Do Output Contractions Cause Investment in Fiscal Capacity?

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Abstract

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, which reduces the efficiency cost of taxation. The behavior of U.S. 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.

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1 Introduction

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 reduced the efficiency cost of raising revenue and 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 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 U.S. 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]

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

[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

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 U.S. history illustrates this correlation: the first U.S. 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 U.S. 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, p. 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 archetypal public good representing broadly common interests for citizens" (Besley and Persson, 2009, p. 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.

Zealand, Norway, Sweden, Switzerland, the United Kingdom, and the United States.

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 do 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 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 is the tax base—corresponding to a higher level of fiscal capacity—the lower is 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 deliberately abstracts from political-economy considerations to investigate the power of a model assum-

ing a benevolent government to explain upgrading in fiscal capacity.

The model's key predictions are tested by studying the behavior of U.S. state governments during the Great Depression. This time period and set of governments provide an excellent setting to examine the effect of an economic slump on tax base expansion. The decline in income was large, with per capita U.S. 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 U.S. 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, U.S. state governments profoundly changed their tax structure. In 1929, none of the 48 U.S. 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 U.S. 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 tax rates, and thus at lower efficiency cost, consistent with the model.

The cross-sectional pattern of tax base adoption is also 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 U.S. state government introducing a retail sales tax in the 1930s by 16 percent. This relationship is robust to a variety of controls.

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 U.S. 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 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 U.S. state governments had limited ability to borrow to fund non-capital 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 are net debt repayments, the greater is the revenue requirement relative income, and the more desirable is 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 et al., 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 et al., 2009), while increases in financial transactions through banks provides records for tax inspectors to enforce tax laws (Gordon and Li, 2009). Particularly in develop-

ing countries, foreign aid flows (Besley and Persson, 2013) and resource revenues (Jensen, 2011) have been found to be associated with lower levels of fiscal capacity. But, to the best of my knowledge, the role of macroeconomic income shocks has not previously been considered.[3]

The remainder of the paper proceeds as follows: Section 2 lays out and discusses a formal model endogenizing the upgrading of fiscal capacity, Section 3 uses the experience of U.S. state governments during the Great Depression to test the model's key predictions, Section 4 discusses the empirical results in light of the model, and Section 5 concludes.

2 Model

2.1 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.[4] 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

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

[4] 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.

a uniform rate on all taxed goods is optimal, permitting the analysis to use a single tax 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 U.S. state governments were unable to meaningfully borrow to fund non-capital expenditures, I assume the government has a per-period balanced budget requirement. The following subsection begins the formal description of the model.

2.2 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:

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

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 over the domain $y_t \in [0, \infty)$. For simplicity, I assume that income shocks are independent and identically distributed: $y_t \sim iid\left(\bar{y}, \sigma_y^2\right)$.[5] 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 $\bar{G}$, such as spending on law and order, that does not vary with income.[6]

The set of goods $i \in [0, I_t]$ are subject to a uniform tax rate, and the remaining set of goods $i \in (I_t, 1]$ are not taxed. The larger is the index of taxed goods, I_t, the broader is 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 pre-tax 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 $i \in (I_t, 1]$.

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

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

2.3 Privately Consumed Goods

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

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

implying period indirect utility for privately-consumed goods equal to

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

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:

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

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 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:

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

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.[7]

2.4 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

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

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

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.[8]

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 infeasiblity 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 dis-

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

guised 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 1a. 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 fiscal capacity is large. I assume that there is no fixed cost associated with a tax base narrowing reform.

2.5 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 (given by Equation 1), subject to the economy's budget constraint (given by Equation 6). The resulting first-order condition provides an implicit expression (i.e., conditional on tax base breadth) for the optimal tax rate:

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

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) (a)* $\Delta\xi_{f,j}/\Delta b_j$ *is increasing in tax base breadth* b_j*, where* $\Delta\xi_{f,j} = \xi_f\left(b_j\right) - \xi_f\left(b_{j-1}\right)$ *and* $\Delta b_j \equiv b_j - b_{j-1}$ *; (b) administrative cost function is such that* $\tau\left(y_t, b_j, b_{j+1}\right) < \tau\left(y_t, b_j, b_j\right)$*, for all j.*

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

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

to be the utility for the representative taxpayer evaluated at the optimal tax rate, where $\tau_t^* = \tau\left(y_t, b_{t-1}, b_t\right)$ and $G_t^* = \tau_t^* b_t y_t - \xi\left(b_{t-1}, b_t\right) y_t$. 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

$$v(y_t, b_{t-1}, b_t) = \gamma + \phi log\phi + (1+\phi) logy_t + (b_t + \phi) log(1 - \tau(y_t, b_{t-1}, b_t)), \quad (10)$$

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 $\frac{\partial(1-\tau)}{\partial y} = \frac{\bar{G}}{b+\phi}\left(\frac{1}{y^2}\right) \geq 0$, and

$\frac{\partial^2 v}{\partial y^2} = -\frac{1+\phi}{y^2} + \frac{b+\phi}{1-\tau}\frac{\partial^2(1-\tau)}{\partial y^2} - \frac{b+\phi}{(1-\tau)^2}\left(\frac{\partial(1-\tau)}{\partial y}\right)^2 < 0$. □

2.6 Income Shocks and Tax Base Breadth

Evidence from U.S. state governments indicates that a sufficiently large fall in income causes tax base expansion. For this to be optimal, the efficiency cost of a narrow tax base must rise relative to a broad tax base when income falls. Efficiency cost is approximately proportional to the tax rate squared (see Equation 4), and thus the tax rate on a narrow base must rise by more than on a broad base when income falls. 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

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

for all j, where $b_{j+1} > b_j$. I assume that U.S. state governments had a mandatory level of spending $\bar{G} > 0$, 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:* $\bar{G} > 0$.

Corollary: *(A fall in income raises per-period utility with a broad tax base relative to a narrow tax base, the more so the larger is mandatory spending) Assumption 2 implies: i)* $\partial\left[v\left(y_t, b_j, b_{j+1}\right) - v\left(y_t, b_j, b_j\right)\right]/\partial y$ *is negative; and ii)* $\partial^2\left[v\left(y_t, b_j, b_{j+1}\right) - v\left(y_t, b_j, b_j\right)\right]/\partial y \partial G$ *is negative.*

Proof: By Assumption 1, $\tau\left(y_t, b_j, b_{j+1}\right) < \tau\left(y_t, b_j, b_j\right)$, and by Assumption 2 $\bar{G} > 0$. i) follows from (11), and ii) follows from differentiation of (11). □

Figure 1b 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 func-

tions shown in Figure 1b, 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* $v\left(\hat{y}, b_j, b_j\right) > v\left(\hat{y}, b_{j+1}, b_{j+1}\right)$*, then there exists* $y < \hat{y}$ *such that* $v\left(y, b_j, b_j\right) < v\left(y, b_j, b_{j+1}\right) < v\left(y, b_{j+1}, b_{j+1}\right)$*. Furthermore,* $v\left(y, b_j, b_j\right)$ *intersects* $v\left(y, b_j, b_{j+1}\right)$ *and* $v\left(y, b_{j+1}, b_{j+1}\right)$ *only once.*

Proof: Define $f_j(y) \equiv v\left(y, b_j, b_{j+1}\right) - v\left(y, b_j, b_j\right)$. Then, note $f_j(\hat{y}) < 0$, because $v\left(\hat{y}, b_{j+1}, b_{j+1}\right) > v\left(\hat{y}, b_j, b_{j+1}\right)$ and by assumption $v\left(\hat{y}, b_j, b_j\right) > v\left(\hat{y}, b_{j+1}, b_{j+1}\right)$. Next, define $y_j \equiv \bar{G} / \left(b_j - \xi\left(b_j, b_j\right)\right)$. Assumption 1b implies $lim_{y \to y_j} \tau\left(y, b_j, b_j\right) = 1$ and $lim_{y \to y_j} \tau\left(y, b_j, b_{j+1}\right) < 1$. 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 $y_j < y < \hat{y}$ such that $f_j(y) = 0$. The Corollary implies that $\partial f_j(y) / \partial y < 0$, and thus $v\left(y, b_j, b_j\right)$ and $v\left(y, b_j, b_{j+1}\right)$ intersect at most once. Because $v\left(y, b_{j+1}, b_{j+1}\right) > v\left(y, b_j, b_{j+1}\right)$ for all y, it is also the case that $v\left(\hat{y}, b_j, b_j\right) < v\left(\hat{y}, b_{j+1}, b_{j+1}\right)$ and $v\left(y, b_j, b_j\right)$ intersects $v\left(y, b_{j+1}, b_{j+1}\right)$ once. □

2.7 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:

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

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 U.S. 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

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

and to undertake a tax base narrowing reform if

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

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 *iid*. 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) or (14) is satisfied:

$$\begin{aligned} v(y_t, b_H, b_H) - v(y_t, b_H, b_L) &> \beta E_y [V(y_{t+1}, b_L) - V(y_{t+1}, b_H)] \\ &> v(y_t, b_L, b_H) - v(y_t, b_L, b_L). \end{aligned} \tag{15}$$

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. When income rises, the per-period benefit of a broad tax base relative a narrow tax base, given by the right-hand-side of (14), falls, but the option value of maintaining a broad tax base, given by the left-hand-side of (14), does not vary with current income. If the right-hand-side of (14) falls sufficiently far, it is optimal to undertake a tax base narrowing reform.

The Proposition 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, the Proposition 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: *(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 *iid* income shocks implies that $E_y[V(y,b_L) - V(y,b_H)]$ 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_H above which it is optimal to undertake a tax base narrowing reform. A sufficient condition is $\lim_{y\to\infty}[v(y,b_H,b_H) - v(y,b_H,b_L)] < v(\bar{y},b_L,b_H) - v(\bar{y},b_L,b_L)$.This condition can be derived by noting that $\beta E_y[V(y_{t+1},b_L) - V(y_{t+1},b_H)] > v(\bar{y},b_L,b_H) - v(\bar{y},b_L,b_L)$ 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 $y > y_L$. □

In the next section, I first show that the behavior of U.S. state governments during the Great Depression supports the Proposition. I then show that the relationship between income shocks and retail sales tax base adoption predicted by the model is robust to a variety of controls.

3 Empirical Analysis

3.1 Background

This behavior of U.S. state governments during the Great Depression provides an excellent opportunity to examine whether an economic slump causes tax base expansion. As mentioned in the introduction, the U.S. Great Depression was deep and prolonged. Per capita U.S. real GDP fell by 29 percent peak-to-trough, and took a decade to regain its 1929 level. There was also 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. Both the time series and cross-sectional variation in income is useful for identifying the effect of income shocks on tax base breadth.

U.S. state government total revenue as a share of income was relatively small prior to the Great Depression, 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 U.S. 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 owed mainly by 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.

3.2 Tax Base Adoption During the Great Depression

The Great Depression had a profound impact on U.S. state government tax structure. None of the U.S. states had a broad-based consumption tax in 1929, but by the 1933 trough in U.S. real GDP, 11 state governments levied a retail sales tax. By

1938, at which point U.S. per capita real GDP was still below its 1929 level, 28 states had levied a retail sales tax for at least one year. All but six of the 28 new retail sales taxes introduced during the 1930s have been levied continuously until the present day (see Table 1 and Figure 2). Retail sales tax rates were low compared to present levels, with states imposing either a 2 or 3 percent rate in the 1930s (Due and Mikesell, 1995).

In the cross-sectional dimension, 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. Figure 3 shows this by plotting average per capital real income for states that did and did not introduce a retail sales tax during the 1930s. States introducing a retail sales tax experienced a 7 percent larger fall in real per capita income on average than those not levying a retail sales tax, and the recovery in incomes was slower.

The first panel in Table 2 provides an alternate way to see the relationship between income shocks and retail sales tax base adoption, grouping states by the fall in real per capita income experienced between 1929 and 1933 and reporting the share of states in each income growth category introducing a retail sales tax. A clear monotonic relationship is evident: 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.

Regression analysis confirms the relationship between income shocks and retail sales tax base adoption evident in the first panel of Table 1. The dependent vari-

able for Regression (1) in Table 6 is an indicator taking the value unity if a state introduced a retail sales tax in the 1930s. 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 0.16. The regression controls for existing tax structure (the presence of personal and corporate income taxes), pre-Depression debt levels, and fiscal institutions, each of which is discussed in more detail later. Regression (2) estimates the same relationship as Regression (1) using a probit model rather than a linear probability model. A similarly strong relationship between income shocks and retail sales tax base adoption is evident. Restricting attention to states whose retail sales tax ultimately became permanent has little impact on the estimated relationship between income shocks and tax base adoption (see Regression 3 in Table 6 and the first panel in Table 2).

The introduction of retail sales tax bases during the 1930s was accompanied by the adoption of additional individual income tax bases. A further 16 states introduced an individual income tax during the 1930s, of which 14 ultimately became permanent (see Table 1). Table 3 shows combinations of retail sales and individual income tax bases introduced during the 1930s. Most states introducing a retail sales tax base either had an individual income tax base prior to the Great Depression or introduced one together with an income tax. Only four states introduced an individual income tax but not a retail sales tax. This indicates that income taxes were in general a complement rather than a substitute to retail sales tax bases.

Regression (4) in Table 6 tests whether the size of income shock experienced by a state increased its propensity to adopt an individual income tax base. The dependent variable is an indicator variable taking the value unity if a state govern-

ment introduced an individual income tax base during the 1930s, and the sample is restricted to states that did not have an individual income tax base in 1929. Controlling for retail sales tax base adoption, the coefficient on the income shock variable is small and insignificant. Income tax bases were a less important source of revenue than retail sales tax bases, and were introduced in part to reduce the perceived regressivity of retail sales tax bases (Penniman, 1980; Due and Mikesell, 1995).[9] For these reasons, I focus mainly on the adoption of retail sales tax bases.

3.3 Spending and Revenues

In the model, a sufficiently deep economic slump causes tax base expansion because government spending varies less-than-proportionally with income (Assumption 2). Consistent with this, the lower panel in Figure 4a shows that spending rose sharply as a share of income between 1927 and 1932. (Consistent revenue and spending data are available at 5-year intervals from the Census of Governments.) By 1937, average state income had recovered most of its 1929 level, and spending fell as a share of income. However, government spending as a share of income remained above its level prior to the Great Depression. This reflects a long-run trend in government spending, which can be seen in the top panel of Figure 4a.

The introduction of retail sales tax bases in the 1930s did not happen because some states increased spending relative to others, and so had greater revenue needs. Regression (5) shows no significant relationship between the change in real per

[9]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.

capita state government spending over the period 1932 to 1937 and the propensity of state governments to adopt a retail sales tax.[10] Over the period 1927 to 1952, average spending was similar for states that did and did not introduce a retail sales tax (see the top panel of Figure 4a). Over the 1932 to 1937 period, when almost all of the retail sales tax bases were introduced, spending growth was slower than over the earlier 1927 to 1932 period, or subsequent periods. State government tax bases were stressed during the Great Depression by a fall in incomes rather than a rise in spending.

Reflecting the limited ability of state governments to borrow, revenues and spending were closely matched (see the upper panels of Figures 4a and 4b). Because government spending rose as a share of income in the Great Depression, so did revenues (see the lower panel of Figure 4b). But Regression (5) shows no statistically significant relationship between retail sales tax base adoption and growth in real per capita total revenues or tax revenues between 1932 and 1937. This implies that, consistent with the model, governments introducing a retail sales tax base were able to raise revenue at lower tax rates, and thus less distortionary cost, than states that did not introduce a retail sales tax.

3.4 Property Tax

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

[10]The dependent variable in Regression (5) excludes temporary retail sales tax bases because all six had been repealed by 1937.

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. On average, general property taxes comprised 26 percent of total state government tax revenue in 1932.

State governments are likely to have been particularly unwilling to raise property tax rates during the Great Depression to fund revenue shortfalls, for fear of forcing property owners into foreclosure. This is a concrete example of a situation in which the marginal efficiency cost of funds is sharply increasing in the tax rate. Thus, large declines in property values created strong incentives for state governments to introduce a retail sales tax. 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.[11] 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: 17 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.)

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

3.5 The Role of Debt

The model assumes away debt, with governments constrained to balance revenues and expenditures period-by-period. Justifying this assumption, debt issue did not play a meaningful role smoothing fluctuations in income during the Great Depression. For most states, there were constitutional or procedural barriers to debt issue that prevented governments from running temporary deficits. At the onset of the Great Depression, a constitutional amendment was required to issue debt in 18 states, and a statewide referendum was required in 15 other states (Ratchford, 1938). Among the remaining 15 states for which the effective power to issue debt resided state legislatures, balanced budget requirements for operating expenses were in force in 7 states (Ratchford, 1938; Rodriguez-Tejedo, 2007).[12] The first state government rainy-day fund did not come into existence until 1945 (Rodriguez-Tejedo, 2007).

Largely reflecting differences in capital works programs, state governments entered the Great Depression with varying levels of debt. Overall, state government debt-to-revenue ratios were moderate in 1929 compared to earlier years (see Table 4). The top panel in Figure 6 shows that, except for Arkansas and South Carolina, there was little change in nominal debt outstanding during the Great Depression.[13] But because debt was largely fixed in nominal terms, the 24 percent peak-to-trough fall in the price level, measured by the U.S. GDP deflator, raised the real value of debt (see the lower panel of Figure 6). This led to a wave of credit rating down-

[12] 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 over voters via referendum, with North Carolina following suit in 1936 (Ratchford, 1938).

[13] Arkansas assumed local government debts during the Great Depression (Ratchford, 1941).

grades: 45 states had a Aaa credit rating in 1929, 35 in 1932, and 13 in 1937 (see Table 5). But only one state, Arkansas, defaulted on any of its debt obligations.[14]

Regression (1) in Table 6 indicates that state governments entering the Great Depression with high debt-to-income ratios were more likely to adopt a retail sales tax than those with low debt-to-income ratios. Each one percentage point increase in the 1929 debt-to-income ratio is estimated to have increased the probability that a state government introduced a retail sales tax by about 0.05; the estimated magnitude is similar across regression specifications. But the association between pre-Depression debt levels and tax base adoption appears to largely be driven by the behavior of a few highly indebted states. The lower panel of Figure 2 shows that 4 of the 5 most highly indebted states in 1929 adopted a retail sales tax during the Great Depression, but indicates no clear association among the other states. Regression (6) confirms this: excluding the five states with the highest 1929 debt-to-income ratios, there is little evidence of a relationship between debt levels and retail sales tax base adoption.

For the five most highly indebted states, interest expense became a large share of spending during the Great Depression, averaging 14.6 percent of total spending in 1932. In the model, interest expense is an example of mandatory spending: with non-state-contingent debt, scheduled interest payments do not vary with income. The larger the level of mandatory spending, the greater is the benefit of a tax base broadening reform when income declines, as formalized in the Corollary to Assumption 2. This provides the most likely explanation for the correlation be-

[14] In August 1932 Arkansas defaulted on some district bonds, and by March 1933 had defaulted on all its highway debt. By 1937 almost all highway debt had been refunded into new bonds shifting the repayment burden out to a 40-year horizon, with no new debt maturing before 1943-44. See Ratchford (1941) for a more detailed account.

tween pre-Depression debt levels and retail sales tax base adoption. There is little evidence that states entering the Great Depression with high debt levels introduced retail sales tax bases because they had less ability than low-debt states to buffer income shocks through borrowing.

There is some evidence that receiving a credit rating downgrade made state governments more likely to adopt a retail sales tax, conditional on income shocks and debt levels. But the evidence is not strong. Regression (7) augments the baseline specification, Regression (1), with state government debt credit ratings in 1937, by which point ratings had reached their minimum for most states. Relative to Aaa-rated states, Aa-rated states were more likely to introduce a retail sales tax, but the null that credit ratings had no influence on retail sales tax base adoption cannot be rejected for states experiencing larger rating downgrades.

3.6 Cross-State Heterogeneity

This section briefly considers remaining sources of heterogeneity among the states that could have affected incentives to adopt a retail sales tax.

Initial Tax Structure

As discussed earlier, the most prominent source of tax revenue for state governments in 1932 (prior to the introduction of all but two retail sales tax bases) was license and permit income, followed by general property taxes. Figure 7 shows that initial tax structure was similar for states that did and did not introduce a retail sales tax during the 1930s. Sales-tax-adopting states relied a little more heavily on property taxes and a little less on license and permit income than non-adopting states,

but these differences are small compared to the relative importance of the different tax bases.

Fiscal Institutions

Differences in fiscal institutions do not appear to have been an important factor influencing retail sales tax base adoption. The coefficient on the *Constitution* variable in Regression (1) is not statistically different than zero, indicating that state governments requiring a constitutional amendment to issue debt were not significantly more likely to introduce a retail sales tax than those for which the effective power to issue debt resided in the legislature, conditional on other variables. However, state governments requiring a referendum to issue debt are estimated to have been more likely to introduce a retail sales tax. A statewide referendum is arguably no more difficult to pass than a constitutional amendment, so this difference is unlikely to be economically meaningful. Regression (8) shows that there is no relationship between tax base adoption and the presence of a balanced budget requirement.[15]

Alcohol Sales Taxes

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.

[15] Thanks to Isabel Rodriguez-Tejedo for sharing data on state government balanced budget requirements.

4 Discussion

The behavior of U.S. 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 sources of heterogeneity between the states that would provide an alternative explanation for the relationship between income shocks and retail sales tax base adoption. Among states that did and did not adopt a retail sales tax during the 1930s, average spending levels and spending growth were similar, as was initial tax structure. Differences in fiscal institutions do not appear to have been an important factor influencing tax base adoption. State governments entering the Great Depression with high debt levels were more likely to introduce a retail sales tax than those with low debt levels, but this can be easily understood in terms of the model. Interest expense did not fall with incomes during the Great Depression, and so comprised a large share of spending for states entering the Great Depression with high debt levels. This stressed initially narrow tax bases, and made the introduction of a retail sales tax desirable.

In the model, the larger is the fixed cost to expand tax base breadth, the greater is the option value to maintaining a broad tax base once incomes have recovered.

And the smaller is the per period administrative cost, the more likely is a broad tax to be optimal once the fixed cost has been incurred. Of the 28 retail sales tax bases introduced during the Great Depression, all but six 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 more tentative than evidence on the relationship between income shocks and retail sales tax base introduction. 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.

The 1930s wave of tax base adoption was the largest, but U.S. 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 twelve states introducing a retail sales tax and seven an individual income tax. Increased social and education spending was a key factor influencing tax base expansion in the 1960s (Due and Mikesell, 1995). 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.

5 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. Doing so enables revenue to be raised by taxing a wider range of economic activity at a lower rate, and thus in a less distortionary manner. Even though macroeconomic income shocks are transitory, improvement in fiscal capacity can be long-lasting. The fixed cost to upgrade fiscal capacity is sunk, and it can be optimal to maintain a high level of fiscal capacity even after incomes have recovered.

Evidence from the behavior of U.S. state governments during the Great Depres-

sion provides robust support for the model. At the onset of the Great Depression, none of the U.S. state governments levied a retail sales tax, but by 1938 22 state governments had adopted a retail sales tax that ultimately became permanent, and a further six states had levied a temporary retail sales tax. The cross-sectional pattern of tax base adoption also provides strong support for the model. Governments in states experiencing larger than average negative income shocks were significantly more likely to adopt a retail sales tax than were governments in states experiencing smaller than average income shocks.

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Table 1: Number of U.S. States with Tax Base: By Decade

	Retail Sales		Individual Income		Corporate Income		
	Permanent	Temporary	Permanent	Temporary	Permanent	Temporary	Total
1900-09	0	0	0	0	0	0	0
1910-19	0	0	8	0	4	0	12
1920-29	0	0	12	0	10	0	22
1930-39	22	6	28	2	24	1	83
1940-49	27	0	28	2	25	1	83
1950-59	32	0	28	0	28	0	88
1960-69	44	0	35	0	33	1	113
1970-79	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 a base that taxes only capital gains and dividends. Temporary retail sales taxes in the mid-1930s in Idaho, Kentucky, Maryland, New Jersey, New York and Pennsylvania were in place for only one or two years in each state. Louisiana is classified as permanently introducing the retail sales tax in 1938 because its 1940 repeal lasted only one year. South Dakota and West Virginia had an individual income tax from the 1930s until 1942, and South Dakota had a corporate net-income tax from 1935-1943. Michigan had a corporate net-income tax from 1967-1975. Sources: State retail sales tax data are from Due and Mikesell (1995) and income tax data are from Penniman (1980).

Table 2: Upgrading of Fiscal Capacity: Bivariate Analysis

		Average Interest Expense Ratio 1932	Number of States	Sales Tax Share: 1930s All	Sales Tax Share: 1930s Permanent
Income Shock: 1929-33	< 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
Debt/Income: 1929	< 0.01	1.1	8	0.3	0.3
	0.01-0.02	2.7	16	0.7	0.4
	0.02-0.03	3.6	9	0.7	0.4
	0.03-0.06	7.6	10	0.5	0.5
	> 0.06	14.6	5	0.8	0.8

Notes: *Income Shock: 1929-33* is the percentage decline in real state per capita personal income from 1929-1933. *Interest Expense Ratio 1932* is interest expense as a share of total spending. *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. Sources: BEA, Due and Mikesell (1995), Penniman (1980), and U.S. Department of Commerce.

Table 3: Combinations of Tax Bases Introduced in 1930s: Number of States

		Individual Income Tax			
		Yes: Existing	Yes: New	No	Total
Retail Sales	Yes	7	14	7	28
Tax Introduced	No	5	4	11	20
	Total	12	18	18	

Notes: *Individual Income Tax: Yes: Existing* are states that had an individual income tax in 1929, *Yes: New* are states that introduced an individual income tax in the 1930s, and *No* are states that did not have an individual income tax in 1929 or introduce one in the 1930s. *Retail Sales Tax Introduced: Yes* are states that introduced a retail sales tax in the 1930s, and *No* those that did not. Before 1930 no state governments had a retail sales tax. Totals include 6 temporary retail sales tax bases and 2 temporary individual income tax bases. 14/15 states that introduced a corporate income tax during the 1930s did so together with an individual income tax. Source: Due and Mikesell (1995); Penniman (1980).

Table 4: Debt-to-Revenue Ratios: Number of U.S. 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 has been used instead. Data for three states are missing for 1890. Average values are unweighted. Source: U.S. Department of Commerce (Various Years).

Table 5: Moody's General Obligation Bond Ratings

Number of U.S. 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 a Aaa rating. Unrated states noted in the table fall into neither of these categories. The number of assigned ratings for the years shown 1922-1952, respectively, is 2, 0, 3, 3, 6, 7, 11, and 9. According to Moody's, the absence of a rating provides no indication of the credit worthiness of an issuer. Source: Moody's Municipal and Government Manual (1920-1950) .

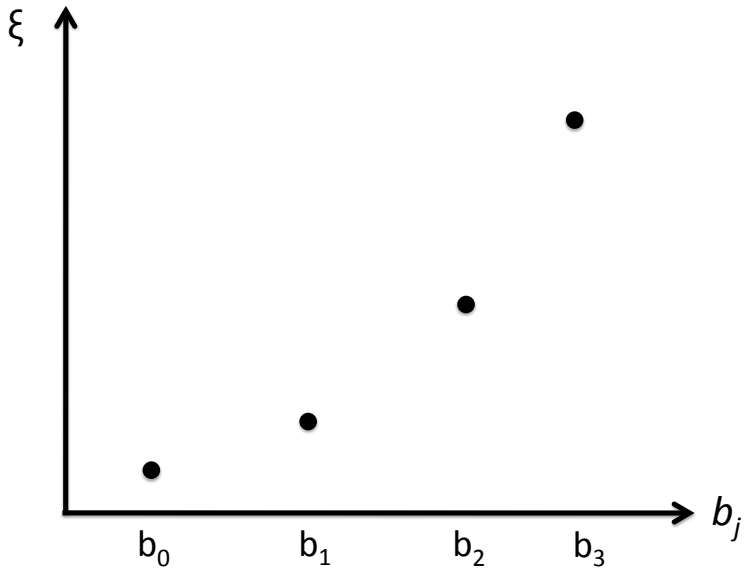
Table 6: Upgrading of Fiscal Capacity: Cross-State Regression Analysis

	(1) Sales Tax 1930s	(2) Sales Tax 1930s	(3) Sales Tax Permanent	(4) Income Tax 1940	(5) Sales Tax Permanent	(6) Sales Tax 1930s ex-High Debt	(7) Sales Tax 1930s	(8) Sales Tax 1930s
	OLS	Probit	OLS	OLS	OLS	OLS	OLS	OLS
Income Tax 1929	0.141	0.142	0.066		0.030	0.129	0.210*	0.100
	(0.137)	(0.181)	(0.163)		(0.157)	(0.162)	(0.119)	(0.198)
Corporate Tax 1929	-0.241	-0.337	-0.089		-0.009	-0.171	-0.246*	-0.306
	(0.164)	(0.208)	(0.162)		(0.155)	(0.183)	(0.129)	(0.197)
Sales Tax 1930s				0.320				
				(0.193)				
ΔInc. 1929-33	-0.016***	-0.024***	-0.018***	-0.006	-0.017***	-0.016***	-0.016***	-0.016***
	(0.004)	(0.007)	(0.004)	(0.005)	(0.003)	(0.004)	(0.005)	(0.005)
Debt: 1929	0.050***	0.073***	0.056***	0.081**	0.049***	0.023	0.040**	0.042***
	(0.014)	(0.024)	(0.014)	(0.032)	(0.011)	(0.048)	(0.017)	(0.013)
ΔSpend. 1932-37					0.003			
					(0.004)			
ΔRev. 1932-37					-0.001			
					(0.008)			
ΔTax. 1932-37					0.009			
					(0.006)			
Constitution	0.152	0.113	0.191	-0.070	0.033	0.079	0.111	
	(0.178)	(0.206)	(0.152)	(0.185)	(0.127)	(0.198)	(0.166)	
Referendum	0.428**	0.398**	0.268	-0.055	0.079	0.404**	0.427**	
	(0.168)	(0.167)	(0.164)	(0.208)	(0.169)	(0.169)	(0.164)	
BBR								-0.036
								(0.145)
Rating: Aa							0.389**	
							(0.178)	
Rating: A							0.163	
							(0.159)	
Rating: Baa/Ba							0.251	
							(0.257)	
Constant	-0.302		-0.507***	-0.042	-0.641***	-0.220	-0.458*	-0.063
	(0.242)		(0.170)	(0.223)	(0.166)	(0.266)	(0.232)	(0.187)
Observations	48	48	48	36	48	43	45	48
R-squared	0.343		0.332	0.279	0.518	0.313	0.464	0.238

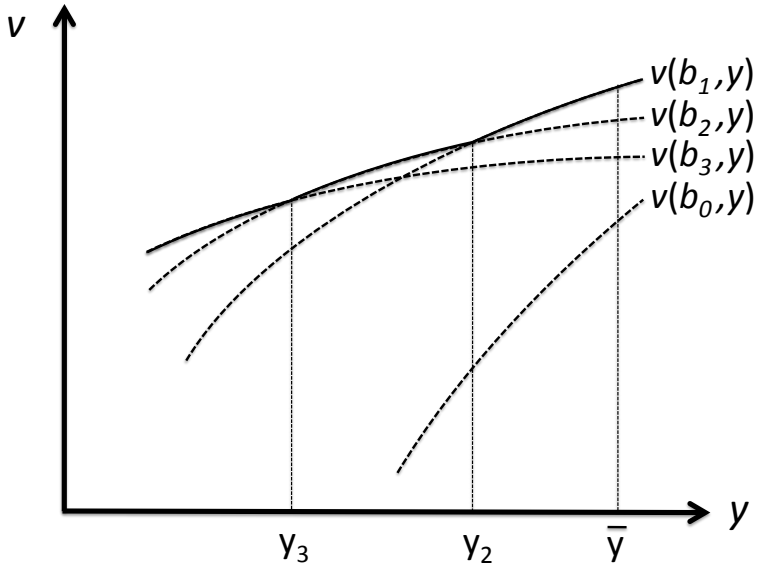
Notes: *Sales Tax 1930s* is a binary variable equal to unity for the 28 states that levied a retail sales tax in the 1930s; *Sales Tax: Permanent* excludes the six states levying a temporary retail sales tax in the 1930s. *Income Tax 1929, Income Tax 1940* and *Corporate Tax 1929* are indicators for the presence of those tax bases in 1929 or 1940. Δ*Inc 1929-33* is 100x the log change in real state per capita personal income from 1929 to 1933, with a mean value of -34. *Debt 1929* is the state debt-to-income ratio in 1929 in percent, with a mean value of 3.2 and a maximum value of 17.9. Δ*Spend 1932-37,* Δ*Rev. 1932-37* Δ*Tax. 1932-37* is 100x the log change in real state per capita state government spending, total revenue and tax revenue, respectively, from 1932 to 1937. *Constitution* is a dummy variable equal to unity for states requiring a constitutional amendment to incur debt, *Referendum* is a dummy variable equal to unity for states requiring a referendum to incur debt, and *BBR* is a dummy variable taking the value unity for states with a balanced budget requirement. *Rating* is the General Obligation bond rating in 1937; omitted category is a Aaa-rating. Coefficients for regression specification (2) are marginal effects at the mean for each variable, and for a discrete change from 0 to 1 for binary dependent variables. Regression (6) excludes the five states with the highest 1929 debt-to-income ratios: Alabama, Arkansas, North Carolina, South Carolina, West Virginia. Regression (4) is restricted to states that did not have an income tax in 1929. Statistical significance at the 1, 5, and 10 percent levels is denoted by ***, **, and *, respectively. Robust standard errors have been used.

Figure 1: Tax Base Breadth

(a) Administrative Cost Function

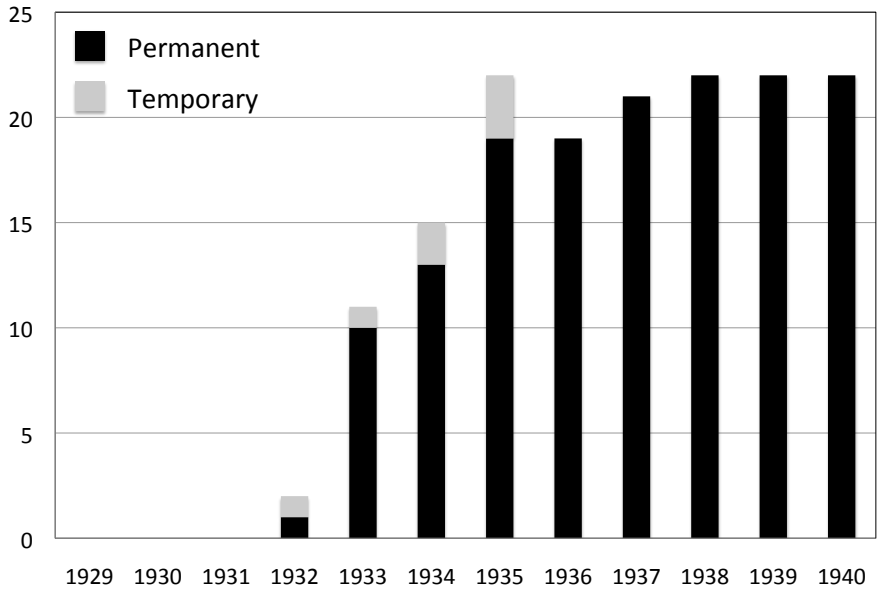


(b) Period Utility as a Function of Income: By Tax Base Breadth



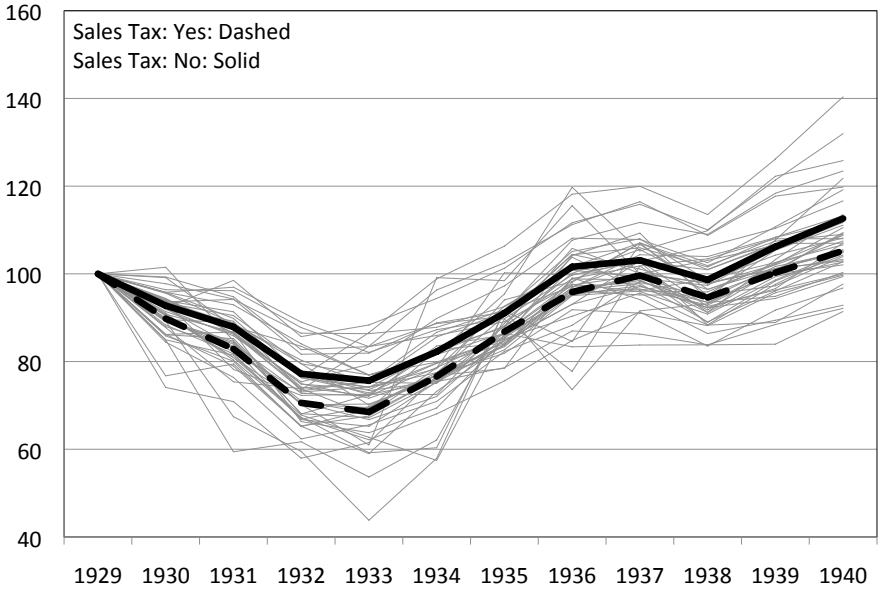
Notes: Panel (a) shows the per-period cost to administer a tax base of breadth b. Panel (b) shows per-period social welfare as a function of income for different levels of tax base breadth.

Figure 2: Number of U.S. State Governments with a Sales Tax



Notes: During the period 1932-1938, 22 states introduced a retail sales tax that ultimately became permanent, and six states levied a temporary retail sales tax for one or two years. Source: Due and Mikesell (1995).

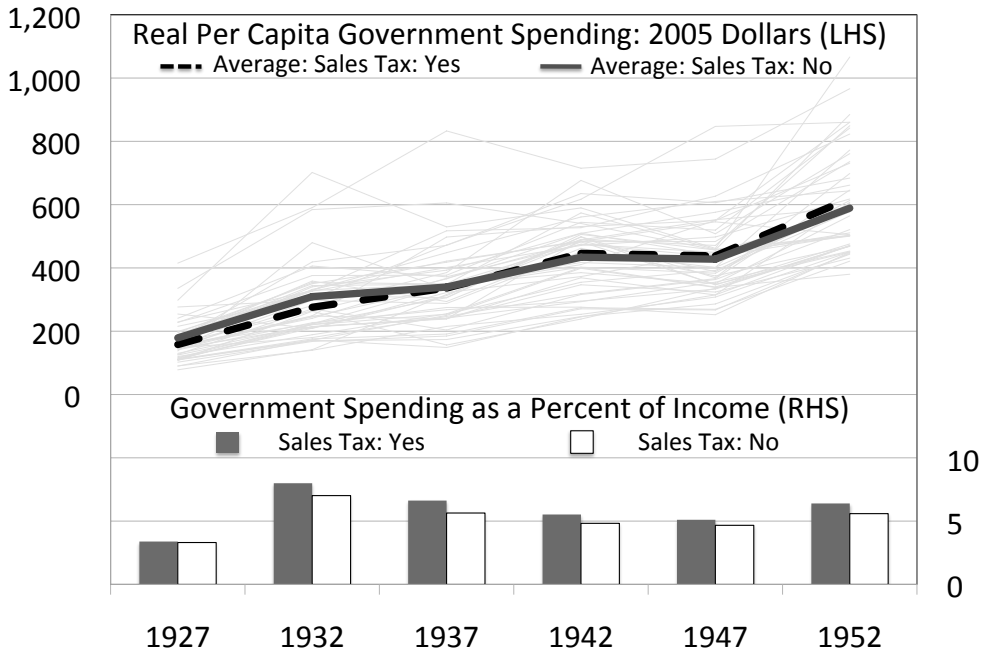
Figure 3: Real State Per Capital Personal Income: 1929=100



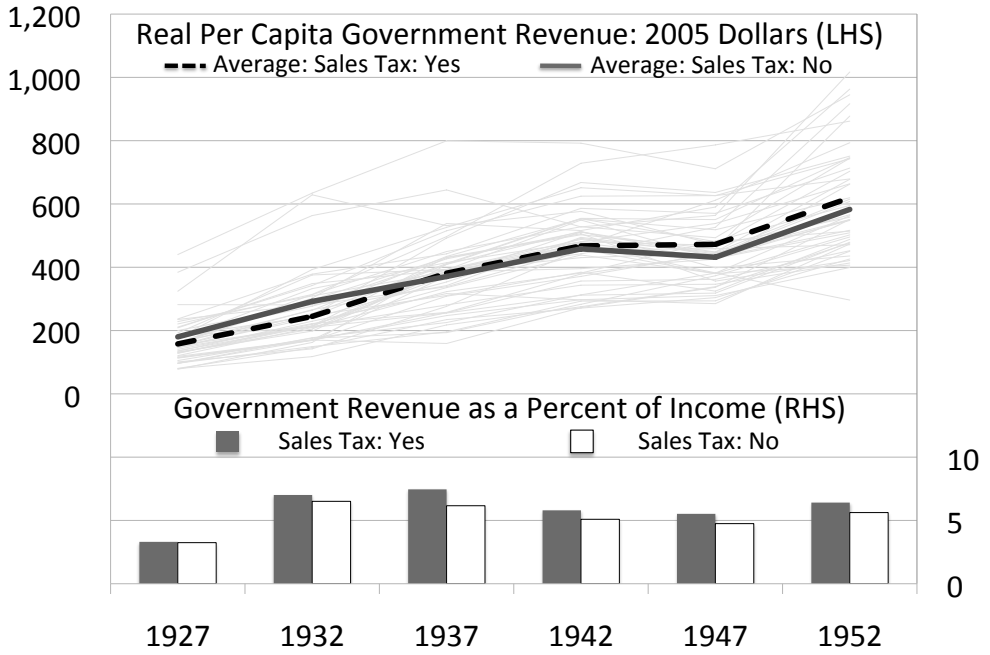
Notes: *Sales Tax: Yes* is the average for the 28 states that levied a retail sales tax in the 1930s, and *Sales Tax: No* is the average for the 20 states that did not; individual states are shown in grey. Nominal state per capita personal income data was converted to real values using the U.S. GDP deflator. Sources: BEA; Due and Mikesell (1995); U.S. Department of Commerce (Various Issues).

Figure 4: Revenue and Spending: By State Government

(a) Spending

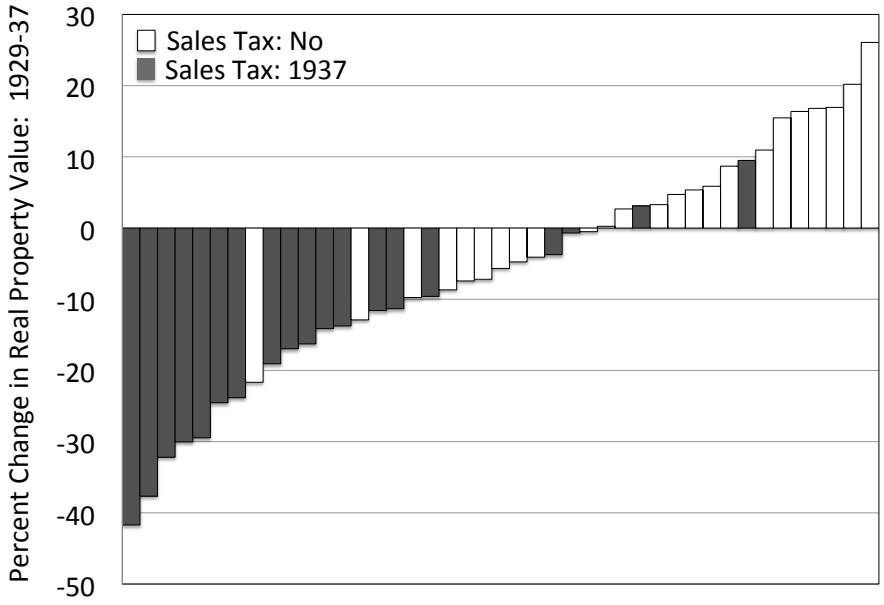


(b) Revenue



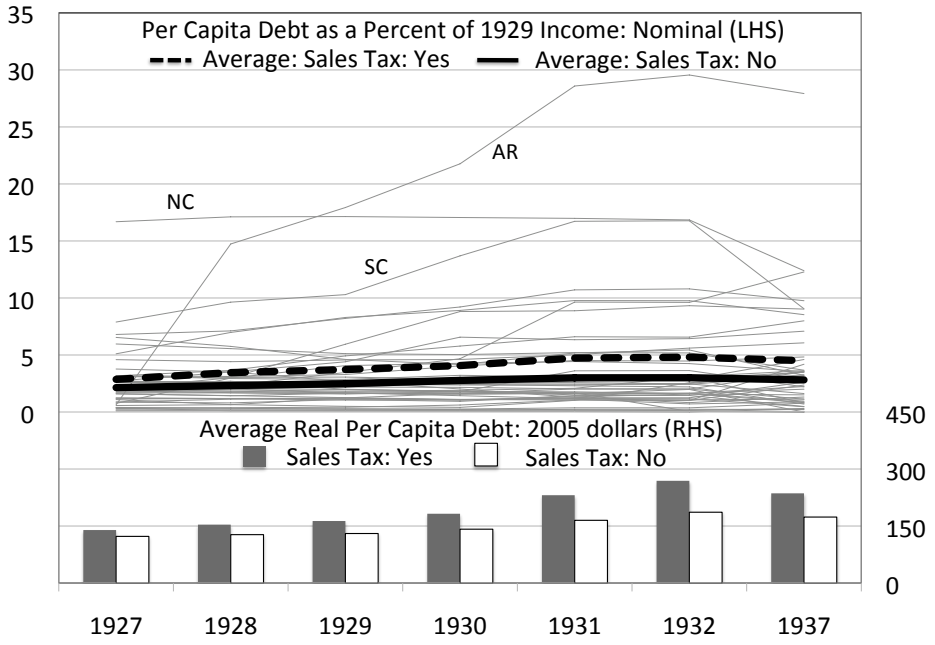
Notes: *Sales Tax: Yes* is the 28 states that levied a retail sales tax in the 1930s, and *Sales Tax: No* is the 20 states that did not. Income is state per capita personal income. Nominal revenues and spending were converted to real values using the U.S. GDP deflator. Spending data are total state government cost payments for 1927-1937, and total state government expenditures for 1942-1952. Sources: BEA, Due and Mikesell (1995), U.S. Department of Commerce (Various Issues).

Figure 5: Retail Sales Tax Adoption: By Percentage Change in Assessed Property Values



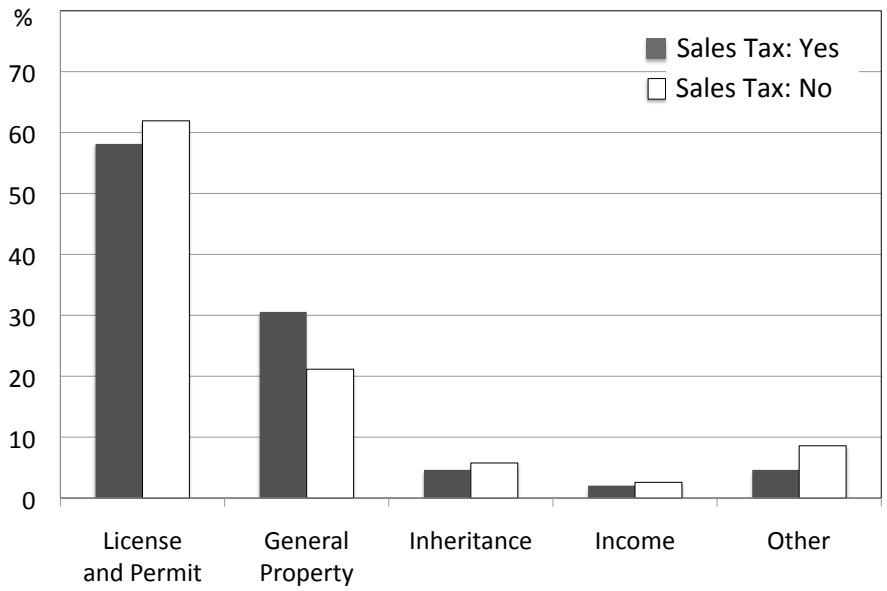
Note: *Sales Tax: No* is the group of states that did not introduce a retail sales tax in the 1930s, *Sales Tax: 1937* is the group of states that had a retail sales tax in 1937. All of these retail sales tax bases ultimately became permanent. Each column indicates the real percentage change from 1929-1937 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. Sources: Due and Mikesell (1995), and U.S. Department of Commerce (Various Issues).

Figure 6: State Government Debt



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. Debt is less sinking fund assets, and real debt is nominal debt deflated by the U.S. GDP deflator. Data shown for years available. Sources: BEA, Due and Mikesell (1995), U.S. Department of Commerce (Various Issues).

Figure 7: Tax Revenue Shares: 1932



Note: *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, non-business, and business license taxes. Sources: Due and Mikesell (1995), and U.S. Department of Commerce (Various Issues).