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Do Output Contractions Cause Investment in Fiscal Capacity?[†]

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This paper shows that an economic slump can induce a government to invest in fiscal capacity. Large negative income shocks stress the revenue-raising capability of narrow tax bases, making an increase in tax base breadth desirable relative to its fixed implementation cost. A broader tax base enables revenue to be raised at lower tax rates, and so lower deadweight loss. The behavior of US state governments during the Great Depression supports the model: states experiencing larger than average negative income shocks were more likely to adopt a retail sales tax than were states experiencing smaller than average income shocks. (*JEL* E32, E62, H25, H71, N42, N92)

Much of the modern public finance literature takes the set of tax bases as exogenously fixed, and studies the optimal tax rate to levy on those bases. But a defining feature of economic development is growth and compositional change in the set of tax bases used to raise revenue. In developed economies, modern consumption and income tax bases have largely replaced comparatively inefficient trade, seignorage, and occupational licensing taxes. These tax base changes have facilitated the growth of government in developed economies (Becker and Mulligan 2003). For developing economies, understanding the determinants of tax base expansion is important because limited ability to raise revenue at tolerable efficiency cost is widely seen as a barrier to economic growth in the developing world today (Besley and Persson 2013).

The adoption of the modern fiscal state in developed economies proceeded in three waves. Income taxes began to be adopted in the late 1800s, income tax withholding and an extension in the reach of the income tax to wide sections of the population occurred in the early to mid-1900s, and the adoption of Value Added Taxes occurred in the post-World War II years (Besley and Persson 2013).[1] In a sample of

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[1]The first income tax was introduced in Great Britain by William Pitt the Younger in 1798.

mostly high-income countries tracked by Besley and Persson (2013), each country had introduced an income tax with withholding by the year 2000, and all but the United States had adopted a VAT. Governments used these new tax bases to increase tax revenue as a share of GDP from on average less than 10 percent in 1900 to around 25 percent by the year 2000.[2]

A growing literature models these tax base changes as purposeful investments in fiscal capacity. The central empirical fact that much of the literature on state capacity seeks to explain is the coincidence of external wars and the upgrading of fiscal capacity. A glance at US history illustrates this correlation: the first US income tax was proposed during the War of 1812 (although the war ended before the tax was instituted); income taxes were imposed on a small number of taxpayers during the US Civil War; the estate tax was introduced during World War I; and during World War II withholding for wage and salary income was introduced, strengthening the ability of tax administrators to enforce the income tax code. The interdependence between wars and fiscal capacity is captured in historian Charles Tilly's (1975, 42) famous words "War made the state, and the state made war."

In a seminal body of research, Besley and Persson (2009, 2010, 2013) and Besley, Ilzetzki, and Persson (2013) present a framework in which wars catalyze investment in fiscal capacity. Their model highlights the role of political frictions limiting investment in state revenue-raising capacity. External wars act as a stimulant to investment in fiscal capacity in their framework because military spending is "… an archetypical public good representing broadly common interests for citizens" (Besley and Persson 2009, 1218). Their framework assumes non-distortionary lump-sum taxes, with fiscal upgrading corresponding to investment in compliance infrastructure that limits evasion and avoidance behavior. In reality, upgrading of fiscal institutions includes both improvement in compliance infrastructure and the adoption of new tax bases, both of which can lower the efficiency cost of raising revenue.

This paper provides a new explanation for investment in fiscal capacity, studying the role of macroeconomic income shocks. Confronted with a decline in income, a government with limited ability to borrow must either raise taxes or cut spending. In general, government spending does not fall proportionately with income in an economic slump, in part because demand for some government activities does not vary proportionately with income. This creates a revenue shortfall that must be covered by either raising the tax rate on existing narrow tax bases, or undertaking a tax base broadening reform, enabling the taxation of a broader set of goods. Raising tax rates on existing tax bases raises revenue but increases deadweight loss, which is convex in the tax rate. For a sufficiently large fall in income, it is optimal to incur the fixed cost to undertake a tax base broadening reform. Taxing a wider range of economic activity at lower tax rates permits raising a given amount of revenue at lower efficiency cost. Macroeconomic income fluctuations are transitory but, when the fixed cost incurred to upgrade fiscal capacity is large, improvements in fiscal capacity can be enduring. The fixed cost to increase tax base breadth includes all the expenses

[2] See figure 5 in Besley and Persson (2013). Their sample of countries is: Argentina, Australia, Brazil, Canada, Chile, Columbia, Denmark, Finland, Ireland, Japan, Mexico, the Netherlands, New Zealand, Norway, Sweden, Switzerland, the United Kingdom, and the United States.

required to build a tax administration to collect and enforce tax payments on a new tax base.

I formalize this intuition with a model in which a benevolent government provides a public good by taxing either a narrow share of private consumption goods at a high tax rate or a broad set of goods at a low tax rate. The broader the tax base—corresponding to a higher level of fiscal capacity—the lower the marginal efficiency cost of raising tax revenue, because a broader tax base permits the same amount of revenue to be raised at a lower tax rate. The model's predictions are not dependent on political economy considerations, although I do allow for distributional considerations in an extension.

The model's key predictions are tested by studying the behavior of US state governments during the Great Depression. This time period and set of governments provides an excellent setting to examine the effect of an economic slump on tax base expansion. The decline in income was large, with per capita US real GDP falling by 29 percent between 1929 and 1933. There was also substantial heterogeneity in the size of income shocks experienced across states. Because US state governments had limited ability to borrow, they quickly faced a choice between raising tax rates on existing tax bases or expanding tax base breadth to address revenue shortfalls.

Over the period of the Great Depression, US state governments profoundly changed their tax structure. In 1929, none of the 48 US state governments levied a broad-based consumption tax. But during the 1930s, 28 states introduced a retail sales tax, of which 22 ultimately became permanent. Tax rates were initially low, but retail sales taxes quickly became an important source of revenue. States adopting a permanent retail sales tax in the 1930s raised on average about one-fifth of total tax revenue from the retail sales tax by 1942. Spending and revenues evolved similarly for US state governments that did and did not introduce a retail sales tax, implying that state governments that introduced a retail sales tax were able to raise revenue at lower average tax rates.

The cross-sectional pattern of tax base adoption is consistent with the model. The average fall in per capita personal income between 1929 and 1933 was 7 percentage points larger for states that adopted a retail sales tax in the 1930s than those that did not. Each 10 percentage point fall in income between 1929 and 1933 is estimated to have raised the probability of a US state government introducing a retail sales tax in the 1930s by 10–15 percent. Furthermore, states with less ability to reduce spending, and those with greater initial fiscal pressure, were relatively more likely to introduce a retail sales tax. These relationships are robust to a variety of controls.

I provide supplementary evidence in support of the model using narrative evidence on the origins of sales taxation in Europe, which reveals post-World War I financial difficulties and the Great Depression as causes of sales tax adoption. I also provide more contemporary evidence consistent with the model, showing in cross-country data that indicators of fiscal stress have been associated with a higher likelihood of countries adopting a Value Added Tax.

This paper's model and empirical findings invite a reconsideration of the factors responsible for the correlation between wars and tax base expansion. The political economy literature emphasizes the common interest nature of military spending as the catalyst for wartime investment in fiscal capacity. But both the magnitude as well

as the nature of spending changes in wartime. High levels of spending in wartime stress the revenue raising capacity of narrow tax bases, making an increase in tax base breadth desirable on efficiency grounds alone. It is therefore unclear whether it is the change in the composition of spending or the magnitude of spending that is the main factor responsible for wartime investment in fiscal capacity. Economic slumps provide an opportunity to determine whether a rise in the distortionary cost of taxation—absent changes in military spending—is sufficient to induce investment in fiscal capacity. The adoption of retail sales taxes by US state governments during the Great Depression indicates that a rise in the distortionary cost of taxation alone is a powerful motive for tax base expansion.

This paper is also related to a literature that studies the optimal use of debt to smooth fluctuations in revenue needs. Barro (1979) shows that, if possible, a government should borrow and lend to minimize tax rate variation, thereby reducing the efficiency cost of taxation, which is convex in the tax rate. This behavior is often described as tax rate smoothing. In my model, governments are assumed to have a balanced budget requirement, and so must match revenues and expenses period by period. But unlike Barro (1979), fiscal capacity is endogenous. I rule out the use of debt as a means to minimize the distortionary cost of taxation because US state governments had limited ability to borrow to fund noncapital-related expenditures. This does not alter the proposition that a sufficiently large fall in income induces a tax base broadening reform. Incurring debt provides a means to postpone the collection of revenue, and spread repayments over time, but absent default governments must ultimately run a budget surplus to make up for past revenue shortfalls. The larger the net debt repayments, the greater the revenue requirement relative to income, and the more desirable a tax base broadening reform.

Although the role of wars is a central feature of the literature, a number of other factors affecting incentives to invest in fiscal capacity have been explored. Political turnover and the cohesiveness of institutions has been shown to affect the incentives for politicians to invest in fiscal capacity (Besley and Coate 1997). A lack of social cohesion, such as ethnic fragmentation, makes incumbent politicians unwilling to invest in fiscal institutions that can be used by future governments to redistribute money to disfavored groups (Alesina, Baqir, and Easterly 1999). More generally, political turnover makes politicians undervalue the future benefits of higher fiscal capacity, and creates incentives for incumbents to tie the hands of their successors (Persson and Svensson 1989). Other work argues that structural change occurring during the process of development changes the types of taxes that are feasible and desirable. For example, increased employment in formal sector firms enables information reporting and withholding of income taxes at source (Kleven, Kreiner, and Saez 2009), while increases in financial transactions through banks provide records for tax inspectors to enforce tax laws (Gordon and Li 2009). But, to the best of my knowledge, the role of macroeconomic income shocks has not previously been considered in the fiscal capacity literature.[3]

[3] See the recent handbook chapter by Besley and Persson (2013), and the references therein, for a more complete account of the existing literature.

More broadly, this paper contributes to the "crises induce reform" literature pioneered by Drazen and Grilli (1993), who argue that the cost of inefficient policies is magnified in crises, leading to the resolution of social conflict that acts as a barrier to reform in normal times. The role of crises as a catalyst for reform is challenging to test, but evidence has been found that: economic recessions promote financial and trade reforms (Agnello et al. 2015); falling per capita income predicts increased economic liberalization, measured by an index of financial, labor, tax, and trade reforms (Lora and Olivera 2004); and that balance of payments crises spur financial liberalization (Abiad and Mody 2005). Countering this, Duval (2008) provides evidence for Organisation for Economic Co-operation and Development (OECD) countries that sound public finances and fiscal expansions were associated with an increased likelihood of product and labor market reforms, indicating that the potential for crises to cause structural reform may depend on the type of reform in question. My findings are notable in providing among the first detailed evidence of crises leading to tax base expansion. Consistent with my findings, the OECD (2012, 27–28) argues that the Global Financial Crisis has acted as a catalyst for structural reforms, pointing to tax base broadening reforms undertaken in Greece, Ireland, and Portugal; notably, these three economies experienced among the largest peak-to-trough declines in real GDP since 2007.[4]

The remainder of the paper proceeds as follows: Section I lays out and discusses a formal model endogenizing the upgrading of fiscal capacity; Section II uses the experience of US state governments during the Great Depression to test the model's key predictions; Section III discusses the empirical results in light of the model; Section IV provides evidence of a relationship between fiscal pressure and tax base expansion in other settings; and Section V concludes.

I. Model

A. *Overview*

The model assumes a government that raises revenue via a distortionary tax to provide a public good. It is based on Yitzhaki (1979), but differs in a number of important ways.[5] Households receive a time-varying income endowment and consume a continuum of private goods, for which the government chooses both the tax rate and the breadth of the tax base (the set of taxed commodities). A broader tax base corresponds to a higher level of fiscal capacity, and these two terms are used interchangeably. Cobb-Douglas utility is assumed because with these preferences a uniform rate on all taxed goods is optimal, permitting the analysis to use a single tax

[4] Other OECD countries to undertake tax base broadening reforms in the post-2008 period include Japan and Korea (OECD 2012, 96, 98). Elsewhere, effective consumption tax base broadening occurred in OECD countries where new or additional VAT rates were introduced to narrow the difference between reduced and standard rates (France, Hungary, Ireland, Poland, and the Slovak Republic) and where the difference between existing standard and reduced VAT rates was narrowed (Czech Republic, Estonia, Norway, and Poland) (OECD 2014, 46).

[5] Wilson (1989) extends the Yitzhaki (1979) model to consider different elasticities of substitution between taxed and untaxed goods. Slemrod and Kopczuk (2002) extend the Yitzhaki (1979) model to include heterogeneity in income-earning ability among taxpayers and a concave social welfare function.

rate and thus sidestep the issue of differentiated tax rates among goods, which is not a central issue in this context.

An increase in tax base breadth lowers the excess burden of taxation, because there are fewer untaxed goods for taxpayers to substitute toward, but raises administrative cost, which is assumed to be increasing in tax base breadth. As an example of the relationship between tax base breadth and administrative cost, expanding the sales tax base to include services is widely believed to raise administrative cost because service transactions are generally more costly to observe, and therefore to tax, than are goods transactions. Because US state governments were unable to meaningfully borrow to fund noncapital expenditures, I assume the government has a per-period balanced budget requirement. The following subsection begins the formal description of the model.

B. *Preferences*, *Income Endowment*, *and Tax Base*

There is a representative consumer who has Cobb-Douglas utility over a continuum of privately consumed goods, $c_{i,t}$, and a single public good, G_t, consumed in time t:

$$U_t = \int_0^1 \alpha_i \log\left(c_{i,t}\right) di + \phi \log\left(G_t - \overline{G}\right), \tag{1}$$

where ϕ parameterizes the representative consumer's preference for the public good relative to privately consumed goods. The sum of the parameters α_i is normalized to unity, $\int_0^1 \alpha_i \, di = 1$. At an optimum for the consumer, the parameter α_i is equal to the consumer's expenditure share of income on good $i \in [0, 1]$; the representative consumer receives an exogenous income endowment y_t. For simplicity, I assume that income shocks are independent and identically distributed: $y_t \sim iid\left(\overline{y}, \sigma_y^2\right)$.[6] The assumption of an endowment economy means that there is no labor/leisure trade-off, and that leisure is not included in the set of privately consumed goods. As a consequence of the representative agent assumption, there are no differences in income or time preference across households that would give rise to borrowing or lending between households, and the representative consumer spends all their income each period. For simplicity, each state is assumed to be a closed economy, so there is no borrowing or lending outside the state. There is a level of mandatory spending $\overline{G}$, such as spending on law and order, that does not vary with income.[7]

The set of goods $i \in [0, I_t]$ is subject to a uniform tax rate, and the remaining set of goods $i \in (I_t, 1]$ is not taxed. The larger the index of taxed goods, I_t, the broader the tax base because a wider set of commodities is subject to tax. The expenditure share of taxed goods is $b(I_t) \equiv \int_0^{I_t} \alpha_i \, di$ and, because b_t is a monotonic transformation of I_t, the planner can equivalently set the breadth of the tax base by choosing b_t or I_t. Normalizing the exogenous pretax price of all goods to unity, households face the price $p_{i,t} = 1/(1 - \tau_t)$ for goods $i \in [0, I_t]$, and $p_{i,t} = 1$ for goods $i \in (I_t, 1]$.

[6] Allowing for serial correlation in income would not alter any of the model's key predictions.

[7] For simplicity the model does not incorporate trend growth in incomes, which is not important in this context.

C. *Privately Consumed Goods*

The utility-maximizing choice of privately consumed goods for the representative consumer is

$$c_{i,t} = \begin{cases} (1-\tau_t)\,\alpha_i y_t & \text{for } i \leq I_t \\ \alpha_i y_t & \text{for } i > I_t \end{cases}, \tag{2}$$

implying period indirect utility for privately consumed goods equal to

$$\tilde{v}(y_t, \tau_t, b_t) = \gamma + \log(y_t) + b_t \log(1-\tau_t), \tag{3}$$

where $\gamma \equiv \int_0^1 \alpha_i \log(\alpha_i)\, di$ is a constant. Ceteris paribus, utility from privately consumed goods is increasing in the income endowment y_t, decreasing in the tax rate τ_t, and decreasing in the share of goods subject to tax b_t.

The excess burden of taxation is the cost to the representative consumer of paying taxes on a narrow tax base relative to a world in which they remit the same tax liability via a lump-sum tax. (In this model, a comprehensive tax base is equivalent to a lump-sum tax, but is assumed here to be prohibitively expensive to administer.) Measured in units of utility, the excess burden of taxation for a tax policy that collects tax revenue $R = \tau_t b_t y_t$ is equal to

$$\begin{aligned} EB(y_t, \tau_t, b_t) &\equiv \tilde{v}(y_t - R, 0, b_t) - \tilde{v}(y_t, \tau_t, b_t) \\ &= \log(y_t - R) - \left[\log(y_t) + b_t \log(1-\tau_t)\right] \\ &\simeq \log(y_t - R) - \left[\log(y_t) - b_t\left(\tau_t + \tau_t^2/2\right)\right], \end{aligned} \tag{4}$$

where the approximate equality follows from taking a second-order Taylor series approximation around $\tau = 0$. In what follows, this excess burden of taxation will sometimes be equivalently referred to as deadweight loss or efficiency cost. Next, consider the reduction in the excess burden of taxation due to a revenue-neutral marginal increase in tax base breadth. This can be found by differentiation with respect to b_t, subject to the requirement that tax revenue collected is unchanged. The decline in excess burden is

$$\frac{\partial EB}{\partial b_t} = -\log(1-\tau_t) - \frac{\tau_t}{1-\tau_t} \simeq -\frac{\tau_t^2}{2}, \tag{5}$$

with the approximation again due to a second-order Taylor series approximation around $\tau = 0$. The decline in excess burden due to a marginal increase in tax base breadth is approximately proportional to the tax rate squared. As discussed in detail later, this convexity plays a crucial role in explaining the occurrence of tax base changes.[8]

[8] The compensated elasticity of taxable income is equal to b, the expenditure share of taxed goods (see Slemrod and Kopczuk 2002, 108).

D. *Budget Constraint and Administrative Costs*

Revenue raised by taxation of the privately consumed goods is used to fund provision of a public good. The government's period budget constraint is given by

$$G_t = \tau_t b_t y_t - \xi(y_t, b_{t-1}, b_t), \tag{6}$$

where G_t is spending on the public good and $\tau_t b_t y_t$ is revenue raised at rate τ_t, on a tax base with breadth b_t, and at income level y_t. The administrative cost function $\xi(y_t, b_{t-1}, b_t)$ depends on both the current and previous period's level of tax base breadth, and the level of income:

$$\xi(y_t, b_{t-1}, b_t) = \xi_f(b_t)\, y_t + \xi_F(b_{t-1}, b_t)\, y_t, \tag{7}$$

where $\xi_f(b_t)$ is the per-period cost to administer a tax base with breadth b_t, and $\xi_F(b_{t-1}, b_t)$ is a fixed cost incurred in undertaking a tax base broadening reform that expands the expenditure share of commodities subject to tax from b_{t-1} to b_t. For simplicity, administrative cost is assumed to be linear in income: $\xi(y_t, b_{t-1}, b_t) = \xi(b_{t-1}, b_t)\, y_t$. This assumes away aspects of administrative cost that do not vary proportionally with the value of the tax base, but does not change the model's key insights.[9]

The administrative cost required to collect tax revenue differs by commodity, because it is more costly to verify and enforce tax liability for some commodities than others. Commodities are assumed to be ordered in increasing administrative cost, so that the per-period administrative cost function $\xi_f(b_t)$ is monotonically increasing and convex in tax base breadth. Reflecting the administrative infeasibility of making arbitrarily narrow distinctions between taxed and untaxed goods, the per-period administrative cost function $\xi_f(b_t)$ permits a finite number of levels of tax base breadth. In practice, differentiating tax liability among highly substitutable commodities is prohibitively expensive, because taxed purchases can be easily disguised as untaxed purchases, and marginal changes in product specification could be made to avoid tax liability. The per-period administrative cost function is shown in Figure 1, panel A. For ease of exposition, I show only a small number of feasible levels of tax base breadth.

The fixed cost incurred when fiscal capacity is upgraded includes all one-time expenses incurred by the tax administration required to collect revenue on a new tax base, such as putting a reporting and compliance infrastructure in place (see Slemrod and Yitzhaki 2002 on administrative costs). The infrequency with which we observe fundamental changes in tax base breadth—such as the introduction, or repeal, of a consumption tax—suggests that the fixed cost component to upgrade

[9] Evasion and avoidance considerations suggest per-period administrative cost may be increasing in the tax rate, but following Yitzhaki (1979) administrative cost is assumed not to be a function of the tax rate for tractability; this simplification does not affect the model's key implications.

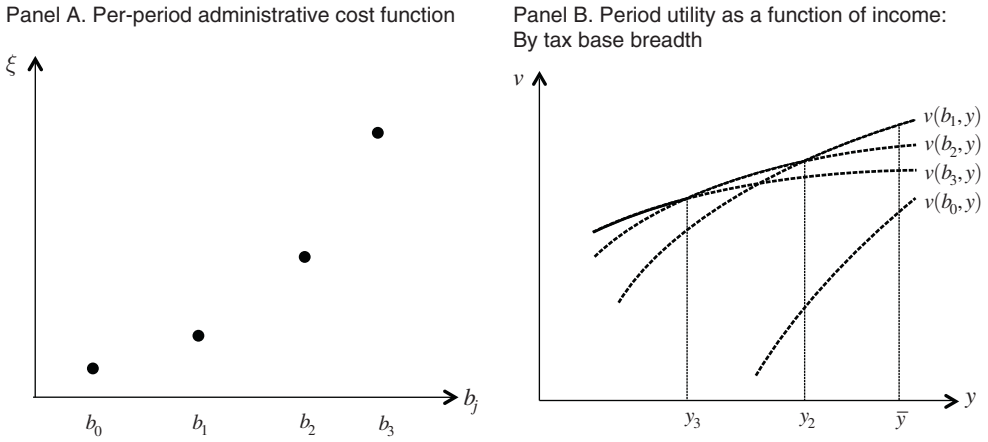

FIGURE 1. TAX BASE BREADTH

Notes: Panel A shows the per-period cost to administer a tax base of breadth b. Panel B shows per-period social welfare as a function of income for different levels of tax base breadth.

fiscal capacity is large. I assume that there is no fixed cost associated with a tax base narrowing reform.

E. *Optimal Commodity Tax Rate and Indirect Utility*

The government enters each period with tax base breadth b_{t-1} (determined in the previous period), and knowing the current period's income endowment y_t. The model assumes no frictions affecting the choice of the tax rate τ_t each period. Taking tax base breadth as given, the planner maximizes welfare for the representative taxpayer (equation (1)), subject to the economy's budget constraint (equation (6)). The resulting first-order condition provides an implicit expression (i.e., conditional on tax base breadth) for the optimal tax rate:

$$\tau(y_t, b_{t-1}, b_t) = \frac{\phi + \xi(b_{t-1}, b_t)}{(b_t + \phi)} + \frac{\overline{G}}{y_t(b_t + \phi)}. \tag{8}$$

Holding administrative costs constant, a broader tax base requires a lower tax rate to raise a given amount of revenue than a narrow tax base, and thus the optimum tax rate is decreasing in tax base breadth.

Having solved for the optimal tax rate, I now state a regularity condition on the slope of the administrative cost function, ensuring that a tax base expansion reduces the tax rate, inclusive of the fixed cost to increase tax base breadth. This is a weak assumption because the distortionary cost of taxation is proportional to the tax rate squared, and thus a tax base broadening would never be optimal if the rate did not fall. Assumption 1 below provides a formal statement, and summarizes the earlier discussion on the convexity of the per-period administrative cost function.

ASSUMPTION 1: *The per-period administrative cost function is convex in tax base breadth; an increase in tax base breadth reduces the optimal tax rate:*

(*i*) $\Delta \xi_{f,j}/\Delta b_j$ *is increasing in tax base breadth* b_j, *where* $\Delta \xi_{f,j} \equiv \xi_f(b_j) - \xi_f(b_{j-1})$ *and* $\Delta b_j \equiv b_j - b_{j-1}$;

(*ii*) *administrative cost function is such that* $\tau(y_t, b_j, b_{j+1}) < \tau(y_t, b_j, b_j)$, *for all j.*

Next, making use of equation (8), the implicit expression for the optimal tax rate, define

$$v(y_t, b_{t-1}, b_t) \equiv \tilde{v}(y_t, \tau_t^*, b_t) + \phi \log\left(G_t^* - \overline{G}\right) \tag{9}$$

to be the utility for the representative taxpayer evaluated at the optimal tax rate, where $\tau_t^* = \tau(y_t, b_{t-1}, b_t)$ and $G_t^* = \tau_t^* b_t y_t - \xi(b_{t-1}, b_t) y_t$. This substitution simplifies the analysis that follows by re-expressing welfare for the representative household in terms of only one choice variable for the planner each period: tax base breadth b_t. With some algebra, it can be shown that

$$\begin{aligned} v(y_t, b_{t-1}, b_t) = {} & \gamma + \phi \log \phi + (1+\phi) \log y_t \\ & + (b_t + \phi) \log\left(1 - \tau(y_t, b_{t-1}, b_t)\right), \end{aligned} \tag{10}$$

where $\gamma + \phi \log \phi$ is a constant that does not depend on the tax rate or tax base breadth. Reflecting concavity of utility for privately consumed goods and the public good, the indirect utility function $v(y_t, b_{t-1}, b_t)$ is strictly increasing and concave in y_t.

LEMMA 1: *Utility is concave in income*: $v(y, b)$ *is strictly concave in y.*

PROOF:

$\frac{\partial v}{\partial y} = \frac{1+\phi}{y} + \frac{b+\phi}{1-\tau}\frac{\partial(1-\tau)}{\partial y} > 0$, using the fact that $\frac{\partial(1-\tau)}{\partial y} = \frac{\overline{G}}{b+\phi}\left(\frac{1}{y^2}\right) \geq 0$, and $\frac{\partial^2 v}{\partial y^2} = -\frac{1+\phi}{y^2} + \frac{b+\phi}{1-\tau}\frac{\partial^2(1-\tau)}{\partial y^2} - \frac{b+\phi}{(1-\tau)^2}\left(\frac{\partial(1-\tau)}{\partial y}\right)^2 < 0$. ∎

F. *Income Shocks and Tax Base Breadth*

The expression for the optimal tax rate, equation (8), shows that if there is no mandatory spending then the tax rate does not vary with income: demand for private and public consumption varies proportionally. But with a positive level of mandatory spending, revenue needs vary less than proportionally with income, and the tax rate rises when income falls. The tax rate rises by more with a narrow than a broad tax base, and thus the efficiency cost of a narrow tax base rises relative to a broad tax

base. Formally, per-period utility rises with a broad tax base (inclusive of the fixed administrative cost) relative to a narrow tax base when income falls if

$$(11) \qquad \frac{\partial v(y_t, b_j, b_{j+1})}{\partial y} - \frac{\partial v(y_t, b_j, b_j)}{\partial y} = \frac{\overline{G}}{y^2}\left[\frac{1}{1-\tau(y_t, b_j, b_{j+1})} - \frac{1}{1-\tau(y_t, b_j, b_j)}\right] < 0$$

for all j, where $b_{j+1} > b_j$. I assume that US state governments had a mandatory level of spending $\overline{G} > 0$, ensuring that a fall in income raises the value of a broad tax base relative to a narrow tax base. Validating this assumption, government spending rose as a share of income in the Great Depression, and states experiencing above-average negative income shocks were the most likely to adopt a retail sales tax. Assumption 2, and its Corollary, summarizes this discussion.

ASSUMPTION 2: *There is a positive level of mandatory spending:* $\overline{G} > 0$.

COROLLARY: *A fall in income raises per-period utility with a broad tax base relative to a narrow tax base, the more so with larger mandatory spending. Assumption* 2 *implies:*

(*i*) $\partial\left[v(y_t, b_j, b_{j+1}) - v(y_t, b_j, b_j)\right]/\partial y$ *is negative; and*

(*ii*) $\partial^2\left[v(y_t, b_j, b_{j+1}) - v(y_t, b_j, b_j)\right]/\partial y \partial G$ *is negative.*

PROOF:

By Assumption 1, $\tau(y_t, b_j, b_{j+1}) < \tau(y_t, b_j, b_j)$, and by Assumption 2, $\overline{G} > 0$. (i) follows from (11), and (ii) follows from differentiation of (11). ∎

Figure 1 panel B shows indirect utility as a function of income, for different levels of tax base breadth. Utility is strictly concave in income for each level of tax base breadth, but the degree of curvature is greater at lower levels of tax base breadth (Lemma 1; Assumption 2 and its Corollary). As income falls, the degree of curvature becomes sufficiently great at low levels of tax base breadth that the curves intersect; Lemma 2 provides a formal statement. For the set of indirect utility functions shown in Figure 1 panel B, utility is highest at tax base breadth b_1 for income levels $y_t > y_2$. At lower levels of income $y_t \in (y_3, y_2)$, utility is greatest at the higher level of tax base breadth b_2. Similarly for the other levels of tax base breadth shown. The solid line (the upper envelope) shows the maximum level of per-period utility at each level of income.

LEMMA 2: *For a sufficiently large fall in income, per-period utility is higher with a broad than a narrow tax base, inclusive of the fixed administrative cost. Suppose* $v(\hat{y}, b_j, b_j) > v(\hat{y}, b_{j+1}, b_{j+1})$, *then there exists* $y < \hat{y}$ *such that*

$v(y, b_j, b_j) < v(y, b_j, b_{j+1}) < v(y, b_{j+1}, b_{j+1})$. *Furthermore*, $v(y, b_j, b_j)$ *intersects* $v(y, b_j, b_{j+1})$ *and* $v(y, b_{j+1}, b_{j+1})$ *only once.*

PROOF:

Define $f_j(y) \equiv v(y, b_j, b_{j+1}) - v(y, b_j, b_j)$. Then, note $f_j(\hat{y}) < 0$, because $v(\hat{y}, b_{j+1}, b_{j+1}) > v(\hat{y}, b_j, b_{j+1})$ and by assumption $v(\hat{y}, b_j, b_j) > v(\hat{y}, b_{j+1}, b_{j+1})$. Next, define $y_j \equiv \overline{G}/(b_j - \xi(b_j, b_j))$. Assumption 1(ii) implies $\lim_{y \to y_j} \tau(y, b_j, b_j) = 1$ and $\lim_{y \to y_j} \tau(y, b_j, b_{j+1}) < 1$. Hence, $\lim_{y \to y_j} f_j(y) = \infty$. The function f_j is continuous in y, and thus by the Intermediate Value Theorem, there exists $y_j < \tilde{y} < \hat{y}$ such that $f_j(\tilde{y}) = 0$. The Corollary implies that $\partial f_j(y)/\partial y < 0$, and thus $v(y, b_j, b_j)$ and $v(y, b_j, b_{j+1})$ intersect at most once. Because $v(y, b_{j+1}, b_{j+1}) > v(y, b_j, b_{j+1})$ for all y, it is also the case that $v(\tilde{y}, b_j, b_j) < v(\tilde{y}, b_{j+1}, b_{j+1})$ and $v(y, b_j, b_j)$ intersects $v(y, b_{j+1}, b_{j+1})$ once. ∎

G. *Optimal Tax Base Breadth*

The existence of a fixed cost to expand tax base breadth makes the optimal choice of tax base breadth a dynamic optimization problem. The government enters period t knowing the income level y_t and carrying over tax base breadth b_{t-1} from the previous period; it chooses b_t to maximize the expected discounted lifetime utility for the representative taxpayer:

$$V(y_t, b_{t-1}) = \max_{b_t} \{ v(y_t, b_{t-1}, b_t) + \beta E_y V(y_{t+1}, b_t) \}, \tag{12}$$

where β is the government's rate of time preference. In what follows, I simplify the analysis by restricting attention to two levels of tax base breadth: $b_{L(ow)}$ and $b_{H(igh)}$. This is reasonable for this application because, although there were differences in breadth of the retail sales tax bases adopted by US state governments, the main distinction is between states that did and did not adopt a retail sales tax. Equation (12) implies that it is optimal to undertake a tax base broadening reform if

$$v(y_t, b_L, b_H) - v(y_t, b_L, b_L) > \beta E_y [V(y_{t+1}, b_L) - V(y_{t+1}, b_H)], \tag{13}$$

and to undertake a tax base narrowing reform if

$$\beta E_y [V(y_{t+1}, b_L) - V(y_{t+1}, b_H)] > v(y_t, b_H, b_H) - v(y_t, b_H, b_L). \tag{14}$$

The left-hand side of (13) rises as income falls (see the Corollary to Assumption 2), and the right-hand side of (13) does not vary with current income, because income shocks are assumed to be i.i.d. This implies that for a sufficiently large fall in income, the per-period efficiency cost of a narrow tax base is sufficiently high that (13) is

satisfied, and a tax base broadening reform is optimal. Once incurred, the fixed cost required to expand tax base breadth creates option value, because a tax base narrowing reform can be undertaken each period at no cost; this is stated formally below in Lemma 3. When the option value of maintaining a broad tax base is large, it can be optimal to maintain a broad base at normal income levels, even if it is not optimal to undertake a tax base broadening reform at normal income levels. The inaction region within which it is optimal to maintain a narrow or a broad tax base is characterized by income levels for which neither (13) nor (14) is satisfied:

$$(15) \qquad v(y_t, b_H, b_H) - v(y_t, b_H, b_L) > \beta E_y\left[V(y_{t+1}, b_L) - V(y_{t+1}, b_H)\right] > v(y_t, b_L, b_H) - v(y_t, b_L, b_L).$$

The width of the inaction region is increasing in the size of the fixed cost to expand tax base breadth. For a tax base narrowing reform to be optimal, income must be sufficiently high that (14) is satisfied.

Proposition 1 below summarizes this discussion, and is the key implication of the model that I test empirically. In particular, I test whether there is an income threshold below which a government with a narrow tax base undertakes a tax base broadening reform. When income returns to normal levels, Proposition 1 states that a government may either retain a broad tax base, or undertake a tax base narrowing reform.

LEMMA 3: *There is option value to maintaining a broad tax base*: $E_y V(y, b_H) > E_y V(y, b_L)$.

PROOF:

A tax base narrowing reform can be undertaken each period at no cost, implying $V(y, b_H) \geq V(y, b_L)$. Lemma 2 implies that for sufficiently low income realizations, per-period utility is higher with a broad than a narrow tax base. Thus, $E_y V(y, b_H) > E_y V(y, b_L)$. ∎

PROPOSITION 1 (Optimal Choice of Tax Base Breadth): *Assume that an initially narrow tax base breadth is optimal at mean income:* $v(\bar{y}, b_L, b_L) + \beta E_y V(y_{t+1}, b_L) > v(\bar{y}, b_L, b_H) + \beta E_y V(y_{t+1}, b_H)$. *Then:*

(*i*) *there exists an income level* $y_H < \bar{y}$ *such that for* $y < y_H$ *it is optimal to undertake a tax base broadening reform;*

(*ii*) *if the fixed administrative cost is not too large, then there exists an income level* $y_L > y_H$ *above which a tax base narrowing reform is optimal;*

(*iii*) *there is an inaction region within which it is optimal to maintain either a high or low tax base breadth: if* y_L *exists then the inaction region is* $y_H < y < y_L$,

otherwise it is never optimal to undertake a tax base narrowing reform and the inaction region is $y > y_H$.

PROOF:

Lemma 3 and i.i.d. income shocks imply that $E_y\left[V(y, b_L) - V(y, b_H)\right]$ is strictly negative and does not depend on current income. The remainder of the proof proceeds in three parts:

(i) Assumption 2 implies that the left-hand side of (13) is strictly decreasing in income, and Lemma 2 implies that for sufficiently low income levels $v(y_t, b_L, b_H) > v(y_t, b_L, b_L)$. Thus, there exists y_H that satisfies (13) with equality, and $y < y_H$ for which a tax base broadening reform is optimal.

(ii) If $\xi_F(b_L, b_H)$ is sufficiently small, then there exists y_L above which it is optimal to undertake a tax base narrowing reform. A sufficient condition is $\lim y \to \infty \left[v(y, b_H, b_H) - v(y, b_H, b_L)\right] < v(\bar{y}, b_L, b_H) - v(\bar{y}, b_L, b_L)$. This condition can be derived by noting that $\beta E_y\left[V(y_{t+1}, b_L) - V(y_{t+1}, b_H)\right] > v(\bar{y}, b_L, b_H) - v(\bar{y}, b_L, b_L)$ given that an initially narrow tax base is assumed to be optimal, and then using (14).

(iii) The right-hand side of (14) is strictly greater than the left-hand side of (13), and Assumption 2 implies that both terms are decreasing in income. Thus, $y_L > y_H$ and there exists an inaction region: $y_H < y < y_L$, or $y > y_H$. ∎

In the empirical analysis I show that the behavior of US state governments during the Great Depression supports Proposition 1.

H. *Distributional Considerations*

Consumption taxation is often said to have distributional effects, because some taxpayers spend a larger share of their income on taxed goods than others. The model can be naturally extended to study the implications of distributional effects. Suppose there are two groups, labeled Democrat (D) and Republican (R) for consistency with the empirical analysis. Let the preference parameters $\alpha_{i,D}$ and $\alpha_{i,R}$ differ across groups, such that for any set of taxed goods $i \in [0, I_t]$ the share of income spent on taxed goods by Democrats, $b_D(I_t) \equiv \int_0^{I_t} \alpha_{i,D}\, di$, differs from that for Republicans, $b_R(I_t) \equiv \int_0^{I_t} \alpha_{i,R}\, di$. If $b_D > b_R$ then Democrats spend a larger share of their income on taxed goods than Republicans, and vice versa. Letting s_D and s_R represent the population shares of the two groups, aggregate tax base breadth is a weighted average of the expenditure shares on taxed goods for each group: $b(I_t) \equiv s_D b_D(I_t) + s_R b_R(I_t)$. Here, it is convenient to consider I_t the choice variable for tax base breadth, rather than b_t, because for any set of taxed goods $[0, I_t]$ the share of expenditure on taxed goods differs for the two groups.

The potential for disagreement between the two groups over the benefit of tax base broadening does not centrally depend on the choice of tax rate chosen each period, so for simplicity assume that, conditional on tax base breadth, the tax rate

coincides with the planner's choice.[10] Under this assumption, per-period utility for members of group $j \in \{D, R\}$ is

$$(16) \quad v_j(y_t, I_{t-1}, I_t) = \gamma_j + \phi \log \phi + (1 + \phi) \log y_t + (b_{t,j} + \phi) \log(1 - \tau_t),$$

where $\gamma_j \equiv \int_0^1 \alpha_{i,j} \log(\alpha_{i,j})\, di$ is a group-specific constant and $\tau_t = \tau(y_t, I_{t-1}, I_t)$ is the optimal tax rate that the planner would choose; this expression is the analogue to equation (10) for the representative agent version of the model. Next, consider how a marginal increase in tax base breadth affects welfare for Democrats relative to Republicans:

$$(17) \quad \frac{\partial[v_{D,t} - v_{R,t}]}{\partial I_t} = \left(\frac{\partial b_{D,t}}{\partial I_t} - \frac{\partial b_{R,t}}{\partial I_t}\right) \log(1 - \tau_t) - \frac{b_{D,t} - b_{R,t}}{1 - \tau_t} \frac{\partial \tau_t}{\partial I_t},$$

where $\partial b_{j,t}/\partial I_t$ is the increase in the share of income spent on taxed goods for group j when the set of goods subject to taxation, I_t, is marginally increased; and $\partial \tau_t/\partial I_t$ is negative because an increase in tax base breadth facilitates a reduction in the tax rate. The first term measures the between-group difference in utility lost from paying taxes on a broader set of goods; the second term measures the difference in the gain from paying a lower tax rate on the initial tax base. An increase in tax base breadth facilitates a reduction in the tax rate on the initial base, and so benefits relatively more the group with an initially larger share of its goods subject to tax; this effect may be large enough that a group benefits relatively more from a base broadening even if it is subject to a larger increase in the share of its purchases subject to tax. This discussion is summarized in Proposition 2 below.

PROPOSITION 2 (Distributional Considerations): *Suppose there are two groups whose preference parameters α_i differ, such that for any set of taxed goods $[0, I_t]$ the share of each group's purchases subject to tax may differ. A group benefits relatively more from a tax base broadening reform if its initial share of purchases subject to tax is relatively large and the other group experiences a larger increase in the share of its purchases subject to tax.*

PROOF:
See equation (17). ∎

Empirically, I test whether distributional considerations were important by investigating whether the likelihood of a retail sales tax being introduced by US state governments in the 1930s varied depending on whether Democrats or Republicans had unified political control of state governments.

[10] This is a reasonable benchmark under divided political control, potentially serving as a focal point for bargaining between the two groups. Under single-party political control group k can unilaterally choose the tax rate to maximize utility of its members. Equation (16) would be modified by replacing the planner's choice τ_t with $\tau_{k,t}$, and adding the term $\phi \log(b/b_k)$. The additional term arises because members of group k do not internalize the cost and benefit of providing the public good to members of the other group when choosing the tax rate; this term is common to both groups so would not appear in equation (17).

II. Empirical Analysis

A. *Background*

The behavior of US state governments during the Great Depression provides an excellent opportunity to examine whether an economic slump causes tax base expansion: the US states provide a relatively homogenous institutional setting and the magnitude of income shocks experienced was particularly large.

Prior to the Great Depression, US state government revenue as a share of income was relatively small, averaging 3.3 percent in 1927; these revenues were collected from a narrow set of tax bases. In 1932, by which point only two states had introduced a retail sales tax, state governments on average raised 60 percent of their tax revenue from license and permit taxes, 27 percent from general property taxes, 5 percent from inheritance taxes, and the remaining 8 percent from a range of less prominent taxes. While none of the US states had a retail sales tax prior to the Great Depression, 12 states levied an individual income tax, and 10 had a corporate net income tax (see Table 1). Most states levying a corporate net income tax did so to prevent revenue leakage from their personal income tax base.

Because there is no borrowing or lending in the model, a comprehensive income and retail sales tax base are theoretically equivalent; for a state with a comprehensive income tax, the addition of a retail sales tax would not represent a tax base expansion. In practice, personal income tax bases were narrow, and the introduction of retail sales tax bases represented a substantial increase in tax base breadth. Personal income taxes were levied mainly on very high income earners, who were taxed at low rates (Bakija 2009). Withholding at source for personal income taxes did not begin to be introduced at the state government level until 1948 (Dušek 2006), limiting the ability of state income taxes to reach a large share of the population.

The Great Depression had a profound impact on US state government tax structure. None of the US states had a broad-based consumption tax in 1929, but by the 1933 trough in US real GDP, 11 state governments levied a retail sales tax; by 1938, at which point US per capita real GDP was still below its 1929 level, 28 states had levied a retail sales tax for at least 1 year (Figure 2). All but 6 of the 28 new retail sales taxes introduced during the 1930s have been levied continuously until the present day (Table 1).

B. *Narrative Evidence*

Narrative evidence provides support for the economic mechanisms underlying the model. A *Wall Street Journal* article in 1933 explained the wave of sales tax base adoption as follows: "Sales taxes are spreading among the states for two reasons: (1) Legislatures and governors shrink from the unpleasant job of cutting expenditure in proportion to the falling revenues; (2) additional taxes cannot be laid upon either property or incomes without crossing the line of diminishing returns" (*Wall Street Journal* 1933, 6). The first point provides evidence for the existence of mandatory spending in the model, and the second point provides evidence that increased reliance on existing narrow tax bases would have resulted in an intolerable level of

TABLE 1—NUMBER OF US STATES WITH TAX BASE: BY DECADE

	Retail sales		Individual income		Corporate income		
	Permanent	Temporary	Permanent	Temporary	Permanent	Temporary	Total
1900–1909	0	0	0	0	0	0	0
1910–1919	0	0	8	0	4	0	12
1920–1929	0	0	12	0	10	0	22
1930–1939	22	6	28	2	24	1	83
1940–1949	27	0	28	2	25	1	83
1950–1959	32	0	28	0	28	0	88
1960–1969	44	0	35	0	33	1	113
1970–1979	44	0	39	0	34	1	118

Notes: Alaska and Hawaii, which achieved statehood in 1959, are excluded. Narrow individual income tax bases are also excluded: New Hampshire and Tennessee have bases taxing only interest and dividend income, and Connecticut has a base that taxes only capital gains and dividends. Louisiana is classified as permanently introducing the retail sales tax in 1938 because its 1940 repeal lasted only one year.

Source: Due and Mikesell (1994), Penniman (1980)

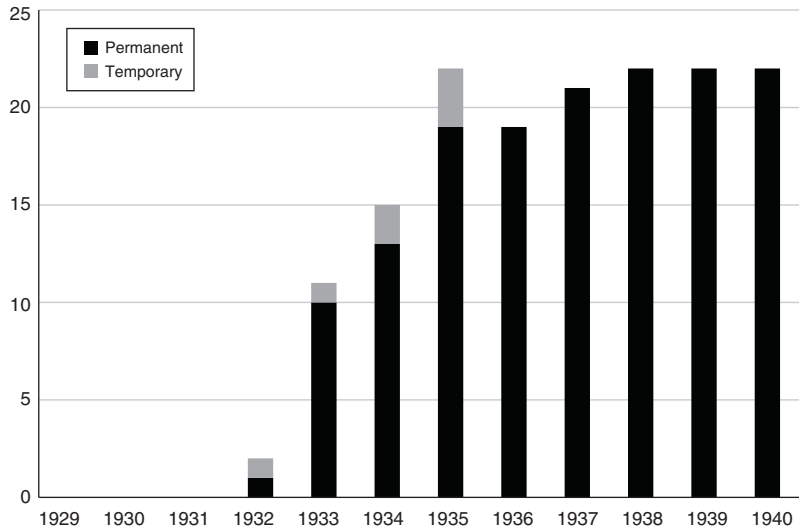

FIGURE 2. NUMBER OF STATES WITH A SALES TAX

Note: During the period 1932–1938, 22 states introduced a retail sales tax that ultimately became permanent, and 6 states levied a temporary retail sales tax for 1 or 2 years.

Source: Due and Mikesell (1994)

deadweight loss. As predicted by the model, sales tax revenues were used to reduce reliance on less efficient tax bases, with the *New York Times* reporting that "One of the major trends in 1933 State enactments has been the widening of tax bases to lift a part of the burden now borne by realty, …" (*New York Times* 1933b, 1).

The experience of Mississippi, the first state to introduce a retail sales tax, provides further evidence on the context and motivations for reform. By 1932, Mississippi had a large accumulated deficit, revenue from the state income tax had slumped to one-quarter of its 1928 level, and property owners were struggling to pay their

tax liability at the prevailing rate (Garner 1934). Governor Connor, a Democrat, proposed deep spending cuts and it was soon reported that "The Legislature has made considerable progress in reducing expenditure by cutting allotments here and there, but it has not been able to stomach larger parts of the plan" (*New York Times* 1932c, 62); the inability to reduce spending in proportion to revenue illustrates the role of mandatory spending in the model.

Confronted with a need for revenue, Governor Connor was the key proponent of the sales tax, with the *New York Times* commenting that "… the young and alert Governor has implicit faith in the efficiency of the sales tax, …" (*New York Times* 1932a, 62). Consistent with the model, the governor stressed the benefit of adopting a broad tax base, saying that "… more than 85 per cent of land taxes are paid by 15 per cent of the population" whereas "The wonderful thing about this [sales] tax is its broad distribution and the decreased cost of collection" (*New York Times* 1932a, 62). Despite Democrats holding unified political control, "The [sales tax] bill was passed after a bitter fight, involving a deadlock lasting nearly three months during which other legislation was lost sight of" (*New York Times* 1932b, 66); one of the most persistent objections to the tax was fear that sales would be lost to neighboring states (*New York Times* 1933a, 61). However, it was soon said that "Organized opposition to the tax, at first offered by many interests, virtually has vanished" (*New York Times* 1932d, 8).

The tax was viewed as a success: its cost of administration was estimated to be modest at 3.8 percent (*New York Times* 1933a, 61) and Garner (1934, 24) argued that "It has enabled the state to balance its budget, to meet its obligations as they have matured; and has been the means of restoring its credit." Governor Connor was prescient in arguing that "Mississippi is merely leading the way. I believe other States are going to find that the retail sales tax is the only way out and that experience will prove it is in reality the only suitable form of taxation" (*New York Times* 1932b, 66).

The next section outlines the data and explains the empirical variation used to test the model. In general, data sources are noted when data are first referenced; the online Appendix contains further detailed information on data sources.

C. *Data and Empirical Predictions*

Income Shocks and Mandatory Spending.—The model's central empirical prediction, that a sufficiently large fall in income causes tax base expansion, is tested using cross-state variation in real per capita personal income. Per capita US real GDP fell by 29 percent from 1929 to 1933, and took a decade to regain its 1929 level. Crucially, from an identification point of view, there was substantial heterogeneity in the size of income shocks experienced across states: Virginia experienced a fall in real per capita income of "only" 12 percent between 1929 and 1933, while at the other extreme South Dakota suffered a 56 percent collapse in income over the same period. Garrett and Wheelock (2006) show that the size of income shocks experienced by states is correlated with industrial structure, but not the level of government spending or pre-Depression income levels. The degree of spatial correlation in the size of income shocks experienced was relatively modest,

indicated by a Moran's *I*-statistic of 0.23, providing statistical power to identify an effect of income shocks on tax structure.[11]

The model predicts that higher levels of mandatory spending, $\overline{G}$, increase the likelihood of adopting a sales tax during a slump. As a proxy for mandatory spending, I use operations and maintenance spending plus interest expense as a share of total; the remaining share of state government spending is capital expenditures. The assumption is that reducing capital expenditures in a slump is less costly in terms of foregone utility than reducing spending on schools, health, and sanitation, and other categories of operations and maintenance spending. Supporting the assumption that states would choose to substitute away from capital spending in a slump, operations and maintenance spending as a share of total spending rose from 67 percent to 75 percent (approximately one standard deviation) between 1929 and 1937. Empirically, I test whether states with a relatively high share of operations and maintenance spending in 1929, and so with less scope to reduce spending, were more likely to introduce a retail sales tax.

The Role of Initial Fiscal Pressure.—The model assumes away debt, with governments constrained to balance revenues and expenditures period by period. Justifying this assumption, debt was mostly issued by state governments to fund capital works programs, and played no meaningful role in smoothing fluctuations in income during the Great Depression; except for Arkansas and South Carolina, there was little increase in nominal debt outstanding during the 1930s. Nonetheless, state governments did find ways to run modest deficits at points in time. I test whether initial fiscal pressure is associated with an increased likelihood of adopting a retail sales tax using cross-state variation in state government budget deficits (and surpluses) as a share of spending in 1929. A larger initial deficit indicates increased revenue needs relative to income, and so provides an indirect means of testing for the role of mandatory spending.

State government debt levels at the onset of the Great Depression provide another source of variation in initial fiscal pressure. While average debt levels were moderate in 1929 compared to earlier years (Table 2), the debt-to-income ratio rose sharply for those states entering the Great Depression with high debt levels, owing both to large falls in income and a 24 percent peak-to-trough fall in the price level, measured by the US GDP deflator. A wave of credit rating downgrades followed: 45 states had an Aaa credit rating in 1929, 35 in 1932, and 13 in 1937 (see Table 3).[12] Entering the Great Depression with a high debt level would have increased revenue needs to fund interest payments and to repay maturing debt, where rolling over may not have been possible; in the model, interest expense, which does not vary with income, is an example of mandatory spending. For the five most highly indebted states, interest expense averaged 14.6 percent of total spending in 1932. Empirically, I test whether states with a high debt-to-income ratio in 1929 were more likely to adopt a retail sales tax; in the robustness analysis, I also test whether credit rating downgrades had

[11] A Moran's *I*-statistic of one indicates perfect clustering, zero no spatial correlation, and minus one perfect dispersion.

[12] Only one state, Arkansas, defaulted on any of its debt obligations (Ratchford 1941).

Table 2—Debt-to-Revenue Ratios: Number of US States

	1890	1902	1912	1922	1927	1929	1932	1937	1942	1947	1952
0.0–0.5	11	15	22	18	19	20	19	23	29	36	32
0.5–1.0	6	14	6	14	13	15	13	12	12	11	11
1.0–3.0	15	12	18	16	15	11	12	12	7	1	5
> 3.0	13	7	2	0	1	2	4	1	0	0	0
Average	2.62	1.47	0.91	0.80	0.87	0.93	1.09	0.66	0.52	0.27	0.44
Median	1.59	0.83	0.54	0.71	0.71	0.67	0.63	0.51	0.39	0.17	0.30
Federal govt.	2.78	2.10	1.72	5.70	4.61	4.38	10.13	6.76	4.95	6.71	3.92

Notes: Debt is par value of gross debt less sinking fund assets. Revenue data for 1902 and 1912 are unavailable, and data for 1903 and 1913 have been used instead. Data for three states are missing for 1890. Average values are unweighted.

Source: Authors' calculations, US Department of Commerce (various years)

Table 3—Moody's General Obligation Bond Ratings

	Number of US states by rating category							
	1922	1927	1929	1932	1937	1942	1947	1952
Aaa	48	44	45	35	13	15	24	22
Aa	0	2	2	10	15	18	16	13
A	0	0	0	2	11	12	7	9
Baa	0	0	0	0	5	2	0	0
Ba	0	0	0	0	1	0	0	0
Unrated	0	2	1	1	3	1	1	4

Notes: Where a state is unrated for the year noted, the state is assigned its rating for the subsequent year. If a rating is unavailable, states with a debt-to-revenue ratio of no more than 0.1 were assigned an Aaa rating. Unrated states noted in the table fall into neither of these categories. The number of assigned ratings for the years 1922–1952, respectively, is 2, 0, 2, 4, 6, 7, 11, and 9. According to Moody's Investor Service, the absence of a rating provides no indication of the credit worthiness of an issuer.

Source: Moody's Municipal and Government Bond Manual (1920–1950)

an independent effect on the likelihood of adopting a retail sales tax, conditional on the magnitude of income shocks and the level of debt.

Political Control and Fiscal Institutions.—The model implies that if changes in tax base breadth differentially affected Democrat or Republican voting constituencies then we should expect to see an increased likelihood of a state adopting a retail sales tax where the party whose supporters most benefited had unified political control (Proposition 2). I use data from Burnham (1985) to construct indicators of unified control by party, and investigate whether the likelihood of introducing a sales tax was higher when either the Democrats or Republicans had unified control.

The US states provide a relatively homogenous group of governments, but there were differences in fiscal institutions across states. At the onset of the Great Depression, a constitutional amendment was required to issue debt in 18 states, a statewide referendum was required in 15 states, and among the remaining 15 states for which the effective power to issue debt resided in state legislatures, balanced

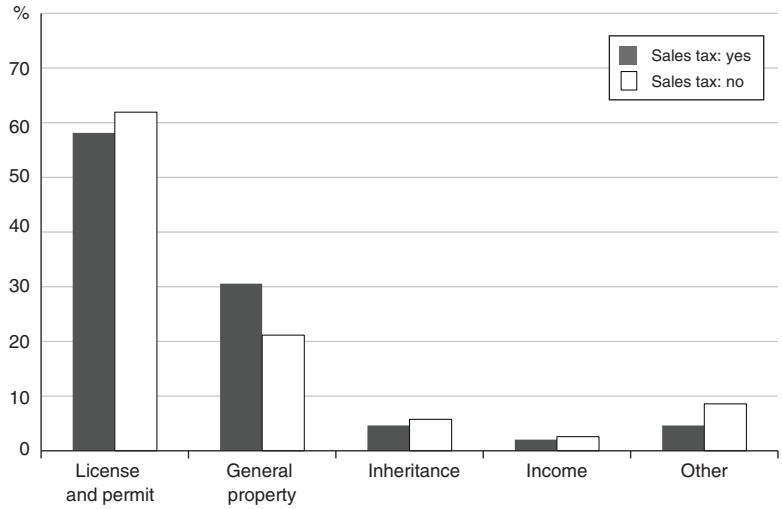

FIGURE 3. TAX REVENUE SHARES: 1932

Notes: Sales tax: yes is the 28 states that levied a retail sales tax in the 1930s, and *Sales tax: no* is the 20 states that did not. Mississippi and Pennsylvania were the first two states to introduce a sales tax in 1932. *License and permit* includes motor vehicle, nonbusiness, and business license taxes.

Source: Authors' calculations, Due and Mikesell (1994), US Department of Commerce (various issues)

budget requirements for operating expenses were in force in 7 states (Ratchford 1938, Rodriguez Tejedo 2007).[13]

The set of variables and controls discussed to this point, plus indicators for the presence of individual and corporate income tax bases, comprise the baseline empirical specifications. Next, I consider sources of heterogeneity among the states that could have affected incentives to adopt a retail sales tax.

Initial Tax Structure.—States that introduced a retail sales tax in the 1930s raised an approximately 10 percentage point higher share of their revenue from property taxes than states not introducing a retail sales tax in the 1930s (Figure 3). There is contemporary evidence that state governments were particularly reluctant to raise property taxes for fear of increasing foreclosures (*New York Times* 1933b), suggesting that states with higher initial property tax revenue share may have experienced greater pressure to seek other sources of revenue. Furthermore, because property tax collections tend to lag changes in the value of the base more than for other types of taxes, variation in states' reliance on the property tax base could have affected the timing of fiscal pressure. I use the share of revenue raised from property taxes

[13] During the 1930s a few states adopted more stringent fiscal institutions: Alabama introduced a constitutional balanced budget requirement in 1933, as did New York in 1938. Arkansas removed the effective power to issue debt from legislators in 1934, and put it in the hands of voters via referendum, with North Carolina following suit in 1936 (Ratchford 1938). The first state government rainy-day fund did not come into existence until 1945 (Rodriguez Tejedo 2007).

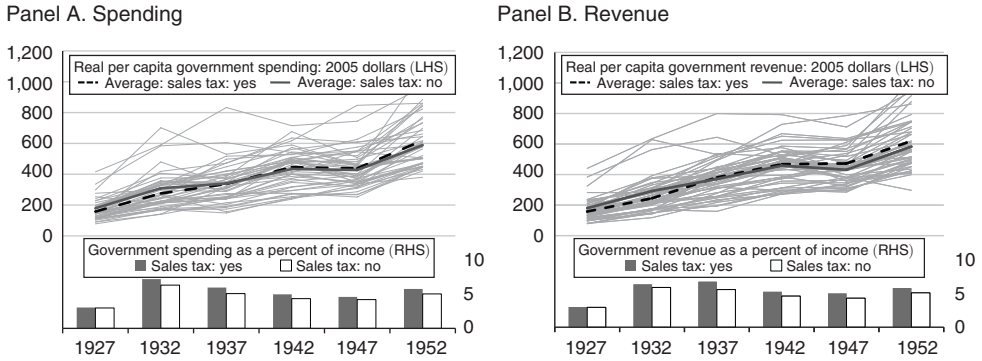

FIGURE 4. REVENUE AND SPENDING: BY STATE GOVERNMENTS

Notes: Sales tax: yes is the 28 states that levied a retail sales tax in the 1930s, and *Sales tax: no* is the 20 states that did not. Income is state per capita personal income. Nominal revenues and spending were converted to real values using the US GDP deflator. Spending data are total state government cost payments for 1927–1937, and total state government expenditures for 1942–1952.

Source: Authors' calculations, Bureau of Economic Analysis (BEA), Due and Mikesell (1994), US Department of Commerce (various issues)

in 1932 and changes in the value of the property tax base as a control in robustness exercises.[14]

Spending.—The model assumes a positive level of mandatory spending, which implies that government spending varies less than proportionally with income (Assumption 2). Supporting the model, spending rose sharply as a share of income between 1927 and 1932, and fell between 1932 and 1937, by which time average state income had recovered most of its 1929 level (Figure 4 panel A). (Consistent revenue and spending data are available at five-year intervals from the U.S. Department of Commerce.)

Government spending as a share of income did not fall back to its pre-1929 level, reflecting a long-run trend in state government spending (Figure 4 panel A). But average spending growth was similar for states that did and did not introduce a retail sales tax in the 1930s, indicating that differences in spending growth were not a primary cause of tax base broadening reforms. Nonetheless, the similarity of average growth in spending across states with and without a retail sales tax could mask differences in spending growth correlated with income shocks; I include spending growth as a control variable in the regression analysis to allow for this. Because states closely matched revenues and expenditures, average per capita real revenues were similar in states that did and did not introduce a retail sales tax (Figure 4 panel B).

Over the 1932 to 1937 period, when almost all of the retail sales tax bases were introduced, average spending growth was slower than over the earlier 1927 to 1932

[14] Following the repeal of Prohibition in 1933, all states introduced alcoholic beverage taxes. There was no strong tendency for states without a retail sales tax to rely more heavily on alcoholic beverage taxes: the 22 states with a retail sales tax in 1942 collected on average 4 percent of total tax revenues from alcohol taxes, only a little less than the 6 percent share for states without a retail sales tax.

period, or subsequent periods, but it is perhaps surprising that spending remained even broadly constant in real terms given the large falls in income (Figure 4 panel A). The level of spending in part reflected new demands for assistance caused by the Great Depression. Public welfare spending rose from 3 percent of state government expenditures in 1927 to 17 percent by 1934, the bulk of which was categorical cash assistance (Historical Statistics of the United States 1975).[15] Another source of spending growth during the 1930s was a trend for state government to assume responsibility for minimum required school costs from local governments (*New York Times* 1933b, 1).

The inauguration of the Roosevelt administration in 1933 ushered in the New Deal, which funded relief, social welfare, and public works programs through a combination of direct federal expenditures and federal grants to state and local governments (Wallis 1998). New Deal spending was divided among the states according to legislated formula, matching grants, and at the discretion of federal administrators; to varying degrees, economic historians have concluded that both economic and political considerations influenced the share of federal expenditures given to each state (Wallis 1998). Under some federal programs such as the Works Progress Administration (the largest New Deal program) wages were given directly to individuals, while under others, such as the Federal Emergency Relief Administrations, state governments acted as intermediaries, disbursing funds to local governments and individuals (Fishback and Kachanovskaya 2010, Wallis 1998). On the one hand, New Deal programs may have substituted for some state government activities, lessening the need for states' own revenues, which in the model could be represented by a decline in mandatory spending. But on the other hand, the use of matching grants may have increased the incentive to raise revenues; during the 1930s state governments grew relative to local governments, which Wallis (1984) attributes to matching grant provisions of federal New Deal programs.[16] I use data from Reading (1973) on New Deal expenditure, loans, and insurance programs to construct a measure of total New Deal spending relative to income by state for the 1933–1939 period. Using this measure, I test whether variation in New Deal spending across states affected the incentives to introduce a retail sales tax.

D. *Results*

This section reports results from the empirical analysis. Bivariate correlation analysis is presented first, followed by cross-state regression analysis and results from a panel data survival model.

[15] A by state breakdown of spending on public welfare is unavailable.

[16] In contrast to Wallis (1984), Coen-Pirani and Wooley (2017) propose a political economy model in which fiscal stress at the local government level increased support for state governments to assume some responsibilities from local governments. The property tax was the most important source of revenue for local governments, so their theory implies that variation in fiscal stress at the local government level was most directly related to changes in assessed property values. Augmenting the baseline specification with changes in assessed property values, as discussed earlier, provides a test of whether variation in fiscal stress at the local government level increased revenue needs at the state government level.

Table 4—Upgrading of Fiscal Capacity: Bivariate Analysis

		Number of states	Sales tax share: 1930s	
			All	Permanent
Panel A. Income shock: 1929–1933	< 20	8	0.3	0.1
	20–30	21	0.5	0.3
	30–40	15	0.7	0.7
	40–50	3	1.0	1.0
	> 50	1	1.0	1.0
Panel B. Mandatory spending: 1929	< 55	3	0.7	0.7
	55–65	20	0.5	0.4
	65–75	16	0.6	0.5
	> 75	9	0.8	0.6

Notes: Income shock: 1929–1933 is the percentage decline in real state per capita personal income from 1929–1933. *Mandatory spending: 1929* is operations and maintenance spending plus interest as a share of total state government spending in 1929; the remainder is capital outlays. *Sales tax share: All* is the fraction of states in each category that levied a retail sales tax in the 1930s, and *Sales tax share: Permanent* is the fraction that introduced a retail sales tax in the 1930s that ultimately became permanent.

Source: Authors' calculations, BEA, Due and Mikesell (1994), US Department of Commerce (various issues)

Bivariate Analysis.—Supporting the model, governments in states experiencing larger than average falls in income were significantly more likely to introduce a retail sales tax than those experiencing smaller than average income shocks. A retail sales tax was introduced by 30 percent of states experiencing a less than 20 percent fall in income, by 50 percent of states experiencing a 20–30 percent fall in income, by 70 percent of states experiencing a 30–40 percent fall in income, and by all four states experiencing a larger than 40 percent fall in income (Table 4, panel A). Providing further support for the model, there is also bivariate evidence that states with higher levels of mandatory spending (proxied by operations and maintenance and interest expense as a share of spending) were more likely to adopt a retail sales tax (Table 4, panel B).

Baseline Regression Specification and Additional Control Variables.—Table 5 reports cross-state regression results, where the dependent variable for each regression is an indicator taking the value unity if a state introduced a retail sales tax in the 1930s; each specification reports coefficient estimates from a linear probability model. The baseline specification provides support for the model along several dimensions. First, each 10 percent fall in real per capita income between 1929 and 1933 is estimated to have increased the probability that a state government introduced a retail sales tax by 0.13; second, each 10 percentage point increase in mandatory spending as a share of revenue in 1929 is estimated to have been associated with a 0.26 higher probability of introducing a retail sales tax; and third, states entering the great depression with larger budget deficits and higher debt-to-income ratio had an increased likelihood of introducing a retail sales tax, consistent with initial fiscal pressure being a cause of sales tax base adoption (Specification 1).

The presence of individual and corporate income tax bases was insignificantly related to the likelihood of introducing a retail sales tax, consistent with those bases

TABLE 5—CROSS-SECTIONAL REGRESSION ANALYSIS: US STATE GOVERNMENT SALES TAX ADOPTION IN 1930s

	Binary dependent variable: Sales tax introduced 1929–1940					
	(1)	(2)	(3)	(4)	(5)	(6)
Income tax 1929	0.099	0.067	0.087	0.124	0.154	0.105
	(0.135)	(0.142)	(0.145)	(0.150)	(0.122)	(0.136)
Corporate tax 1929	−0.186	−0.143	−0.156	−0.193	−0.178	−0.191
	(0.149)	(0.173)	(0.143)	(0.177)	(0.127)	(0.149)
ΔInc. 1929–1933	−0.013	−0.016	−0.013	−0.011	−0.014	−0.013
	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)	(0.004)
$\overline{G}$: 1929	0.026	0.027	0.020	0.023	0.023	0.026
	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.006)
Deficit: 1929	0.009	0.009	0.010	0.007	0.007	0.009
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Debt: 1929	0.052	0.055	0.053	0.053	0.050	0.053
	(0.015)	(0.015)	(0.014)	(0.015)	(0.017)	(0.015)
Constitution	0.159	0.134	0.049	0.160	0.144	0.157
	(0.163)	(0.175)	(0.171)	(0.175)	(0.167)	(0.165)
Referendum	0.584	0.581	0.463	0.585	0.591	0.584
	(0.146)	(0.149)	(0.161)	(0.150)	(0.152)	(0.146)
New Deal		−0.007				
		(0.010)				
ΔSpend. 1929–1932			0.005			
			(0.004)			
ΔSpend. 1932–1937			0.004			
			(0.003)			
ΔProp. 1929–1932				−0.000		
				(0.007)		
ΔProp. 1932–1937				−0.002		
				(0.002)		
Prop. Share: 1932				0.003		
				(0.004)		
BBR						−0.049
						(0.126)
Constant	−1.969	−2.032	−1.797	−1.884	−1.938	−1.999
	(0.407)	(0.409)	(0.422)	(0.457)	(0.479)	(0.408)
Credit ratings	No	No	No	No	Yes	No
Observations	48	48	48	48	45	48
R^2	0.480	0.488	0.506	0.492	0.563	0.482

Notes: Income tax 1929 and *Corporate tax 1929* are indicators for the presence of those tax bases in 1929. Δ*Inc. 1929–1933* is 100 × the log change in real state per capita personal income from 1929 to 1933. $\overline{G}$ is operating expenses plus interest expense on government debt as a share of total state government spending in 1929, *Deficit 1929* is the state government budget deficit as a percent of spending in 1929 and *Debt 1929* is the state debt-to-income ratio in 1929, in percent. *Constitution* is an indicator variable for states requiring a constitutional amendment to incur debt, *Referendum* is for states requiring a referendum to incur debt, and *BBR* is for states with a balanced budget requirement. *New Deal* is total New Deal spending (expenditure, loans, and insurance programs) as a percent of state personal income for the period 1933–1939. Δ*Spend. 1929–1932* and Δ*Spend. 1932–1937* is 100 × the log change in real state per capita state government spending. Δ*Prop. 1929–1932* and Δ*Prop. 1932–1937* is 100 × the log change in assessed property values and *Prop. Share 1932* is property tax revenue as a percent of tax revenue in 1932. *Credit rating* is the General Obligation bond rating in 1937: Aaa, Aa, A, or Baa/Ba (data missing for three states). Robust standard errors are in parentheses.

being narrow and administratively difficult to broaden (Specification 1). State governments requiring a referendum to issue debt are estimated to have been more likely to introduce a retail sales tax than states where the power to issue debt resided in the legislature, but states requiring a constitutional amendment to issue debt were no more likely to introduce a retail sales tax (Specification 1). A statewide referendum is arguably no more difficult to pass than a constitutional amendment, so this difference does not have a clear economic interpretation. Political control changed hands during the 1930s in many states, and so analysis of these data is postponed until the panel data survival model.

Variation in New Deal spending across states was insignificantly related to the likelihood of adopting a retail sales tax (Specification 2), suggesting that New Deal allocations did not significantly alter the incentives to adopt a retail sales tax; variation in own spending growth across state governments was also insignificantly related to sales tax adoption (Specification 3).[17] The importance of the property tax base varied across states, and changes in its value may have changed more or less than proportionately with income, but this variation did not appear to alter states' willingness to adopt a retail sales tax (Specification 4). Although states suffering the largest falls in income and entering the Great Depression with high debt-to-income levels had sharp credit rating downgrades, credit rating downgrades to 1937 were insignificantly related to the likelihood of adopting a retail sales tax (Specification 5 includes dummy variables for states' 1937 credit rating, which for brevity are not reported). Lastly, the presence of a balanced budget requirement did not appear to have influenced sales tax base adoption (Specification 6). The inclusion of each of these sets of control variables has a mostly minor effect on the size and significance of coefficients on the set of variables used in the baseline specification.

Regression Results: Robustness to Estimators and Outliers.—The next set of cross-state regression results consider robustness of the baseline cross-sectional specification (Table 6). One potential concern is that spillover effects were important, with the adoption of a sales tax by one state lowering the cost to neighboring states of adopting a sales tax. For example, lost sales through cross-border shopping would be less of a concern if neighboring states also adopted a retail sales tax. This would be a concern because the estimated relationships between sales tax base adoption and the independent variables could be biased by the omission of interactions between neighboring states. Perhaps the simplest means to allow for spatial correlation in the dependent variable is by inclusion of regional fixed effects. The coefficient on the income shock variable is lower and less precisely estimated after the inclusion of regional fixed effects, but the remaining relationships of interest are little changed (compare Specification 1 in Tables 5 and 6). None of the regional fixed effects are significantly different from zero.

A drawback of including regional fixed effects is that they absorb useful cross-regional variation in income. A better and more direct means to control for spatial correlation in sales tax base adoption is by inclusion of a spatial lagged

[17] State government spending data are unavailable for the years 1933–1936.

TABLE 6—CROSS-SECTIONAL REGRESSION ANALYSIS: US STATE GOVERNMENT SALES TAX ADOPTION IN 1930s—ROBUSTNESS

	Binary dependent variable: Sales tax introduced 1929–1940							
	OLS region FE (1)	GMM spatial lag (2)	GMM spatial lag and error (3)	Probit (4)	OLS Cook's dist. outliers (5)	OLS ex-large ΔInc. (6)	OLS ex-high debt (7)	OLS permanent sales tax (8)
Income tax 1929	0.147	0.067	0.071	0.109	−0.147	0.071	0.098	0.041
	(0.152)	(0.166)	(0.145)	(0.264)	(0.117)	(0.143)	(0.163)	(0.190)
Corporate tax 1929	−0.291	−0.271	−0.275	−0.081	0.037	−0.197	−0.151	−0.053
	(0.185)	(0.190)	(0.191)	(0.263)	(0.150)	(0.156)	(0.165)	(0.157)
ΔInc. 1929–1933	−0.009	−0.015	−0.014	−0.020	−0.013	−0.015	−0.013	−0.016
	(0.007)	(0.004)	(0.005)	(0.008)	(0.003)	(0.007)	(0.004)	(0.004)
$\overline{G}$: 1929	0.027	0.037	0.036	0.058	0.037	0.026	0.024	0.019
	(0.007)	(0.007)	(0.007)	(0.021)	(0.008)	(0.006)	(0.007)	(0.008)
Deficit: 1929	0.010	0.013	0.014	0.022	0.012	0.008	0.009	0.007
	(0.004)	(0.004)	(0.003)	(0.010)	(0.005)	(0.004)	(0.004)	(0.004)
Debt: 1929	0.046	0.065	0.059	0.081	0.060	0.057	0.028	0.056
	(0.015)	(0.016)	(0.015)	(0.032)	(0.014)	(0.016)	(0.043)	(0.016)
Constitution	0.096	0.187	0.158	0.323	0.224	0.126	0.113	0.196
	(0.190)	(0.166)	(0.158)	(0.303)	(0.143)	(0.170)	(0.183)	(0.140)
Referendum	0.552	0.758	0.709	0.711	0.807	0.559	0.557	0.385
	(0.139)	(0.150)	(0.138)	(0.193)	(0.170)	(0.152)	(0.147)	(0.170)
Northeast	−0.268							
	(0.361)							
South	−0.023							
	(0.229)							
West	−0.022							
	(0.253)							
Constant	−1.817				−2.837	−2.037	−1.774	−1.744
	(0.535)				(0.582)	(0.468)	(0.424)	(0.536)
Observations	48	48	48	48	44	44	43	48
R^2	0.504				0.585	0.458	0.446	0.410

Notes: See the notes to Table 5 for variable definitions. *Region FE* are census region fixed effects, with Midwest the omitted category. Column (2) includes a spatial lagged dependent variable and (3) also allows for spatial correlation in the error term; reported coefficients are Average Total Direct Impacts. Models (2) and (3) use inverse distance weights and estimation is by two-stage GMM using X, WX, WX^2, and WX^3 as instruments, where X is the vector of exogenous variables and W is the weights matrix; the first stage F-statistic for the instrument set is 65.2; errors are assumed to be heteroskedastic. Coefficients for (4) are marginal effects at the mean for each variable, and for a discrete change from zero to one for binary variables. Column (5) excludes the four states with Cook's distance greater than $4/n$: Delaware, Maryland, Missouri, and Virginia. Column (6) excludes the four states with falls in real per capita personal income between 1929 and 1933 of greater than 40 percent. (7) excludes the five states with highest debt-to-income ratios in 1929. The dependent variable for (8) takes the value unity for the 22 states that introduced a sales tax that ultimately became permanent and zero otherwise. Robust standard errors are in parentheses.

dependent variable. I use inverse distance weights and instrument for the endogenous spatial lagged dependent variable using the set of exogenous regressors and their interaction with the spatial weights matrix; the instrument set is strong, having a first-stage F-statistic of 65.2.[18] Specification 2 in Table 6 reports estimated average total direct impact (ATDI) effects, which can be interpreted as the change in the

[18] I use the STATA *spreg* function developed by Drukker, Prucha, and Raciborski (2013); see notes to Table 6.

probability of the average state introducing a retail sales tax for a given change in each of the independent variables for that state. The results indicate that allowing for spatial correlation in sales tax base adoption does not qualitatively affect the relationship between the exogenous variables and the likelihood of adopting a retail sales tax; this likely reflects a modest spatial correlation in sales tax base adoption, indicated by a Moran's *I*-statistic of 0.05, which is lower than the degree of spatial correlation in the peak-to-trough size of income shocks (Moran's *I*-statistic of 0.23). The third specification allows for both a spatial lagged dependent variable and spatial correlation in the error term, which may arise through spatial correlation in the independent variables, such as income growth. Allowing for spatial correlation in the error term does not substantially alter the precision of the estimated relationships (Specification 3).

The next set of results considers robustness to alternative estimators and outliers. Average marginal effects at the mean of each dependent variable are generally larger using a Probit model compared to the linear probability model results, but the results are qualitatively similar (Specification 4). Specifications 5 to 7 consider robustness to excluding states with high leverage, and those with the largest income shocks and initial debt levels, respectively; the relationship between tax base adoption and the measure of initial fiscal pressure is less evident for some of these specifications, but otherwise similar to the baseline results. Lastly, the results are similar restricting attention to the adoption of the 22 retail sales tax bases that ultimately became permanent (Specification 8).

Survival Analysis.—This section extends the analysis to use panel data, rather than purely cross-sectional variation. A survival model is used because the choice to introduce a retail sales tax is a binary "failure" event and we are interested in understanding factors affecting the time to introduction of a sales tax. Table 7 reports hazard ratio estimates assuming a Cox Proportional Hazard function; a coefficient greater than unity indicates that an increase in the explanatory variable increases the likelihood of introducing a retail sales tax relative to the baseline hazard function, and ratios less than unity indicate a reduced likelihood. The estimation period is 1929 to 1942, and standard errors are clustered at the census division level to allow for spatially correlated errors.

The first specification augments the set of variables in the baseline cross-sectional specification with indicators of unified political control (Specification 1 in Table 7). The income measure is real per capita personal income, with each state's level rebased to 100 in 1929; annual data are unavailable for the mandatory spending, debt, and deficit variables, which are held constant at their 1929 levels. The relationship among retail sales tax base adoption and the key variables of interest is qualitatively unchanged relative to the baseline cross-sectional regression. However, the use of panel data allows investigation of the effect of differences in political control on the likelihood of adopting a retail sales tax. Unified political control appears to have been associated with an increased likelihood of introducing a retail sales tax, but only where the Democrats held power (Specification 1). This implies that the burden of taxation was greater on Republican supporters (Proposition 2), which is perhaps surprising because consumption taxes are often perceived to be regressive.

TABLE 7—COX PROPORTIONAL HAZARD MODEL: US STATE GOVERNMENT SALES TAX ADOPTION 1929–1942

	(1)	(2)	(3)	(4)	(5)	(6)
Income tax	1.081	0.922	1.013	0.996	0.766	0.965
	(0.335)	(0.324)	(0.348)	(0.365)	(0.191)	(0.236)
Corporate tax	1.003	1.112	1.046	1.278	1.386	1.063
	(0.480)	(0.551)	(0.559)	(0.557)	(0.654)	(0.490)
Real income	0.947	0.945	0.947	0.923	0.940	0.945
	(0.016)	(0.017)	(0.015)	(0.026)	(0.018)	(0.017)
$\overline{G}$: 1929	1.205	1.209	1.190	1.213	1.205	1.220
	(0.044)	(0.044)	(0.040)	(0.034)	(0.044)	(0.049)
Deficit: 1929	1.053	1.056	1.048	1.053	1.077	1.069
	(0.011)	(0.010)	(0.013)	(0.010)	(0.015)	(0.015)
Debt: 1929	1.211	1.209	1.188	1.221	1.279	1.174
	(0.105)	(0.105)	(0.093)	(0.098)	(0.094)	(0.079)
Constitution	1.639	1.498	1.179	1.025	1.059	1.451
	(1.206)	(1.035)	(0.558)	(0.841)	(0.806)	(0.884)
Referendum	16.816	15.422	10.863	11.991	11.561	18.112
	(12.352)	(10.672)	(5.059)	(8.405)	(9.210)	(14.348)
Democrat	2.280	2.182	2.381	2.710	1.531	2.375
	(1.014)	(0.940)	(1.042)	(1.058)	(0.689)	(0.935)
Republican	1.305	1.560	1.521	1.600	1.632	1.580
	(1.672)	(1.944)	(1.918)	(2.103)	(1.908)	(1.790)
Neighbor: Region		1.031		1.044	1.034	1.027
		(0.016)		(0.014)	(0.016)	(0.016)
Neighbor: Division			1.020			
			(0.016)			
New Deal				0.954		
				(0.023)		
ΔSpend. 1929–1932					1.019	
					(0.006)	
ΔSpend. 1932–1937					1.024	
					(0.007)	
ΔProp. 1929–1932						0.976
						(0.026)
ΔProp. 1932–1937						0.999
						(0.007)
ΔProp. share: 1932						0.983
						(0.015)
States	48	48	48	48	48	48
Failures	28	28	28	28	28	28

Notes: Coefficients are hazard ratios and the sample period is 1929–1942. *Income tax* and *Corporate tax* are indicators for the presence of those tax bases in each year. *Real income* is real state per capita personal income, with each state rebased to 1929 = 100. *Democrat* is an indicator for unified Democratic party control of state government (state House, Senate, and Governorship) by year and similarly for *Republican*. *Neighbor: Region* is the percentage of states in each census region with a sales tax in the previous year, and *Neighbor: Division* is the percentage by census division. All remaining variables do not vary by year and are described in the notes to Table 5. Standard errors (in parentheses) for hazard ratios are constructed using the delta method, and are clustered by census divisions. Efron's method is used to handle tied failures.

The apparent greater resistance from Republican administrations could reflect their sensitivity to opposition by store owners to the tax, who feared loss of sales to neighboring states (*New York Times* 1933a, 61).

The panel aspect of the data lends itself to a direct means of controlling for diffusion effects. To do so, I construct a variable measuring the percentage of states

within each census region that had adopted a retail sales tax by the previous year. Including this variable in the model provides evidence of diffusion effects; a 1 percentage point increase in the share of a state's regional neighbors to have adopted a retail sales tax is estimated to increase the probability of a state introducing a retail sales tax by about 3 percent (Specification 2). Importantly, the magnitudes and significance of the other variables of interest are little changed after allowing for diffusion effects (compare Specifications 1 and 2). Defining a state's neighbors more narrowly to be those within each census division (of which there are nine in total) provides less clear evidence that diffusion effects were important (Specification 3).

The final three model specifications reported in Table 7 revisit the relationship between the additional controls and retail sales tax base adoption using the survival model. There is now evidence that increased New Deal allocations reduced the likelihood of implementing a retail sales tax, and that states introducing a sales tax tended to have faster spending growth (Specifications 4 and 5); note that annual data are unavailable for these variables, so they are held constant over the estimation period. These results provide some suggestion that New Deal spending could substitute for own spending, and that states introducing a sales tax had greater spending needs. Critically, allowing for these effects has a minimal effect on the key variables of interest (compare Specification 2 with Specifications 4 and 5). As for the cross-sectional analysis, initial reliance on the property tax or changes in the value of its base did not appear to play any special role conditional on income shocks (Specification 6). Note that, for all the specifications reported in Table 7, the presence of income tax bases remains insignificantly related to the adoption of retail sales tax bases; this is consistent with broad income tax bases being administratively infeasible in the 1930s and so a poor substitute for a broad retail sales tax base.

E. *Ancillary Predictions and Evidence*

Intensive Margin Variation in Sales Tax Base Breadth.—The model implies that among the group of states introducing a retail sales tax base those experiencing relatively large negative income shocks should have introduced retail sales tax bases with relatively broad bases. I construct a measure of retail sales tax base breadth for each state by dividing general sales tax revenues by the retail sales tax rate to get a measure of the value of the tax base, and scaling this by personal income. Ideally, the value of the tax base would be scaled by consumption to get a "C-efficiency" ratio, but these data are unavailable at a state level for the 1930s.[19]

There was little variation in the tax rate chosen by states: of the 22 states with a retail sales tax in 1938, 16 levied a 2 percent rate and the remaining 6 levied a 3 percent rate. (Tax rate data are available from Due and Mikesell 1994 for 1934, 1938, 1950, and subsequent years.) The model predicts an inverse relationship between

[19] There are some other data limitations. First, tax rate data are available for 1938 but the nearest year for which revenue data are available is 1939, requiring an assumption that few states changed their tax rate between 1938 and 1939; only two states had different retail sales tax rates in 1938 and 1950 so this is likely to be a safe assumption (Due and Mikesell 1994). Second, tax revenue data for Arkansas, Michigan, and West Virginia include gross receipts revenue; I exclude these states from the analysis. New Mexico is an outlier, having an implied coverage ratio of 0.94 in 1939, and is also excluded.

the tax rate and tax base breadth, implying that states levying a 2 percent rate should have had broader retail sales tax bases than states levying a 3 percent rate.

The following cross-sectional regression provides a test of the model's predictions:

$$(18)\quad coverage_{i,\,1939} = \underset{(14.30)}{88.13} - \underset{(0.11)}{0.34}\left[100 \times \log\left(\frac{y_{i,\,1933}}{y_{i,\,1929}}\right)\right] - \underset{(5.07)}{18.78}\ \tau_{i,\,1938},$$

where *coverage* is the breadth of the tax base, constructed as discussed above, and τ is the retail sales tax rate, and the number of observations $N = 18$. These estimates reveal an inverse relationship between retail sales tax base breadth and both the change in income and the sales tax rate, as predicted by the model; robust standard errors are reported in parentheses.

Interestingly, there is evidence of persistence in tax base breadth: the correlation between retail sales tax base breadth in 1939 and 2012 is 0.33. Furthermore, of the 45 states with a state-level retail sales tax in 2012, those that have levied a retail sales tax continuously since the 1930s on average have a 15 percentage point broader tax base, measured by the C-efficiency ratio.[20]

The Example of Property Taxes.—The model assumes that a decline in income causes a proportional reduction in tax base value. For most tax bases this is untestable: while data on revenue collections by tax base are available, data on average tax rates and taxable value are not. An exception is the property tax base, for which data on assessed property values are available. The property tax base was the second most important source of revenue for state governments, raising on average 27 percent of total state government tax revenue in 1932.

Figure 5 sorts states by their percentage change in assessed real property tax values over the period 1929 to 1937. A longer period than the 1929 to 1933 peak-to-trough in incomes is used because changes in assessed property values typically lag changes in the market value of property.[21] Although delayed, the peak-to-trough (1929–1933) fall in incomes was reflected on average about one-for-one in lower assessed property values by 1937. A clear relationship is evident between declines in assessed property values and retail sales tax base adoption: 16 of the 27 states experiencing a fall in assessed real property values between 1929 and 1937 had a retail sales tax in 1937, whereas only 2 of the 16 states experiencing a rise in property values had a retail sales tax in 1937. (States without a property tax in 1929 are excluded. See the notes to Figure 5.)

Income Tax Base Changes.—The inability of households to borrow or lend in the model implies that a broad-based flat-rate consumption and income tax are equivalent. Thus, the model predicts that among states introducing a retail sales tax, those with an existing individual income tax would either reduce reliance on the individual income tax, increasing the share of revenue raised from the broadened consumption

[20] Excluding Hawaii, which has levied a retail sales tax since 1935 but did not become a state until 1959, the difference is 10 percentage points.

[21] Comprehensive data on assessed property values are unavailable between 1932 and 1937.

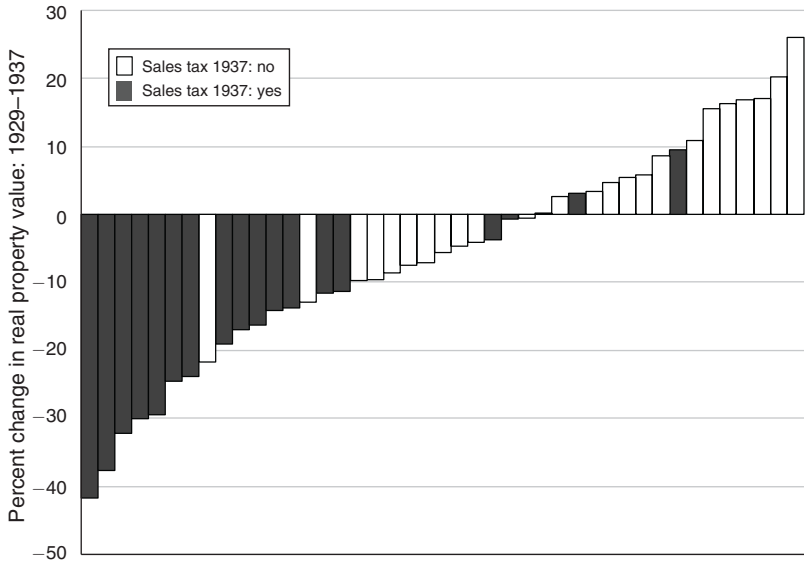

FIGURE 5. RETAIL SALES TAX ADOPTION: BY PERCENTAGE CHANGE IN ASSESSED PROPERTY VALUES

Notes: Sales tax 1937: no is the group of states that did not levy a retail sales tax in 1937 and *Sales tax 1937: yes* is the group of states that did. Each column indicates the real percentage change from 1929–1937 in the assessed valuation of property subject to general property tax. California, Delaware, Pennsylvania, and North Carolina did not levy property tax at the state government level in 1929, and are excluded from the figure; except for Delaware, these states levied a sales tax during the 1930s. Iowa, which experienced a 158 percent increase, is also excluded from the figure.

Source: Authors' calculations, Due and Mikesell (1994), US Department of Commerce (various issues)

tax base, or else simultaneously increase the breadth of the existing income tax base. Of the 28 states introducing a retail sales tax in the 1930s, 7 had an income tax in 1929. None of these states reduced marginal rates, but five of the seven states did increase the share of taxpayers covered by their income tax bases through reductions in exemption thresholds and tax bracket thresholds. The other two states made no change to their income tax schedule. See Table A2 in the online Appendix for details on changes by state.

Half (14 out of 28) of the states introducing a retail sales tax during the 1930s also introduced a new individual income tax base. These were narrow bases, taxing top income earners, and were most likely introduced in part to reduce perceived regressivity of the retail sales tax.[22] Only four states introduced an individual income tax but not a retail sales tax, indicating that income taxes were in general a complement rather than a substitute to retail sales tax bases.

[22] Income tax bases were a less important source of revenue than retail sales tax bases: by 1942, the 22 states that had adopted a retail sales tax during the 1930s raised on average 19 percent of their total tax revenue from the sales tax, compared to an 11 percent income tax revenue share for the 35 states collecting income tax revenue in 1942. Note that income tax revenue-share data include inheritance taxes.

III. Discussion

The behavior of US state governments during the Great Depression provides strong support for the model. The collapse in economic output during the Great Depression caused a wave of retail sales tax base adoption, with states experiencing the largest falls in income being the most likely to introduce a retail sales tax. The only source of heterogeneity between states in the model is the size of income shocks experienced, and so there is a threshold income level below which all states are predicted to undertake a tax base broadening reform. In reality, there are other sources of heterogeneity between states, and there is no threshold income level below which *all* states introduced a retail sales tax, and above which none did. But there do not appear to be any obvious sources of heterogeneity between the states that would provide an alternative explanation for the relationship between income shocks and retail sales tax base adoption.

In the model, the larger the fixed cost to expand tax base breadth, the greater the option value to maintaining a broad tax base once incomes have recovered. And the smaller the per-period administrative cost, the more likely a broad tax is to be optimal once the fixed cost has been incurred. Of the 28 retail sales tax bases introduced during the Great Depression, all but 6 have remained in place continuously until the present day. This suggests that the fixed cost is large relative to the incremental per-period administrative cost to maintain a broad tax base. But this conclusion is necessarily tentative because the permanence of retail sales tax bases could reflect a range of factors beyond the scope of the model that have influenced tax base breadth over subsequent decades. For example, the Peacock and Wiseman (1961) displacement hypothesis predicts changes in fiscal capacity to proceed in a steplike manner because each improvement in fiscal capacity increases society's tolerance for new revenue-raising methods.

Related to this, while the introduction of retail sales taxes can be said to have facilitated collection of additional revenues in the 1930s at lower efficiency cost than existing alternatives, conclusions on whether overall economic efficiency was improved are necessarily tentative. The model assumes a benevolent government, but public choice-type arguments imply that once the acute revenue needs of the Great Depression had passed, the revenue-raising capacity of the new sales tax bases could have been used to fund socially wasteful spending (Weingast 1995).

The 1930s wave of tax base adoption was the largest, but US state governments continued to introduce retail sales and income tax bases in subsequent decades (see Table 1). The 1960s was the next most important decade, with 12 states introducing a retail sales tax and 7 an individual income tax. Increased social and education spending was a key factor influencing tax base expansion in the 1960s (Due and Mikesell 1994). Such changes in demand for public spending are beyond the scope of the model, but the distortionary cost of taxation emphasized by the model remains relevant. A large increase in government spending funded by narrow tax bases requires high tax rates, which raises the deadweight cost of taxation. A sufficiently large increase in spending makes a tax base broadening reform optimal. But because the level of public good provision is endogenous to tax base breadth—a broader tax base lowers the deadweight cost of taxation and makes a higher level of

spending optimal—causality from spending to tax base adoption is unclear in the 1960s. This is in contrast to the Great Depression, which provides plausibly exogenous variation in fiscal stress.

IV. Evidence from Other Settings

This section provides evidence of fiscal stress leading to tax base expansion in other countries and time periods, showing that the model's key prediction extends beyond the experience of the US states during the Great Depression.

A. *European Sales Taxation*

In a survey on the origins of sales taxation in Europe, Due (1955, 319) concludes that "European sales taxation, in its modern form, is a product of the financial disturbances arising out of two world wars and the depression of the 1930s; none of the present sales taxes date back before World War I, and the majority of them were introduced in the period of financial difficulties arising from that war." Consistent with the model, Due (1955) highlights fiscal stress, arising as a result of World War I and the Great Depression, as the cause of sales tax adoption. Table A1 in the online Appendix provides case-by-case narrative evidence that fiscal stress was a cause of sales tax base adoption for European countries, as well as in Australia and Canada.

B. *Value Added Tax Adoption*

The spread of the Value Added Tax (VAT) has been one of the most important tax policy changes in the past 50 years; the first VAT was adopted in 1960, and by 2013 164 countries had adopted a VAT (OECD 2014, Annex B). Keen and Lockwood (2010) provide some of the first cross-country evidence on the factors responsible for the spread of the VAT. In this section I extend the set of factors considered by Keen and Lockwood (2010) to consider whether proxies for fiscal stress are related to VAT adoption. The first indicator of fiscal stress I consider is demeaned average GDP growth over the past five years; the model implies that a growth slowdown should increase the likelihood of a country adopting a VAT. However, an important difference between US state governments and nation states is the greater ability of nation states to accumulate debt to smooth income shocks. This presents a challenge for identification because borrowing permits a government to delay tax base changes undertaken as part of a fiscal consolidation for a potentially long period of time. Reflecting this, the second measure of fiscal stress I consider is interest payments on government debt as a share of revenue; the larger the share of revenue diverted to interest payments, the more limited a government's ability to delay a fiscal consolidation and the more immediate the choice of whether or not to increase tax base breadth.

The first five columns in Table 8 report estimates from a Cox Proportional Hazard model used to study the factors associated with VAT adoption; the reported

TABLE 8—COX PROPORTIONAL HAZARD MODEL: CROSS-COUNTRY VAT ADOPTION

	(1)	(2)	Excl SSA, MEA, SA (3)	(4)	(5)	Dep. var: Interest (6)
Income	0.591	1.082	1.799	0.740	0.702	
	(0.110)	(0.236)	(0.638)	(0.144)	(0.280)	
Trade	0.992	0.992	0.990	1.000	0.999	
	(0.004)	(0.003)	(0.005)	(0.004)	(0.006)	
Agriculture	0.957	0.968	0.986	0.986	0.983	
	(0.012)	(0.010)	(0.022)	(0.006)	(0.012)	
Growth	0.979	0.958	0.923			−0.324
	(0.024)	(0.018)	(0.023)			(0.135)
Interest				1.050	1.048	
				(0.012)	(0.017)	
EU	1.472	0.757	0.468	2.128	4.796	
	(0.652)	(0.530)	(0.289)	(1.101)	(5.727)	
OECD	2.821	0.464	0.186	23.451	40.380	
	(2.011)	(0.394)	(0.286)	(41.587)	(117.996)	
Federation	0.781	0.459	0.277	0.246	0.136	
	(0.470)	(0.192)	(0.113)	(0.242)	(0.202)	
Neighbor	1.006	1.008	1.008	1.030	1.028	
	(0.017)	(0.014)	(0.023)	(0.015)	(0.022)	
Population		1.388	1.776		1.141	
		(0.140)	(0.203)		(0.157)	
Dependency: Old		1.055	1.125		0.900	
		(0.048)	(0.102)		(0.063)	
Dependency: Young		1.003	1.045		0.974	
		(0.013)	(0.018)		(0.017)	
IMF: Crisis		1.868	1.729		2.437	
		(0.796)	(0.388)		(1.505)	
IMF: Noncrisis		3.937	1.263		2.539	
		(1.684)	(0.554)		(1.159)	
Region FE	Yes	Yes	Yes	Yes	Yes	—
Observations	2,702	2,343	921	493	454	423
Countries	122	115	55	58	55	50
Failures	99	93	47	35	32	

Notes: Unbalanced panel for 1960–2014. Coefficients are hazard ratios for (1)–(5). Column (3) excludes sub-Saharan Africa (SSA); Middle East and North Africa (MEA); and South Asia (SA). *Income* is 1 period lagged GDP per capita in 2005 US dollars; *Trade* is external trade as a percent of GDP; *Agriculture* is agriculture value-added as a percent of GDP; *Growth* is 1 period lagged 5-year average real (local currency) GDP growth less country specific mean growth (sample excludes countries with less than 25 years available GDP data); *Interest* is 1 period lagged interest payments on government debt as a percent of revenue; *EU* is a dummy variable for European Union membership; *OECD* is a dummy variable for OECD membership; *Federation* is a dummy variable for federated countries; *Neighbor* is the percentage of countries in each region with a VAT in the previous year; *Population* is log population; *Dependency: Old* is the population over 64 years of age as a percent of the working-age population; *Dependency: Young* is the population under 15 as a percent of the working-age population; *IMF: Crisis* is an indicator for being on an IMF structural adjustment program for 5 months or more in a year; *IMF: Noncrisis* is an indicator for being on an IMF noncrisis program (Standby Agreement; Extended Fund Facility; Poverty Reduction and Growth Facility) for 5 months or more; *Region FE* are region fixed effects based on World Bank country and lending groups: East Asia and Pacific, Europe, Former Soviet Republics, Latin America and Caribbean, Middle East and North Africa, North America, South Asia, and sub-Saharan Africa. The dependent variable for (6) is *Interest* and the regression includes country and time fixed effects; the sample is the subset of countries from (4) with at least 25 years of available GDP data. Standard errors (in parentheses) for hazard ratios are constructed using the delta method, and are clustered by region. Efron's method is used to handle tied failures.

Source: Dreher (2006), Elazar (1995), OECD (2014, Annex B), World Bank (2015)

coefficients are hazard ratios.[23] The coefficient on the variable *Growth* in the first column is less than unity, indicating that below-trend growth is associated with a higher likelihood of introducing a VAT; including a broader set of controls results in more precise estimates (Specification 2); while restricting the sample to exclude Africa and South Asia provides stronger evidence of a negative relationship between GDP growth and the likelihood of adopting a VAT (Specification 3).[24] The standard deviation of the variable *Growth* is 3.4 percentage points, indicating that for Specification 3 a one standard deviation decline in growth below average is associated with an approximately 20 percent higher likelihood of adopting a VAT. Specification 4 reports estimates using the second measure of fiscal stress, indicating that an increase in the share of revenue devoted to interest payments on government debt is associated with a significantly higher likelihood of adopting a VAT; this finding is robust to a broader set of controls (Specification 5). Specification 6 provides evidence (using a panel data model with time and country fixed effects) that below trend growth has tended to precede an increase in interest payments as a share of revenue, consistent with governments initially using debt to buffer income shocks; the sample for Specification 6 is the set of countries from Specification 4 for which at least 25 years of GDP data are available. Taken together, the findings in this section provide support for the model, indicating that periods of fiscal stress were associated with a higher likelihood of VAT adoption.

V. Conclusion

This paper contributes to the literature on state fiscal capacity by providing a new explanation for tax base broadening reforms. It shows, theoretically and empirically, that an economic slump can be an important stimulant to investment in fiscal capacity. This complements the existing literature, which has emphasized political economy explanations for the adoption of broad-based income and consumption taxes in developed economies.

In the model, tax collections fall in an economic slump, but demand for public spending falls by less. This puts stress on the revenue raising capability of narrow tax bases, particularly when the ability to borrow is limited. Raising the tax rate on narrow tax bases increases revenue collections, but raises the deadweight cost of taxation, which is convex in the tax rate. For a sufficiently deep economic slump, it is optimal to incur the fixed cost necessary to expand tax base breadth. Even though macroeconomic income shocks are transitory, the fixed cost incurred to undertake a tax base broadening reform implies that increases in fiscal capacity can be long-lasting.

Evidence from the behavior of US state governments during the Great Depression provides robust support for the model. At the onset of the Great Depression, none of the US state governments levied a retail sales tax, but during the 1930s 28 states

[23] Keen and Lockwood (2010) use a dynamic probit model rather than a survival model to study the factors related to VAT adoption, including a lagged dependent variable as a means of controlling for the fact that only five countries have ever repealed a VAT. The set of included variables closely follows Keen and Lockwood (2010).

[24] The coefficients on the control variables are generally consistent with Keen and Lockwood (2010). In particular, countries with larger populations, less trade openness, and smaller agriculture sectors tended to be early adopters of a VAT.

introduced a retail sales tax, of which 22 ultimately became permanent. The cross-sectional pattern of tax base adoption also provides strong support for the model: states were more likely to introduce a retail sales tax if they experienced above-average negative income shocks, had less ability to reduce spending, and faced greater initial fiscal pressure.

Narrative evidence on the adoption of sales taxes in Europe provides additional support for the paper's central argument that output contractions can cause tax base expansion. Further supporting evidence is provided by a cross-country study, which finds evidence of a relationship between indicators of fiscal stress and an increased likelihood of a country introducing a VAT.

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