside cuts in marginal income tax rates included in the 1981 bill, new depreciation guidelines decreased the tax base as well. The 1984 bill, designed to increase revenues, reduced tax benefits for tax-exempt entity leasing and other base-broadening measures. In contrast, the large, tax reform grand bargain of 1986 saw the tax base and tax rate moving in opposite directions. This is

[28] The initial Senate vote prior to the Conference Committee was close to unanimous at 97 to 3, demonstrating the breadth of support for tax reform in general.

inconsistent with the predictions of models where administrative costs are the main barrier to base broadening policies, but coherent with the theory presented in this paper.

Canada In other countries, tax reform has followed similar patterns. The main objective of Canada's "1985 Plan" was the reduction of the Federal deficit: It came amidst a significant effort to consolidate the Federal budget. The plan was, however, accompanied by proposals to reform the Canadian tax code. (See Sancak, Liu and Nakata, 2011.) These led to legislation in 1987 that broadened the personal and corporate tax base and eliminated deductions, while lowering corporate tax rates.

The second phase of tax reform was introduced in 1991, with a reform of the sales tax. The reform replaced the 13.5% Manufacturers' Sales Tax with a 5% Goods and Services Tax, introduced a more transparent tax that provided a more equal treatment of business, thus broadening the sales-tax base alongside the lower tax rates.

Germany The German tax reform of 2000—passed after a decade of debates—was discussed in the context of fiscal consolidation. Chancellor Gerhard Shroeder's initial proposals were for fiscal consolidation and tax cuts. (See IMF, 1999; IMF, 2000; and Breuer, Gottschalk, and Anna Ivanova, 2011.) The theory in this paper provides a rationalization for these seemingly contradictory aims. Prior to the reform, the corporate tax base was so narrow that the 45% statutory rate on retained earnings raised only 2% of GDP in revenues (IMF, 2000). Corporate tax reform involved a broadening of the tax base, limitations to depreciation allowances, and lowering top marginal tax rates. Personal income tax rates were also decreased, although without substantial changes in the tax base.

The German experience may also highlight the broader applicability of the political economy of reform presented in this paper. Not only was corporate tax reform comprehensive, rather than a marginal elimination of individual tax benefits, but was also bundled together in a broader reform agenda. Tax reform was one element of the Agenda 2010 reform plan of the Schroeder administration. Rather than taking a piecemeal approach to reform, as would be advocated by a gradualism, Schroeder proposed reforming several aspects of economic policy simultaneously.[29] The reform package included labor market reforms, social benefit reform, and tax reform. A gradualist view to reform would suggest that such an ambitious agenda is foolhardy or doomed to failure. Our theory provides some insights on the political viability of such a grand policy of reform. While each individual reform proposal had winners and losers, the general equilibrium benefits of wide-sweeping reform may have been sufficient to compensate losers. The bundling of reforms may have been a recipe for success rather than a formula for failure.

Latin America Mahon (2004) and Focanti et al (2013) conduct panel regressions of determinants of tax reform in Latin America and both find that high inflation was the main domestic driver of tax reform. Given that high inflation in the region has often been due to fiscal pressures, this too is consistent with the theory that revenue needs are a stimulant for tax reform. Sanchez (2006) reviews the history of and political forces motivating tax reform in Latin America. He describes tax reforms undertaken in Latin America over the past three decades "to create simpler, more efficient tax systems with a greater emphasis on indirect taxes of broader bases, and more moderate marginal tax rates." (pp. 772) He too cites the debt crises of the 1980s as the leading domestic forces towards reform.

Sweden The Swedish tax reform of 1991 was dubbed by some the "tax reform of the century" (Agell et al, 1996). The reform involved a significant reduction in personal income tax rates, estimated to lose as much as six percent of GDP in tax revenues. A large part of these reductions in marginal tax rates were financed by a broadening of the VAT tax base to include goods and services that were previously exempt, as well as the elimination of tax loopholes. Consistent with the model, tax reform passed in the aftermath of a fiscal crisis, with the debt to GDP ratio increasing from 40% of GDP in 1980 to over 60% by the middle of the decade and a currency crisis following at the end of the decade. The reform was passed by a left-wing government, in what was viewed as a shift in policy, consistent with consensus for tax reform at a reform moment, predicted by the theory.

[29] The Agenda 2010 reform program was first announced in March 2003. See http://germanhistorydocs.ghi-dc.org/sub_document.cfm?document_id=3973

United Kingdom In the United Kingdom, the 1980s and early 1990s were also periods of tax reform, partially stimulated by debt consolidation attempts. (See Ahnert, Hughes and Takahashi, 2011.) In 1980, the Thatcher government faced a fiscal deficit of 4.8%. After failed attempts by his predecessor to rein in the deficit, Chancellor Nigel Lawson presented a plan in 1984 that envisaged a deficit reduction of nearly four percentage points. The lion's share of the consolidation came on the expenditure side, while tax reform measures were planned to be roughly revenue neutral. The reform package included a reduction in the corporation tax rate from 52% to 35%, financed by base-broadening measures.

Recent Events Recent discussions of tax reform in the U.S. have arisen again in a time of budget consolidation. Alongside debates about the relative merits of expenditure cuts and tax increases, a debate has also emerged as to whether new revenues should come through increases in marginal tax rates or broadening the tax base. Again, as in the Tax Reform Act of 1986, there have been strong political pressures to compensate for base-broadening measures with decreases in marginal rates. (See for example the House of Representative's Committee on the Budget Budget proposal in 2014: http://budget.house.gov/.)

The European sovereign debt crisis has also brought tax reform to the forefront. This is consistent with the theory presented here, where large revenue needs trigger tax reform. While it is still early to predict whether any significant reform will be enacted, nor what form it will take, there are some early indicators of reforms along the lines suggested here. The Financial Times predicts that

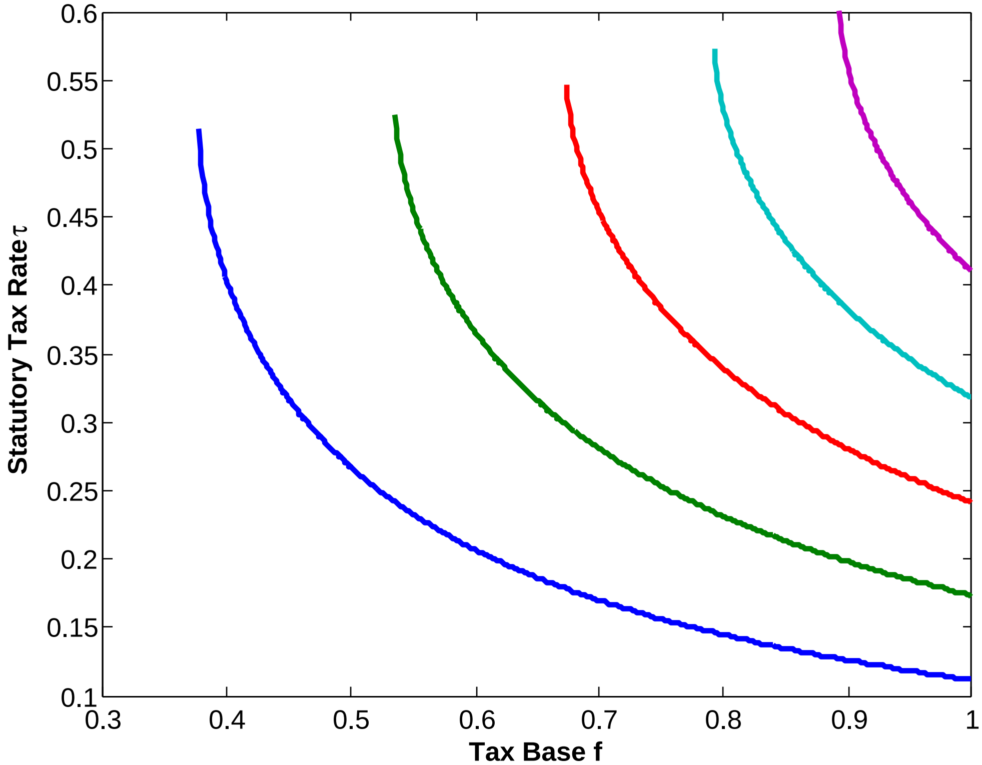
> "At the heart of the overhaul [of the Spanish tax code] will be an election-friendly move to lower marginal rates on income and corporate tax. The headline reductions will be balanced by steps to broaden the tax base, mostly by eliminating some of the exemptions and deductions that litter the system." Financial Times, February 10, 2014.

The notion that base-broadening measures will have to "bought" with lower tax rates seems to be on the minds of reform-oriented politicians.

In summary, several of the largest successful efforts to reform the tax code in the U.S. and other industrialized countries in the past few decades seem to conform with the general features of the model. Tax reform successfully passes through the political process as alongside efforts to reign in deficits–in times of high revenue needs. They often involve broadening the tax base, used to finance reductions in marginal tax rates. Reforms were often comprehensive, eliminating many tax breaks in one fell swoop, rather that gradualist. In some instances these gained broad and bipartisan support that was unexpected to political observers at the time.

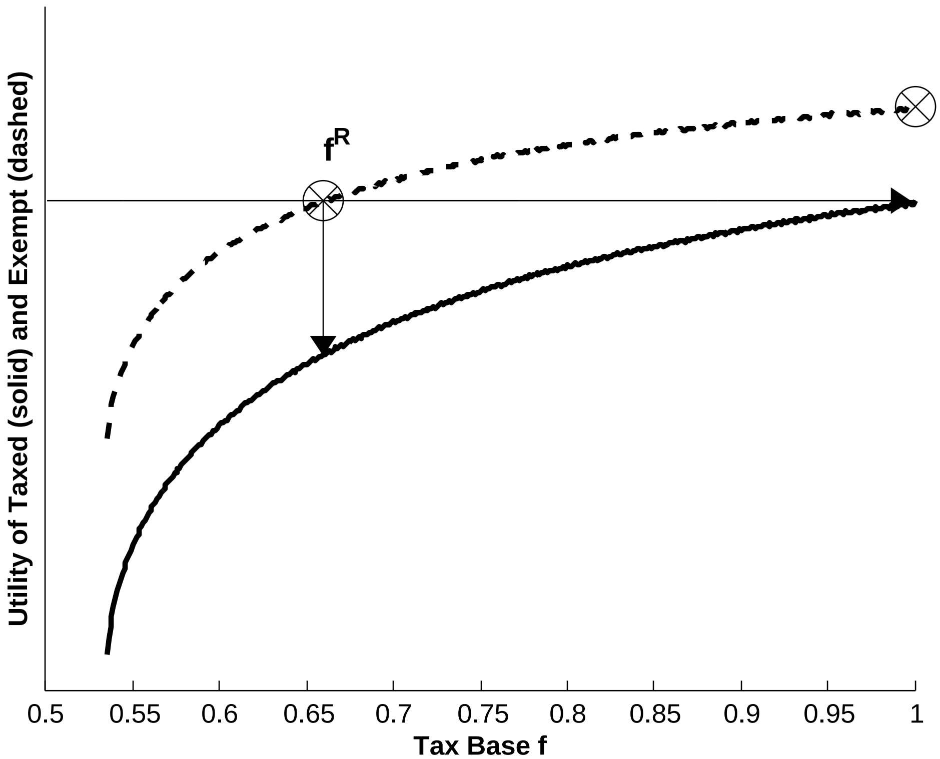
References for this appendix can be found in the online appendix.

Figure 1: Budget Curves



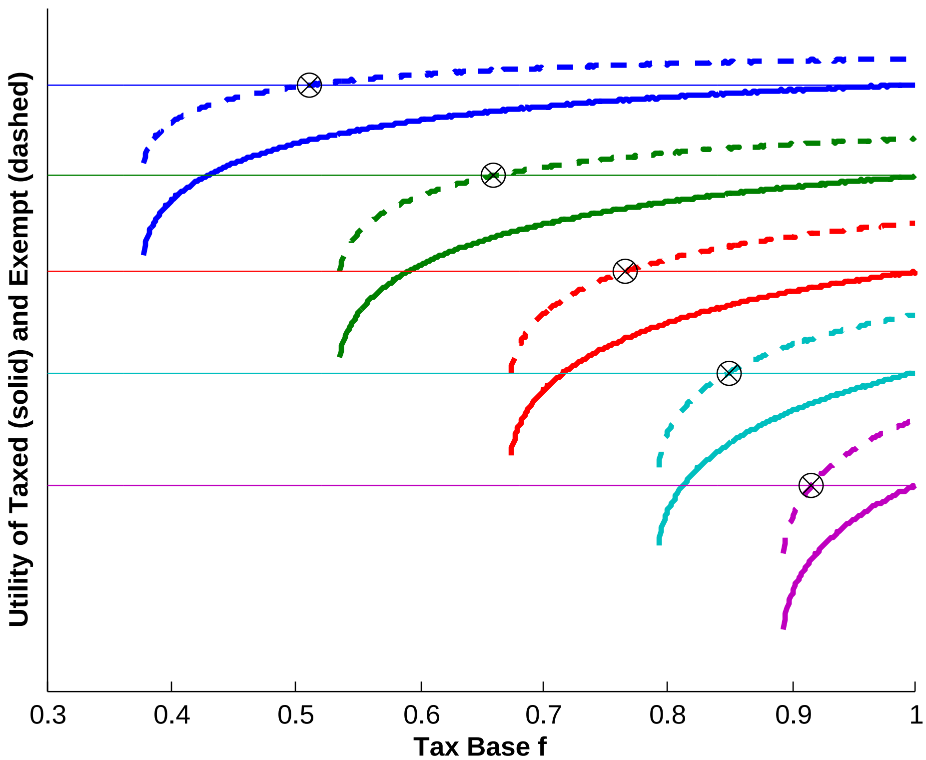
This figure shows budget curves. Points along each curve are combinations of a tax base f and a statutory tax rate τ that raise the same revenues. The curves further to the right raise higher revenues. Parameter values here and in later figures: $\eta = 0.5$, $\varepsilon = 2$, $\mu = 1.1$.

Figure 2: Utility of Taxed and Exempt Along A Budget Curve



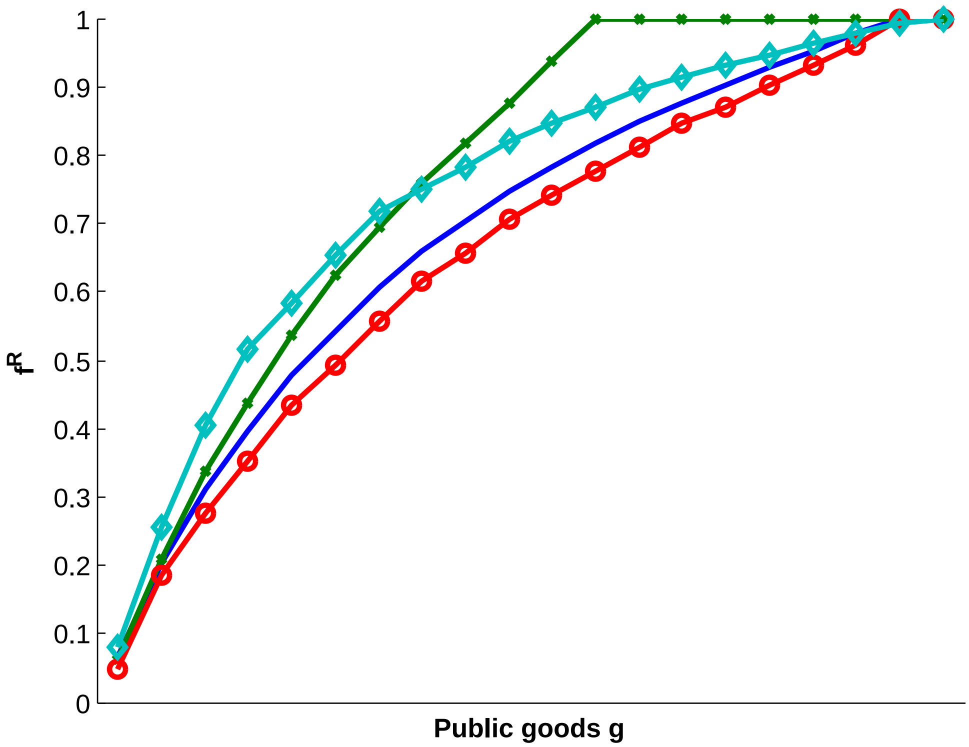
The curves show the utility of citizens whose firm has a tax exemption (dashed line) and those who are not exempt (solid line) as a function of the tax base f. The curves are along a balanced-budget path, i.e. all points on the curves raise the same amount of revenues. The leftmost marker (X) is the utility maximizing policy for a citizen: the broadest possible tax base, while retaining her own tax exemption. The point f^R is the tax base that is the tipping point for reform. At this tax base, exempt citizens are indifferent between retaining their exemption and a tax reform that eliminates all exemptions. The two arrows represent utility losses to losers from reform. The downward arrow is the loss of utility as part of a gradual reform that eliminates one tax exemption at a time. The rightward arrow represents the loss of utility (equaling zero) as part of a "big bang" reform that eliminates all exemptions simultaneously.

Figure 3: Utility of the Taxed and Exempt for Several Values of g



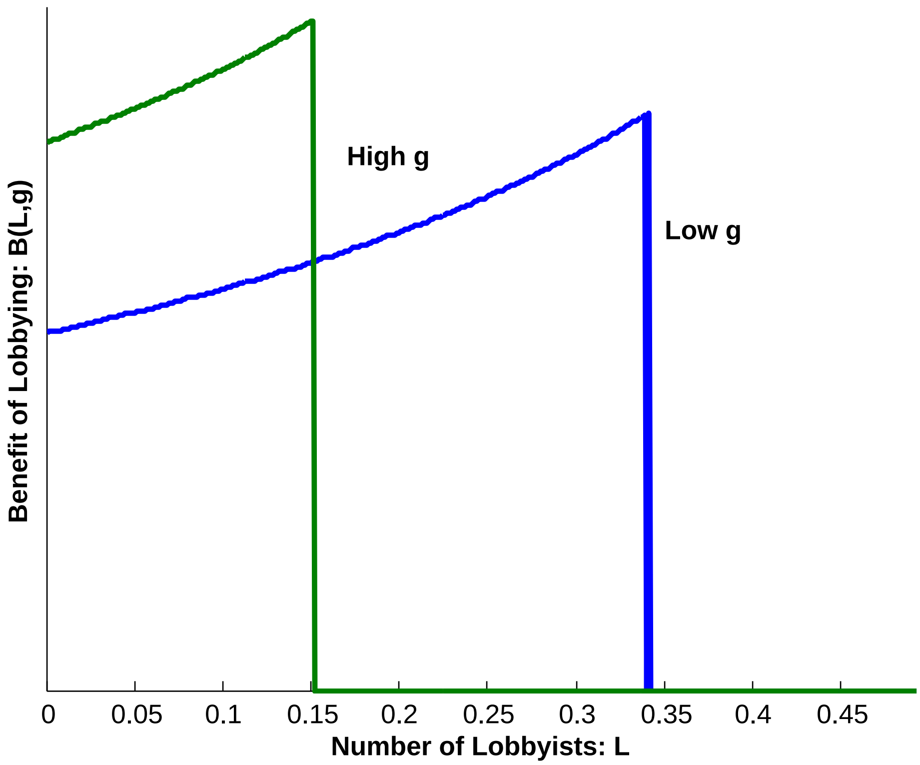
This figure shows the utility of citizens with tax exemptions (dashed lines) and those who are taxed (solid lines). Each pair of curves represents a specific value of the public good g. Curves further to the bottom reflect higher levels of g. The Xs indicate the tax base that triggers reform for that level of public goods: f^R. This is the tax base that leaves the exempt indifferent between a reform that eliminates all exemptions and a tax exemption at that tax base. The figure illustrates that f^R is increasing in g. It also shows that the value of a tax exemption–the gap between the dashed and solid lines–is increasing in g.

Figure 4: The Reform-Triggering Tax Base f^R vs. Public Goods g



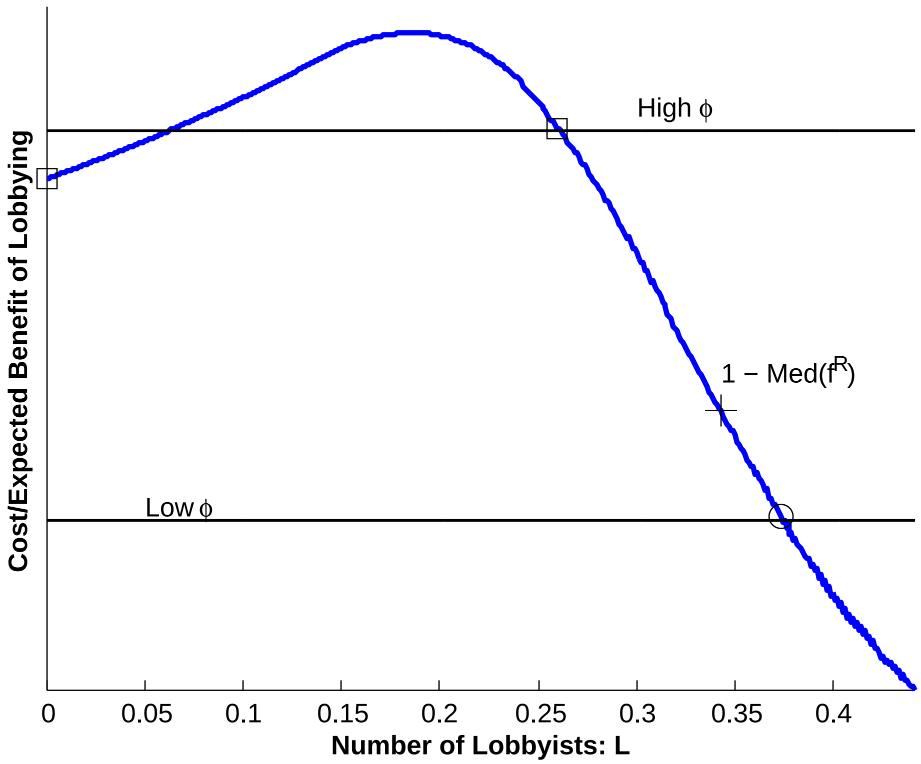
This figure shows the reform-triggering tax base f^R as a function of g, for several parameterizations. In all cases, f^R is increasing in g. The solid line uses the benchmark parametrization of $\eta = 0.5$, $\varepsilon = 2$, $\mu = 1.1$. The circle markers use $\varepsilon = 1$. The square markers use $\eta = 1$. The cross markers use $\mu = 1.05$.

Figure 5: The Benefit of Lobbying vs. the Number of Lobbyists



The benefit of lobbying is plotted against the number of lobbyists entering the lobbying game, for two values of g. The benefit of lobbying is the value of a tax exemption, if tax exemptions are distributed in equilibrium. This benefit is decreasing in the tax base and therefore increasing in the number of lobbyists, as long as exemptions are allocated. There is a discrete downward jump in the value of lobbying where tax reform is enacted. Higher values of g increase the value of tax exemptions when they are distributed, but also reduces the number of lobbyists that can be sustained in equilibrium before reform is passed.

Figure 6: The Cost and Expected Benefit of Lobbying



The expected benefit of lobbying is plotted against the number of lobbyists, before the value of public goods g is realized. In this figure, g is drawn from a normal distribution, but the general shape of the curve would be similar for any distribution. Two values of ϕ, the cost of lobbying, are plotted. For the low lobbying cost, equilibrium is at the circle where costs and expected benefits are equal. The two equilibria for the high cost are shown in squares. The cross indicates one minus the tax base that leads to tax reform with probability $\frac{1}{2}$.

Table 1: Regression Results

	Dependent Variable = Reform					
	1	2	3	4	5	6
g/GDP	.009** (.004)	.010** (.004)	.009** (.004)	.032** (.014)	.008** (.003)	.007* (.004)
Corp. Tax Rate		.009*** (.002)	.007*** (.002)	.026*** (.009)	.008*** (.003)	.007* (.004)
Δ Tax Rate		-.017*** (.006)	-.018*** (.006)	-.060*** (.022)	-.020*** (.007)	-.014** (.006)
Country FE	NO	NO	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	YES	YES
R^2	0.01	0.05	0.15	0.11	0.20	0.19
n	709	621	621	566	621	653

Panel evidence on the relationship between base-broadening reforms, revenue needs, and changes in statutory rates. Data for 30 countries from 1980-2004. A list of countries and definitions of base-broadening measures are found in Kawano and Slemrod (2012): The source of this variable. Dependent variable is a dummy taking on the value of 1 if a base-broadening measure was legislated that country and year. Independent variables are government consumption as a fraction of GDP (source: World Bank), the current statutory corporate tax rate (source: Kawano and Slemrod, 2012), and the change in the corporate tax rate. Regressions are OLS, with the exception of Column 4, giving results from a Probit regression. Column 6 replaces the first independent variable with revenues as a fraction of GDP (source: OECD). Base broadening legislation occurs when government consumption and statutory rates are high and are associated with a decrease in the statutory tax rate. ***, **, * represent statistical significance at the 1%, 5% and 10% confidence levels, respectively