Consumption Taxes, Income Taxes, and Revenue Stability: States and the Great Recession

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Abstract

This paper translates state reliance on income versus consumption taxes into tax burdens by income slice and uses those burdens, together with changes in Adjusted Gross Income by income slice, to explain state tax revenue changes during the Great Recession. We find that more unequal income distributions increased tax base volatility, but greater base volatility did not systematically translate into more volatile tax revenues. While regressivity is decreased in states with higher income tax shares, and increased where there are higher consumption tax shares, simulation results from imposing national average income and consumption tax shares challenge the conventional wisdom that consumption taxes are more stable than income taxes. Volatility would have been *greater* in high income tax share states, and *lower* in high consumption share states, if they had more balanced tax structures. The *interaction* between tax burdens and base volatility by income slice is key to these surprising results.

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Introduction

Stability of tax revenues over the business cycle is an important feature of state and local tax systems. With almost all states subject at least to some degree to balanced budget requirements, sharp declines in revenue during recessions must be met by drawing down reserves, cutting services, or raising taxes. While many expenditure needs are stable throughout the business cycle, income maintenance and services for the poor and unemployed tend to be countercyclical, with need rising during recessions. The more stable are revenues, the less the need for adjustments that may worsen economic downturns.

The major sources of state tax revenue are personal income taxes and taxes on consumption – general sales and gross receipts taxes and excise taxes on tobacco, alcohol, and gasoline. Among the 48 contiguous states in 2007, the median share of tax revenue contributed by the personal income tax was 36 percent, while the median share from consumption taxes was 46 percent. With little support in the literature, the conventional wisdom says that consumption taxes are more stable than taxes on income, because the consumption tax base is less elastic than the income tax base with respect to changes in aggregate income (Tax Foundation, 2013).

The Great Recession provides an important test case for investigating the role of state tax structure in revenue volatility. The recession precipitated the sharpest decline in state tax revenues in the post-war period. From peak to trough (Q4 2008 to Q2 2010), real per capita

income tax receipts fell by 19.4 percent. Sales tax receipts fell by 17.6 percent (Q4 2008 to Q3 2010). State tax revenues did not regain their prior nominal peak until 2011, and real receipts did not reach their prior peak until the fourth quarter of 2013.[1] However, despite the depth of the aggregate decline, there was considerable variation across states. As shown in Figure 1, of the 48 contiguous states, 36 had nominal declines in state tax revenue between 2007 and 2009, while twelve had increases. Part of this variation was due to differences in the impact of the recession, while part may also have been due to differences across states in tax structure.

While its scope was national, the Great Recession comprised a set of shocks with differential impacts across income classes, states, and regions. The financial shock, reflected in sharp drops in capital gains, dividends, and interest income, hit high income households the hardest (Saez, 2012).[2] Hence, the impact was likely to be greatest in states with the greatest concentration of high income households and the greatest reliance on capital gains and other income from capital. Among these states are New York, California, Florida, Connecticut, and Wyoming.

The housing shock – a sharp decline in home values, an increase in mortgage delinquencies and home foreclosures, and the collapse of the home construction sector – was greatest in states with the greatest prior run-ups in housing prices; i.e., the largest housing

[1] In real terms, state tax revenues in 2012 were 5 percent lower than in 2008. In the 2001 recession, nominal tax revenues declined for only one year. By 2004, three years after the onset of the recession, nominal revenues were 5.7 percent higher than the previous peak in 2001. In the double-dip recession of 1980-1982, state tax revenues continued to grow in nominal terms throughout the recession and its aftermath. By 1985, five years after the onset of the first of the double-dip recessions (and three years after the official end of the second), state tax collections were up 57.4 percent.

[2] Between 2007 and 2009 average real family income fell by 17 percent while real income for the top percentile fell by 36 percent (Saez, 2012). Aggregate capital gains realizations plummeted from $913 billion in 2007 to $48 billion in 2009 (Lurie and Pierce, 2012). For filing units with adjusted gross income (AGI) of $200,000 or more, representing a little less than 5 percent of all returns, capital gains fell by 73 percent between 2007 and 2009. Interest payments fell by 44 percent, and dividends by 40 percent.

bubbles. For example, housing prices in the major metropolitan areas of Arizona, California, Nevada, and Florida fell by 15 percent or more in both 2008 and 2009, compared with a nationwide average among large cities of about 5 percent per year (Chernick, Langley and Reschovsky, 2011). This list suggests substantial overlap between the financial shock and the housing shock, and indeed California and Florida are among those states with the greatest potential revenue shocks from the Great Recession (Chernick, Reimers, and Tennant, 2014). Housing market declines affected the entire income distribution, so that losses were less concentrated at the top than losses due to the financial shock. Construction and other housing-related employment losses were also more likely to be concentrated among middle-income earners.

Other industry-specific shocks also varied in their regional impacts. Declines in financial services had particularly large impacts in New York, New Jersey, and Connecticut. Michigan and Rhode Island, both of which had suffered from secular decline in manufacturing, were among the states where the upper middle of the income distribution was hardest hit. In contrast to these negative shocks, states such as Wyoming and North Dakota benefited from positive shocks to the energy sector, while agricultural states such as Iowa benefited from price increases for corn and wheat. Both the positive and negative shocks had differential impacts across the income distribution.

This paper challenges the conventional wisdom that attributes revenue volatility to a state's dependence on income rather than consumption taxes. We show that this simplistic model explains very little of the variation in the change in tax revenue across states during the Great Recession. The variation across states in the relative magnitude of the shocks to different income classes, together with differences across states in relative tax burdens by income,

suggests the desirability of an income distribution-based analysis of revenue volatility. We introduce a more complex model that takes account of the amounts of income in different slices of the income distribution and the shocks thereto, as they interact with the tax burden on each slice. Our approach differs from the conventional analysis of revenue volatility in that we estimate separate effects, not for each tax, but for changes in income at different points in the income distribution, interacted with the relevant tax burdens. We find that differences across states in their income distributions, the distribution of income shocks, and the income-class incidence of their tax sources are important in explaining the different revenue impacts of the Great Recession. The distribution of income shocks in turn depends on the state's industrial structure, the degree of concentration of income at the top, and the importance of capital gains in top incomes; whereas the relative burdens depend on the state's reliance on income vs. consumption taxes.

The paper has five sections. The first section provides a short literature review. Section II discusses the models of tax burden and tax revenue change. Section III presents the model estimates, while Section IV discusses the simulation results. Conclusions are presented in Section V.

I. Literature Review

Prior research on state tax volatility has used panel data to estimate separate revenue elasticities for the major state taxes and attempted to distinguish between short and long run elasticities. Holcombe and Sobel (1997) find similar short run elasticities with respect to personal income for the sales tax (1.3) and the income tax (1.4) in the period 1972-1993. Dye

and McGuire (1991), using consumption estimates from the National Income Accounts and income changes by income class from the Current Population Survey, find greater variability of the income tax under a progressive structure and conclude that state tax structure has an important impact on volatility. In a later review paper, however, Dye (2004) suggests that changing the mix of taxes would on average have little effect on state tax volatility.

A number of observers have noted an increase in state tax volatility in the 2000s (Dadayan and Boyd, 2009). In contrast to Dye's conclusion for the 1990's and earlier, Seegert (2012) concludes that most of the increase in state tax volatility in the 2000s can be attributed to what he calls "imbalance" in state tax structures, meaning heavy reliance on either sales or income taxes. Matoon and McGranahan (2012) and Kodrzycki (2014) also find an increase in cyclicality of state revenues in the 2000s. Matoon and Granahan attribute about 70 percent of this increase to greater cyclicality of the base, mainly due to greater volatility of income from capital, leaving about 30 percent due to the fact that tax rate changes in the 2000s were less likely to offset base changes than in the 1990s. Kodrzycki (2014) finds that state tax revenues were more volatile than their economies in the period 2000-2012, and that the main source of this increased volatility was an increase in the volatility of personal income tax receipts. Kodrzycki (2014, Table 78) reports that, among the 38 states with both a broad-based income and a broad-based sales tax, in the 1980-2000 period the sales tax was more volatile than the income tax in 26 states, while from 2000-2011 the income tax was more volatile in 33 states.

In his literature review, Dye (2004) emphasizes that both base and revenue elasticities may differ across states. Matoon and McGranahan (2012) test this hypothesis by grouping states based on the degree of income concentration. Though they find some difference across groups in the change in cyclicality, they conclude that the increase occurred in almost all states. Like

Matoon and Granahan, Kodrzycki (2014) finds that the principal source of increased income tax volatility was an increase in the volatility of the federal tax base.

Though several of these papers note the role of increased volatility of investment income in the 2000's, none of them make the link between increased volatility by income source and increased concentration of income. By contrast, our examination of revenue volatility during the Great Recession focuses explicitly on the role of differences in the distribution of income across states and the interaction of those differences with differences in tax structure.

II. Models and Data Sources

To take account of the differential impact of the recession on high income households, we decompose the shock to each state by income level, using data from the Internal Revenue Service to obtain changes in adjusted gross income (AGI) by income slice by state. Our analytic strategy is illustrated in Figure 2. We start with the share of state tax revenue that comes from the personal income tax and from taxes on consumption. These tax shares are translated into tax burdens by income slice after dividing the income distribution, as measured by AGI, into three slices. Tax burdens and base changes for each slice are then used to predict changes in tax revenue. As shown in the figure, the change in AGI for the top 5 percent depends on the concentration of income in that group and the importance of capital gains in their income.

Based on available IRS data and our focus on the effect of income changes at the upper end of the income distribution, families are divided into three income slices: the top 5 percent of tax filers, the next 15 percent, and the bottom 80 percent. Changes in the tax base by income level within a state are measured by the change in AGI for that income slice. The data source for

AGI by state and AGI bracket is the published Internal Revenue Service Statistics of Income data (Internal Revenue Service, no date).

Effective tax burdens by income quintile are produced by the Institute for Taxation and Economic Policy (ITEP, 2009). The Institute for Taxation and Economic Policy is an affiliate of the better-known Citizens for Tax Justice, and henceforth we will refer to the incidence data as the "CTJ data." The CTJ 50-state tax incidence model assigns taxes to families based on patterns of income and consumption. CTJ measures tax burdens by simulating taxes paid based on the structure of state income taxes, the rates and coverage of general and specific sales taxes, and rates of the corporation income tax. Income taxes are assumed to be borne by taxpayers, while consumption taxes are mainly shifted forward to consumers. In estimating tax burdens, the CTJ model excludes the portion of taxes that is exported to other states, but does not take account of taxes imported from other states.[3] Estimated tax burdens for the high end of the state's income distribution are largely a function of the structure of the personal income tax, including the top marginal rate, bracket widths, and the tax treatment of capital gains. Consumption tax burdens are assigned according to spending patterns by income class for taxed items, using the Consumer Expenditure Survey.

In addition to the tax burden estimates, the CTJ data also provide estimates of average family income by income slice by state for 2007. The income base used by CTJ for the calculation of average tax burdens is average family income for a family of four by income slice. Family income is measured by federal adjusted gross income, plus other items available from the tax

[3] While for most states this exclusion makes little difference, for those few states with high revenues from mineral taxation (severance taxes) or high levels of tourism, the disparity between average tax burdens as measured by the CTJ and tax collections as a fraction of state personal income could be substantial.

returns, such as excluded capital gains and rental and partnership losses.[4] The slices are the first four quintiles, the next fifteen percent, the next four percent, and the top one percent. In contrast, the published IRS data provide AGI, realized capital gains income, and number of returns by AGI bracket, state, and year. The brackets are (in thousands): less than $50, $50-$75, $75-$100, $100-200, $200 and above. To combine the IRS data on changes in income with the CTJ data on tax burdens, we need to express the IRS data in terms of percentiles. Given the share of returns in each AGI bracket, we use linear interpolation to assign a share of the AGI and capital gains amounts within each bracket to the respective percentiles.[5] We could not estimate AGI or capital gains amounts for the top one percent, because the open-ended top AGI bracket ($200,000 or more) contains more than one percent of the returns in every state. A disproportionate share of the income and capital gains in this bracket belong to the top one percent, but we have no way of estimating that share, on a state-by-state basis. We therefore collapse the CTJ data into three slices: the top 5 percent, the next 15 percent, and the bottom 80 percent.[6]

A. Tax Burdens and Tax Shares

States vary substantially not only in their overall tax burdens but also in their reliance on different types of taxes and in the resultant distribution of tax burdens by income level. In 2007 on average, 32.2 percent of state tax revenue came from the personal income tax, while 46.7

[4] Because the tax return data do not include non–filers, and because most transfer income is excluded from AGI, the CTJ income measure is not a representative sample of the low-income population.

[5] Linear interpolation implicitly assumes that the AGI and capital gains amounts are uniformly distributed within an AGI bracket. However, national data on the shape of the AGI and capital gains distributions indicates that capital gains are more concentrated than AGI at the upper end of each bracket. Therefore, linear interpolation understates the capital-gains share of AGI in the top 5 percent of returns. Unfortunately, the published IRS data are in broad income brackets, which do not permit a more refined interpolation.

[6] In 2007 and 2009 fewer than 5 percent of returns were in the top AGI bracket ($200,000 or above) in every state but one (New Jersey with 5.1 percent in 2007, and Connecticut with 5.1 percent in 2009). We treat the top AGI bracket as equivalent to the top 5 percent in New Jersey in 2007 and Connecticut in 2009.

percent came from general and selective sales taxes. Table 1 shows the shares in total state tax revenue of the personal income tax, taxes on consumption, and severance taxes, for the year 2007.

Of the 48 contiguous states, six (South Dakota, Nevada, Washington, Wyoming, Texas, and Florida) have no income tax, while two (Tennessee and New Hampshire) have very limited income taxation.[7] Of the 40 states that use a broad-based income tax, the rate structure varies widely. Nineteen tax most income at a single rate. For the rest of the income-tax states, there is considerable variation in both the top rate and the degree of graduation (Dye, 2004). At the beginning of the recession in 2007, the highest top marginal rate was in California, at 10.3 percent for taxable income above $1 million (Tax Foundation, 2014).

Differences in the structure of the income tax translate into substantial variation in the progressivity of the income tax across states. The CTJ estimates indicate that the ratio of the income tax burdens on the top 5 percent to the bottom 80 percent in a state ranges from 0.94 to 5.8, with an average of 1.84 and standard deviation of 0.95. While nominal rates for the general sales and excise taxes are typically uniform within states (with some minor variation across counties), effective consumption tax rates vary by income level because of differences in the share of taxable consumption in income. Based on data from the Current Expenditure Survey, the elasticity of consumption of taxable items with respect to annual income is substantially below one (Poterba, 1989).[8] For taxes on consumption, CTJ estimates an average ratio of

[7] Tennessee levies a 6 percent tax on dividends, interest, and some capital gains income, while New Hampshire has a 5 percent rate on interest and dividend income.

[8] There has been some debate concerning the long run income class incidence of consumption taxes. A number of economists argue that the ratio of taxable consumption to income varies much less when one measures income over a time period longer than a year. For example, Poterba (1989) finds that the gasoline tax is substantially less regressive when one uses annual consumption as a proxy for permanent or longer run income than when one uses annual income. In constrast, Chernick and Reschovsky (1997), using 11 years of panel data on individual families,

effective tax burdens on the top to middle quintile equal to 0.53. Variation around this average across states is small (standard deviation = .03), suggesting that variation across states in the taxable base has relatively little effect on the incidence of consumption taxes, at least in the upper part of the income distribution.

In this paper we model the level and distribution of state tax burdens as a function of the relative reliance on the two major types of state taxes: personal income and consumption taxes (both general sales and excise taxes). The share of total tax revenue from each of these taxes is equal to the weighted average of the burdens of that tax by income slice (where the weights are the share of each slice in the tax base for that tax), multiplied by the total tax base and divided by total state tax revenue. For both income and consumption taxes, the tax base is measured by AGI. Tax shares are equal to

$$SHR_{pit,cons} = Burd_{pit,cons}\frac{AGI}{Tottax}$$

$$= \frac{[(\sum_{i=1}^{3} Burd_{\{pit,cons\},i}\ ShrAGI_i)]\ \cdot AGI}{Tottax} \qquad (1)$$

In (1), *SHR* is the share of total state tax revenue (*Tottax*) from each type of tax, *pit* refers to the personal income tax, *cons* are taxes on consumption, including general and selective sales taxes, *Burd* is the effective tax rate, *ShrAGI* is the share of total AGI, and *i* indexes slices of the income distribution. Our estimation procedure essentially inverts equation (1), by regressing burdens by income class on tax shares. With states indexed by *s*, we estimate equations of the form

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find that the gasoline tax is only slightly less regressive over the intermediate term than when one uses annual income.

$$Burd_{is} =$$

$$a_{0i} + \ a_{1i}\, SHR_{pit,s} + \ a_{2i} SHR_{cons,s} + \ a_{3i} SHR_{sev,s} + \ a_{4i} \left(\frac{Tottax}{Income}\right)_s + \ error_{is} \qquad (2)$$

The dependent variable $Burd_i$ is the effective tax burden on the ith income slice. SHR_{sev} is the share from severance taxes, and *Tottax/Income* is total state taxes relative to personal income.[9] While in most states taxes on consumption and personal income contribute the preponderance of state tax revenue, a few states are heavily dependent on severance taxes. Because tax shares are correlated by construction, omitting severance taxes would bias the estimates of the income and consumption tax effects. The total tax burden is included as a measure of the size of the state's public sector, with the expectation that a larger public sector is associated with higher tax burdens on all income slices.

The coefficients in (2) represent the average relationship between the revenue share from each tax and the burden on a particular income slice, holding constant the shares of other taxes. For example, the coefficients of income tax share summarize the effects on the burden for each income slice, for the state with the average degree of income tax progressivity and the average income distribution. The equation may underestimate the burden on the top 5 percent in states whose income tax is substantially more graduated than the average. By contrast, it may overestimate the burden on the top 5 percent for states such as Connecticut, that have an average degree of income tax progressivity but a very high proportion of total AGI in the top income slice.

[9] The major tax omitted from (2) is the corporation income tax (CIT), which in aggregate provided less than seven percent of state tax revenues. A portion of each state's CIT is borne by the owners of capital in other states and is not captured in the CTJ methodology.

B. Tax Revenue Change Model

The model of tax revenue change is written as

$$\Delta TAX_s = b_0 + \sum_1^3 b_{1i}\, Burd_{is} + \sum_1^3 b_{2i}\, \Delta AGI_{is} + \sum_1^3 b_{3i}\, Burd_{is} * \Delta AGI_{is} + error_{is} \qquad (3)$$

where ΔTAX is the change in state tax revenue from 2007 to 2009, scaled by the number of federal income tax returns in 2007. Tax rates *t* are the effective burdens on the three slices *i* of the AGI distribution, the $\Delta AGI's$ are the changes in federal adjusted gross income between 2007 and 2009 for the three slices, each scaled by the number of 2007 federal tax returns from that slice. The third set of terms are the interactions between the tax rate and the change in the tax base.

If tax policy responses were systematically related to the magnitude of the base decline, either in total or in particular slices of the income distribution, then the estimates of (3) would be biased, thus undermining the validity of the estimate-based simulations which follow.[10] In Chernick, Reimers and Tennant (2014) we calculated the difference between actual tax changes and potential revenue exposure, where the latter equals the weighted average of the initial tax burden times the change in AGI per return for each income slice. We found that none of the regressors in (3) was correlated with this difference at the 5 percent significance level.[11] This suggests that the potential bias from correlation of the error term with the regressors in (3) is unlikely to be very severe.

[10] Poterba (1994) found just such an offset in the 1988–1992 period, with state tax responses to unexpected negative deficit shocks proportional to the magnitude of the shock. However, as noted above, Matoon and McGranahan (2012) find that tax rate changes in the 2000s were less likely to offset base changes than in the 1990s.

[11] At the ten percent level of significance, changes in top 5 percent AGI were negatively correlated (Pearson correlation coefficient) with the difference, while changes in the next 15 percent were positively correlated with it.

If income changes were uniform across the distribution within a state, decomposing by income slice would yield little additional insight. Figure 3 shows that this is not the case. It plots the change in AGI (per filing unit) for the next 15 percent of the AGI distribution against the change for the top 5 percent. The figure shows that the largest decreases in the top part of the income distribution occurred in Connecticut, Wyoming, Nevada, New York, Massachusetts, and Florida. Only two of these states, Nevada and Florida, were among the 12 states with the largest decreases in the next 15 percent of the AGI distribution. The two largest losses in this second income slice were in Michigan and Rhode Island, manufacturing states that have been subject to secular decline. The correlation between dollar changes in AGI per return for the top 5 percent and the next 15 percent is relatively low (ρ=0.4) compared with that between the next 15 and bottom 80 percent (ρ=0.74).

Figure 3 also highlights how much larger was the shock to the top of the income distribution than to the next 15 percent. Consequently the potential effects on tax revenues of the recessionary shock were very different, depending on the relative rates of taxation in these two slices of the income distribution. The relative magnitude of the shocks to the two components of the top income quintile and its variation across states, together with differences across states in relative tax burdens within the top quintile, provides a strong justification for our income distribution-based analysis of revenue volatility.

III. Empirical Results

In this section we will present estimates of the *a* coefficients from the tax burden equations in (2) and the *b* coefficients from the tax change model in (3). However, we begin by

directly regressing the 2007-2009 change in state tax revenues, scaled by the number of federal tax returns in 2007, on the income, consumption, and severance tax shares.[12] Descriptive statistics are given in Table 1, and results from the tax share regression are shown in Table 2. The first column of Table 2 indicates that states with a higher personal income tax share experienced a larger revenue decrease, though the estimated coefficient is significant only at the 6 percent level, and this variable explains very little of the interstate variation in revenue changes. By contrast, the consumption tax share alone (column 2) has no effect on tax revenue changes. Column (3), which includes the income tax share and the consumption tax share, but excludes the severance tax share, indicates that *both* a higher income tax share *and* a higher consumption tax share were associated with a greater drop in tax revenues, with the magnitude of the effect virtually equal for the two types of taxes. The inclusion of severance taxes (column 4) improves explanatory power, but renders both income tax and consumption tax shares insignificant.[13] [14] Overall, these results do not support the proposition that greater reliance on income taxes led to greater tax instability in the Great Recession. The models that follow, which are based on differences across states in income distributions and tax incidence patterns, attempt to provide a structural explanation for the results in Table 2.

[12] The omitted category is the share of taxes from the corporate income tax and other miscellaneous taxes. Though the corporate tax share of state taxes is small (2.7% in 2007), corporation income taxes tend to be among the most volatile of state taxes, while other taxes, which comprised 4.3% of tax revenues in 2007, tend to be quite stable.

[13] We also tried a specification which included dummy variables for North Dakota and Wyoming, which had very large increases in severance tax revenues, instead of the severance-tax share. The other coefficients were virtually unchanged.

[14] When severance taxes are included the interpretation of the other coefficients changes, from the effect of substituting the personal income (or consumption) tax for all other taxes, to the effect of substituting the personal income (or consumption) tax for all other taxes except for the severance tax.

A. Tax Burdens

As shown in Figure 2 and equation (2), tax burdens are assumed to depend on the shares of income, consumption, and severance taxes in total tax revenue, as well as the overall burden of taxation. Estimates of the tax burden models are shown in Table 3. Tax shares are most successful in explaining the variation in burden for the top quintile, with an adjusted R^2 equal to 0.76 for the top 5 percent and 0.65 for the next 15 percent, but only 0.43 for the bottom 80 percent. The coefficient estimates show the effect on burdens of substituting each of the listed taxes for the omitted category, which is "other" taxes, including the corporation income tax and license taxes. Notably, the income tax share has a significantly positive effect on all burdens across the income distribution, with the effects on the top-5 and next-15 burdens almost equal, and only slightly larger than the effect on the next-80 burden. Thus, the main effect of a higher personal income tax share is to increase state tax burdens across the board, with relatively small differences across the income distribution.

Greater reliance on consumption taxes has a regressive impact, with an insignificant effect on the top-5 burden, but increasing the bottom-80 burden 70 percent more than the next-15 burden. The contrast between the incidence effects of the income and consumption tax shares is striking. Compared with the consumption-tax share, the personal income-tax share has four times the effect on the top-5 burden, twice the effect on the next-15 burden, and about the same effect on the bottom-80 burden.

As shown in row 3 of Table 3, a higher severance tax share is associated with lower burdens on the top quintile of the AGI distribution, but has no significant effect on the burden on the bottom 80 percent. Severance tax revenues are determined by mineral prices in world

markets and by the available supply, given the state of technology. The results in Table 3 suggest that states use these revenues to reduce tax burdens on the top quintile of the income distribution. The overall tax burden is a measure of preferences for public services.[15] A higher overall tax burden is associated with higher tax burdens across the income distribution (Table 3, row 4). However, the effect of the overall burden is greater the higher the income slice, suggesting that a more progressive tax structure accompanies, or is required for, a larger public sector.

We can use the results in Table 3 to answer the following question: What would be the effect on tax burdens across the distribution of a marginal substitution of the income tax for taxes on consumption, holding constant their combined share of total tax revenue? The net effect on burdens of such a change, taking account of both the offsetting change in the consumption tax share and of their combined share in total tax revenue, is shown in Table 4. This net effect is smaller than the coefficient of the income tax share shown in Table 3, where a higher income tax share or consumption tax share comes at the expense of lower shares of the omitted taxes. In Table 4 an increase in the income tax share implies a lower consumption tax share, while the share of omitted taxes is constant. Since we know from Table 3 that the consumption tax share has a positive effect on tax burdens when it is substituted for the omitted taxes, the net effect of increasing the income tax share is smaller when we reduce the consumption tax share instead of the share of omitted taxes.

Whereas Table 3 showed that substituting the income tax for "other" taxes (keeping the consumption tax share constant) raises burdens more or less equally across all income slices, Table 4 shows that substituting the income tax for consumption taxes has a progressively smaller

[15] This statement is subject to the caveat that higher states taxes may be at least partially offset by lower local taxes.

effect as we move down the income distribution. Evaluated at the mean share of income and consumption taxes in total state taxes (0.79), a ten percentage point increase in the income tax share of combined income and consumption taxes (e.g., from 40 percent to 50 percent) would raise tax burdens on the top 5 percent by half a percentage point, and on the next 15 percent by a third of a percentage point. There is no effect on the bottom 80 percent. Not surprisingly, the expressions in Table 4 show that the effects of changing income and consumption tax shares will be larger, the more states rely on these two types of taxes.

B. Change in Tax Revenues

Estimates of the model of change in total tax revenue per return (equation 3) are shown in Table 5. When interpreting the results from Table 5, it should be kept in mind that these are cross-state, not longitudinal within-state effects. The adjusted R^2 is 0.58, indicating that our distributional model captures factors that are important in explaining the variation in state tax revenue changes.[16] The model is discussed more fully in Chernick, Reimers, and Tennant (2014). Here we emphasize the marginal impact of the tax burdens for each of the three income slices.[17] Manipulating the estimated coefficients in Table 5, the marginal impact on the 2007-2009 tax revenue change is equal to

$$\partial(\Delta Tax_s) = \left(16277 + .296 * \Delta AGI_{top5,s}\right) * \partial\left(Burd_{top5,s}\right) + \left(-9935 - 6.116 * \Delta AGI_{nxt15,s}\right) * \partial\left(Burd_{nxt15,s}\right) + \left(-16339 - 3.114 * \Delta AGI_{nxt80,s}\right) * \partial\left(Burd_{nxt80,s}\right) \quad (4)$$

[16] In an alternative specification that includes dummy variables for North Dakota and Wyoming (outliers with huge increases in revenue from severance taxes -- see Figure 1), the adjusted R^2 increases to .87.

[17] Because the dollar change in taxes and the percentage change are almost perfectly correlated (rho = .97), the results, though estimated less precisely, are basically unaffected if we replace the dollar amount of tax change with the percentage change. In terms of policy interpretation, we would argue that the dollar change is more relevant.

In (4), ΔTAX is the 2007-2009 dollar change in tax revenue, ΔAGI is the change in adjusted gross income for the respective income slice (top 5, next 15 and bottom 80 percent), and *Burd* is the tax burden for the income slice. To make states comparable, ΔTAX and ΔAGI are divided by the number of federal income tax returns in the income slice in 2007. We expected that, holding the change in AGI constant, a higher tax burden at any point in the income distribution would be associated with a greater change in tax revenues. Similarly, the greater the change in the tax base (i.e., AGI) at any income level, the greater the expected revenue response.

Table 5 shows that the burden and base-change effects are non-linear, depending on the interaction between the two, and that the direction of effect differs across the income distribution. For states where top-5 AGI fell by $55,000 or more, the higher the tax burden, the greater the decrease in total tax revenues. At the mean change in adjusted gross income for the top 5 percent (−$84,000), a one percentage-point increase in the tax burden would increase the revenue loss by $86 per return, nearly two thirds again as much as the average reduction of $138. Despite the fact that, unlike the rest of the distribution, the average change in AGI was *positive* for the bottom 80 percent, the effect of higher tax burdens on this slice, like the effect for the top 5 percent, is to exacerbate the decline in total tax revenues. At the mean change in bottom-80 AGI of +$1100, a one percentage-point increase in the tax burden is associated with a $198 (per return) larger reduction in total tax revenues.

In contrast, states with higher tax burdens on the next 15 percent, all else equal, experienced a *smaller* hit to tax revenues. The second term in equation (4) implies that for states with reductions in next-15 AGI of $1625 per return or more (which was the case for all but three states), the net effect of a higher next-15 burden is positive; that is, to *reduce* the tax loss. At the mean change in next-15 AGI (-$5260), a one percentage-point increase in the next-15 burden

corresponds to a $222 (per return) smaller loss (or larger gain) of tax revenues. These results reflect the pattern across states of total tax revenue changes combined with AGI changes and tax burdens by income slice. It is possible that unobserved factors that are correlated with the burden on the next 15 percent produce more tax revenue in states with a higher burden on that income group.[18] In any case, the result suggests that differences across states in tax burdens by income level may have unpredictable effects on revenue volatility. The difference in burden effects across income slices will turn out to be crucial for explaining the simulation results in the next section.

IV. Using Predicted Tax Burdens to Simulate Revenue Changes

The goal in this section is to use the estimated coefficients from the tax burden and tax change regressions (Tables 3 and 5) to predict how the recession-induced change in tax revenues would have been affected under the counterfactual assumption of a more balanced (i.e., national average) mix of income and consumption taxes in each state. The analysis proceeds in two stages. First we use the predicted tax burdens from the tax share regressions in Table 3, given actual 2007 tax shares, together with the coefficient estimates from Table 5, to generate baseline simulations of the 2007-2009 change in tax revenue. We then simulate the burdens when we replace actual income- and consumption-tax shares (of their combined total) with the 2007 averages for all states. We use these simulated burdens with the coefficients from the tax change regression to simulate the state-by-state change in tax revenue under the hypothetical balanced

[18] One possible explanation for the counterintuitive effect of next-15 tax burdens is that estimates of tax changes are confounded by the cyclical behavior of state corporation income taxes. Though small as a share of total state tax revenues, the corporation income tax is extremely volatile. However, when we excluded the corporation income tax from our measure of the change in taxes, the results were unaffected.

system. While a nationally uniform, more balanced system of income and consumption taxes is of course unrealistic, and actual adjustments in tax shares are likely to be incremental, we believe there is considerable insight to be gained from an examination of this extreme case.

The first step is to generate predicted burdens given actual income- and consumption-tax shares, using the estimated coefficients from Table 3. The predicted burden for income slice *i* in state *s* ($\widehat{Burd}_{is}$) is given by

$$\widehat{Burd}_{is} =$$

$$\hat{a}_{0i} + \hat{a}_{1i}\left(SHR_{pit,s}\right) + \hat{a}_{2i}\left(SHR_{cons,s}\right) + \hat{a}_{3i}\left(SHR_{sev,s}\right) + \hat{a}_{4i}\left(\frac{Tottax}{Income}\right)_s + error_{i,s} \quad i = 1,3 \qquad (5)$$

where the $\hat{a}$ coefficients are taken from Table 3.

The next step is to generate predicted tax revenue changes given predicted burdens, using equation (3):

$$Predicted\ \ Revenue\ Change_{s|\widehat{Burd}} =$$

$$\hat{b}_{0i} + \sum_{i=1,3} \hat{b}_{1i}\,\widehat{Burd}_{is} + \sum_{i=1,3} \hat{b}_{2i}\,\Delta AGI_{is} + \sum_{i=1,3} \hat{b}_{3i}\left(\widehat{Burd}_{is} * \Delta AGI_{is}\right) \qquad (6)$$

where the $\hat{b}$ coefficients are taken from Table 5.

The third step is to predict the tax revenue change if each state's income- and consumption-tax shares of their combined share of total taxes were set at the national average. There are three parts to this calculation. First, we replace the income- and consumption-tax shares (of their combined share of total taxes) with the national averages. We multiply this by the state's own combined income and consumption tax share to get the simulated shares of total

taxes. Next, we calculate the predicted burdens using the $\hat{a}$s from Table 3 and these simulated tax shares, while keeping the state's own severance tax share and overall tax burden unchanged:

$$\widehat{Burd}_{(is|\overline{SHRs})} =$$

$$\hat{a}_{0i} + \hat{a}_{1i}\left(\overline{SHR}_{pit/(cons+pit)}\right) * SHR_{(cons+pit)s} + \hat{a}_{2i}\left(\overline{SHR}_{cons/(cons+pit)}\right) * SHR_{(cons+pit)s} +$$

$$\hat{a}_{3i}(SHR)_{sev,s} + \hat{a}_{4i}\left(\frac{Tottax}{Income}\right)_s + error_{i,s} \qquad i = 1,3 \tag{7}$$

We then calculate the predicted change in tax revenue using the predicted burdens from equation (7). The prediction equation is given by

$$Predicted\ Revenue\ Change_{s,(\widehat{Burd}|\overline{SHRs})} =$$

$$\hat{b}_{0i} + \sum_{i=1,3} \hat{b}_{1i}\, \widehat{Burd}_{i,s|\overline{SHRs}} + \sum_{i=1,3} \hat{b}_{2i}\, \Delta AGI_{i,s} + \sum_{i=1,3} \hat{b}_{3i}\left(\widehat{Burd}_{i,s|\overline{SHRs}} * \Delta AGI_{i,s}\right) \tag{8}$$

Since the overall burden is a weighted average of the burdens by income slice, it will change when any of these burdens change:

$$Simulated\ Overall\ Burd_s = \sum_{i=1,3}(AGI_{is}/AGI_s) * \widehat{Burd}_{(i.s|\overline{SHRs})} \tag{9}$$

The final exercise is to simulate the effect on tax changes under uniform personal income tax and consumption tax shares, while maintaining the initial tax burden. The objective here is to separate the tax incidence effect from the overall burden effect. To do this, we preserve the simulated *relative* burdens across income slices, while adjusting the burden on each slice proportionally:

$$\widehat{Burd}_{i,s|(\overline{SHRs},overall\ burd\ constant)} = \left[\widehat{Burd}_{is|\overline{SHRs})}\right] * \left(\frac{Actual\ overall\ burd}{Simulated\ overall\ burd}\right)_s \quad (10)$$

Finally, we calculate the predicted revenue change, using the predicted burdens from (10) and the estimates of $\hat{b}$ from Table 5:

$$Predicted\ Revenue\ Change_{s,[(\widehat{Burd}|(\overline{SHRs},overall\ burd\ constant)]} =$$

$$\hat{b}_{0i} + \sum_{i=1,3} \hat{b}_{1i}\, \widehat{Burd}_{i,s\,|(\overline{SHRs},overall\ burd\ constant)} + \sum_{i=1,3} \hat{b}_{2i}\, \Delta AGI_{i,s} +$$

$$\sum_{i=1,3} \hat{b}_{3i} \left(\widehat{Burd}_{(i,s\,|(\overline{SHRs},overall\ burd\ constant)} * \Delta AGI_{i,s}\right) \quad (11)$$

The tax change simulations from (11), with constant overall burdens, can then be compared to (8), where overall burdens are allowed to change

Tables 6 and 7 show the key results from our analysis. States are broken into two groups, based on the personal income tax share of combined income and consumption taxes. Other taxes, including severance, corporate, and inheritance taxes, are outside the scope of our analysis, hence taken as exogenous. In Table 6 we consider states whose income tax share is above the median. Table 7 includes states whose income tax share is below the median, excluding the two states with the highest severance tax share of revenue, for the reason discussed below. The simulation exercise assigns all states the national average income tax share of income plus consumption taxes. Hence, states in Table 6 would get a smaller share of tax revenues from the personal income tax, while states in Table 7 would get a larger share. According to the conventional wisdom, one would expect the states in Table 6 to see a decrease in volatility under

the simulation (i.e., a smaller revenue hit), while states in Table 7 would see an increase in volatility (i.e., a bigger hit).

The first row of Tables 6 and 7 shows the actual tax revenue change for the two groups of states. It is noteworthy that the average changes, a decrease of $246 per return for the high income-tax-share states and a decrease of $233 for the low income-tax states, are quite similar in sign and magnitude. The exclusion of the two highest severance-tax states, Wyoming and North Dakota, is key to the latter result.[19] Both states experienced substantial increases in tax revenue during the Great Recession, due mainly to large increases in severance tax revenues from expanded oil, gas, and coal production. As shown in Table 3, states tend to use severance tax revenues to reduce tax burdens, especially on the high income groups. Hence, in addition to the severance tax windfall, low tax burdens in Wyoming and North Dakota, plus the fact that AGI actually increased in North Dakota, tended to mute the effect of the recession on tax revenue. Nevertheless, whether these two states are included or not, the predicted revenue hit at national average shares is smaller than at the actual shares.

In Tables 6 and 7, row 3 summarizes predicted revenue changes using actual tax shares to predict burdens by income class. Predicted tax changes under the simulation models (rows 4 and 5) are compared with row 3. Substituting national averages for actual income-tax shares affects both the incidence of state tax systems and the overall tax burden. For high income-tax states, increasing the consumption tax share makes the tax system more regressive while lowering the overall burden. For low income-tax states, the opposite occurs when the national averages are

[19] Including these states would reduce the average actual revenue cut for the below-median income tax states to −$29 from −$233. In 2007 Wyoming got 40 percent of its tax revenue from severance taxes, and North Dakota got 22 percent. These two states, though small in terms of population and share of aggregate state tax revenues, also have low income tax shares.

substituted – less regressivity and a higher overall burden. Row 4 shows both effects combined, while row 5 takes account of the incidence effect alone, while keeping overall burdens constant. Row 4 of Table 6 shows that increasing the regressivity of high income-tax-share systems by increasing the consumption tax share, *and* allowing the state tax burden to decrease, would have resulted in a *greater* average hit to tax revenues than is predicted by the actual mix of taxes, with the simulated decrease going from −$218 to −$252. Row 5 shows that a more regressive tax system by itself would have led to a substantially larger tax hit to these states than if the overall burden were allowed to drop as well - −$319 instead of −$252. These results suggest that the effect on the average tax burden partially offsets the regressivity effect, as a lower average burden by itself reduces the tax hit, while a more regressive tax structure increases it.

Table 7 shows the opposite effect for the low income-tax states. Making them less regressive, while allowing their overall tax burden to increase, reduces the average predicted tax hit from the recession from −$228 to −$202. Keeping their smaller public sector size (i.e., holding the overall tax burden constant), but imposing a more progressive tax system, would further reduce the average tax hit from −$202 all the way down to −$161. As in Table 6, the effect on the overall burden partially offsets the progressivity effect, as a heavier overall tax burden increases the tax hit, while a less regressive tax structure reduces it.

These results are quite remarkable. They suggest that, contrary to the conventional wisdom, low income-tax states would have had better revenue performance during the Great Recession with a more balanced tax structure, while high income-tax states would have had worse performance had they had a more balanced tax structure. To explain these counterintuitive results, it is useful to look more specifically at states at the extremes, with the greatest and least reliance on the personal income tax. Table 8 compares simulated to predicted

revenue changes for the 5 states with the highest shares of the personal income tax in the combined total of income plus consumption taxes, while Table 9 looks at the 5 states with no personal income tax, other than Wyoming.[20] In these states, the simulation exercise of setting income and consumption tax shares to their national averages represents especially large changes in tax structure.

The results in Table 8, for the states with the five highest income-tax shares, are remarkably similar to those in Table 6. A lower income tax share would have resulted in a *larger* revenue hit from the recession. The fourth row of Table 8 indicates that reducing the income tax share to its national average would have lowered the income tax share from 70 to 40 percent of income plus consumption taxes. After adjusting to keep the overall burden constant, this change would have reduced the predicted top-5 burden from 8.2 to 6.9 percent, and the predicted next-15 burden from 9.5 to 8.9 percent. The predicted revenue hit would have been 63 percent greater than the predicted hit under the actual tax shares, −$419 instead of −$224. Equally high but much more regressive tax burdens would have increased the fiscal vulnerability of the high income tax states.

Why would high income tax states have been hit harder on average had they been less reliant on the income tax? Inspection of the individual states in this group shows that the results vary by state. In line with conventional wisdom about the greater volatility of income taxes, if the overall tax burden were held constant while the income-tax share is reduced to the national average, a reduced revenue hit would be predicted for Massachusetts. However, this reduction is

[20] The five states with the greatest reliance on the income tax relative to consumption taxes are Oregon, Delaware, Massachusetts, New York, and Virginia. The six states with no personal income tax are Florida, Nevada, South Dakota, Texas, Washington, and Wyoming. We exclude Wyoming from Table 9 because it got a huge windfall increase in revenue from severance taxes, which contribute 40 percent of its tax revenues.

outweighed by an *increased* hit for Delaware, New York, Virginia, and especially Oregon. If the overall tax burden were allowed to change along with the income-tax share, New York would join Massachusetts in having a reduced revenue hit. Thus, New York's result is also consistent with the conventional wisdom.

However, for Delaware, Oregon, and Virginia the reduction in top quintile tax burdens would have *increased* the hit to revenues. The reason is that in these three states the decline in AGI for the top 5 percent was relatively small, muting the reduction in the revenue hit that results from the (simulated) reduction in the top-5 tax burden. In Oregon, moreover, the recession led to a particularly large decline in AGI for the next 15 percent of the income distribution, fully 65 percent greater than the national average. Recalling from Table 5 that a higher tax burden on the next 15 percent was associated with a smaller rather than a larger revenue hit, the large decline in AGI magnified the negative effect of the simulated decrease in the next-15 burden, leading to an increase in Oregon's revenue hit. The Oregon result strikingly illustrates that revenue volatility reflects a complicated interaction between tax structure and the size and distribution of recession-induced changes in the tax base.[21]

Table 9 shows the results for states without an income tax, other than Wyoming. Compared with the high income-tax share states in Table 8, these states have average tax burdens

[21] New Jersey is another state with a relatively progressive tax structure, high concentration of income in the top 5 percent, and high overall tax burden. A shift to a smaller income tax share would therefore have lowered volatility. A rough calculation is that if New Jersey were to substitute neighboring Pennsylvania's flat income tax for its progressive income tax, but maintain the same overall income tax burden, the hit to New Jersey's income tax revenue would have been about 40 percent lower. Overall, such a substitution would have reduced the recession-induced total tax hit by about 30 percent. The cost of this policy is a dramatic increase in regressivity, with the top 5 percent realizing a permanent reduction in effective tax rates of more than two percentage points and the bottom 80 percent seeing a rate increase of two percentage points.

that are considerably lower, and much more regressive tax structures.[22] Imposing average income and consumption tax shares in the states without an income tax would have raised the overall tax burden from 6.1 percent to 7.5 percent. The fifth row of Table 9 shows the predicted revenue change when we impose the national average income and consumption tax shares, but adjust all tax burdens proportionally to keep the overall tax burden constant. The predicted revenue change would rise from −$43 to +$24. This result suggests that a more balanced tax structure would have enabled states with no income tax to better weather the Great Recession.

The last three columns in the first row of Table 9 highlight the extremely regressive tax structure in these states. Tax burdens on the bottom 80 percent (8.7 percent) were more than 2½ times as high as on the top 5 percent (3.4 percent). Nonetheless, during the Great Recession these five states mirrored the national trend, realizing an actual revenue decrease of −$261. However, their predicted revenue decrease of −$43 using actual tax shares (row 3) is much smaller than that for the 5 highest income tax states (−$224, according to Table 8). This would seem to support the proposition that less reliance on the income tax is likely to reduce fiscal vulnerability during recessions.

However, the fifth row of Table 9 suggests that in fact, no-income tax states paid a fiscal penalty for the imbalance in their tax structures. If we alter the tax structure in those states to make income and consumption tax shares equal to the national average, while keeping the overall tax burden unchanged, the predicted revenue change would switch from a decrease to an *increase*, going from −$43 to +$24. In contrast, the fourth row indicates that imposing the national average tax shares, while also allowing the increase in overall tax burdens that would

[22] The average tax burden in the no income tax states is a full 2.3 percentage points lower than in the high income tax states.

result from this change in tax structure, would have increased the predicted reduction in tax revenues by −$31 per return, from −$43 to −$74, as compared with the prediction based on actual tax shares (row 3). Comparing rows 4 and 5, the effect of allowing overall burdens to rise as we substitute income for consumption taxes is to reverse the predicted revenue increase, from +$24 to −$74. Thus for the no-income tax states, a more balanced tax structure, and the higher overall burdens that typically accompany such a tax structure, would have increased fiscal vulnerability during the recession.

These results suggest that it is the higher overall burden that tends to go along with state income taxation, rather than the division of taxes between income and consumption, that primarily affects revenue resilience. Moreover, recall that Table 8 shows that the lower overall burden makes revenue less volatile when we reduce the income tax share. Allowing the overall burden to drop, the extra hit to revenue is smaller than when we keep the overall burden constant. This too suggests that it is the lower overall burden that goes with reliance on consumption taxes, rather than the shift in the tax burden from the top to the rest of the income distribution, that reduces volatility.

Looking at the individual states in Table 9, again we see considerable variation in the direction of effects. In Florida, imposing the average income tax share while allowing the overall burden to increase would have *reduced* the revenue hit by $30, while in South Dakota, the predicted revenue change would have gone from a decrease of −$65 to an *increase* of +$96. In Nevada and Washington, where actual tax revenue declined, and Texas, where it increased, the predicted tax loss would have been greater (or the predicted increase smaller), by an average of $116. As is the case for the high income tax states, the combinations of differing changes in predicted burdens with differing changes in AGI by income slice account for these differences.

V. Conclusion

State tax revenues took a major hit during the Great Recession, which began in December 2007. Though the recession was officially over by 2009, seven years later real tax revenues are still below 2007 levels in many states. This paper investigates the role of state tax structure in determining the magnitude of the revenue shock, in particular whether there is a systematic relationship between the degree of reliance on the income tax and the decline in state revenues during the Great Recession.

The two major sources of state tax revenue, generating 79 percent of all tax revenue in 2007, are personal income taxes (PIT) and taxes on consumption: general sales and excise taxes. On average, about a third of state tax revenue comes from the PIT, while a little less than half comes from consumption taxes. However, states vary widely in their relative reliance on each of these taxes. Eight of the 48 contiguous states have zero or very low personal income taxes, while 5 states generate more than half of their tax revenue from this tax.

The Great Recession was notable both for its overall severity and for its differential impact across states and income groups. One important aspect was the very large shock to the highest income group, reflecting a dramatic decline in income from capital. Given large differences across states not only in average income but also in the degree of concentration of income, the distribution of losses to the top 5 percent was very unequal, ranging from $237,000 per return in Connecticut to less than $30,000 in Arkansas and West Virginia.

A second Great Recession shock was associated with the bursting of the housing bubble. Declines in housing values were particularly large in Arizona, California, Florida, and Nevada,

all of which experienced large drops in tax revenue. While financial sector losses were concentrated in the top 5 percent, the decline in housing values affected the entire income distribution. States that had exhibited longer-term economic weakness related to secular decline in manufacturing were also at risk for large declines in incomes below the top 5 percent. On the other hand, a few states benefited from sharp increases in oil and gas extraction activities, and saw AGI go up for those below the top 5 percent.

To link the differential distributional effects of the recession and state tax structures, we first estimated regressions of the tax burdens for three slices of the income distribution, as a function of the shares of tax revenue from income, consumption, and severance taxes, and the overall tax burden in the state. This analysis showed that a higher income-tax share is associated with higher tax burdens throughout the income distribution, while a higher consumption-tax share has no significant effect on the top-5 burden, but is associated with higher burdens for the rest of the distribution.

Next we estimated the relationship between the revenue hit experienced by each state and the tax burdens and changes in the AGI base by income slice. We expected that differential shocks by income level (as measured by the change in federal AGI per return for the top 5, next 15, and bottom 80 percent of the income distribution) would be translated into tax revenue shocks in proportion to the average tax burdens imposed on each income slice at the onset of the recession. We found that the relationship is more complicated than this. The key factor in determining revenue impact is the interaction between the change in the tax base and the tax rate. As expected, for the top 5 percent and the bottom 80 percent, the higher the tax burden, the greater the hit to tax revenues for a given reduction in AGI. However, for the 80^{th} to 95^{th} percentiles the effect of an increase in the tax burden went in the opposite direction. For most

states, a higher tax rate for this slice was associated with a *smaller* revenue hit or a larger increase.

These offsetting effects of changing tax burdens translate into ambiguous effects of income and consumption tax shares on revenue stability. We simulated the effect on tax revenues of setting each state's relative income and consumption tax shares equal to the national average, while preserving the differential share of other types of state taxes. This simulation affects both the income class incidence of state taxes and the overall tax burden. For states with the highest income tax shares of combined income and consumption taxes (Oregon, Delaware, Massachusetts, New York, and Virginia), predicted tax burdens for the top 5 percent are lowered by 1.6 percentage points, and by 1 percentage point for the next 15 percent.[23] In Oregon, Delaware, New York, and Virginia, a more balanced tax structure with constant overall burdens, rather than reducing revenue volatility, would have *increased* the predicted revenue hit by $271 per return on average, a very large percentage increase. In Massachusetts, however, it would have reduced the predicted revenue hit from the Great Recession by 28 percent. If the overall burden were allowed to fall, New York would also have had a smaller than predicted revenue loss. The difference in the predicted effect for states with similarly extreme tax structures reflects the very different distributional impacts of the Great Recession. States whose predicted revenue hit would have decreased if their income tax share were reduced are states with high burdens and very large decreases in AGI at the top. States whose predicted revenue hit would have increased are states that were relatively insulated from the financial shock of the recession to high income taxpayers, but were hard hit by the income losses lower down the distribution.

[23] This is if the overall average burden is allowed to drop. The burdens on the top 5 and next 15 percent would be lowered by 1.3 and 0.6 points, respectively, if the overall burden were kept constant.

Similarly counterintuitive simulation results are obtained for states with no income tax. On average, moving to a more balanced tax structure, but with overall burdens constant, would have helped these states to realize increases in revenue instead of losses. Imposing a more balanced structure while allowing overall burdens to increase would, however, have reduced revenue performance during the Great Recession. These results, as well as our results for high income tax states, suggest that it was the heavier overall tax burden associated with higher income-tax shares, not the relatively progressive tax structure, that had an adverse effect on tax revenue during the Great Recession.

Our results imply that the extreme volatility of state taxes in the Great Recession was *not* the result of heavy reliance on one form of taxation or another. States that shift their tax mix away from income taxes and towards consumption taxes would be choosing a more regressive tax structure and less revenue for the public sector. The increasing concentration of income means that states which rely more heavily on consumption taxes will forego increasing amounts of revenue over time. Offsetting benefits in terms of revenue stability are highly uncertain. Given the variation across states in the distributional impact of national recessions, and the inherent uncertainty about the impact of future recessions, shifting to a consumption-based tax structure from one based on income lowers available public sector revenues, but does little to insulate states from the risks of cyclical revenue variability.

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Figure 1

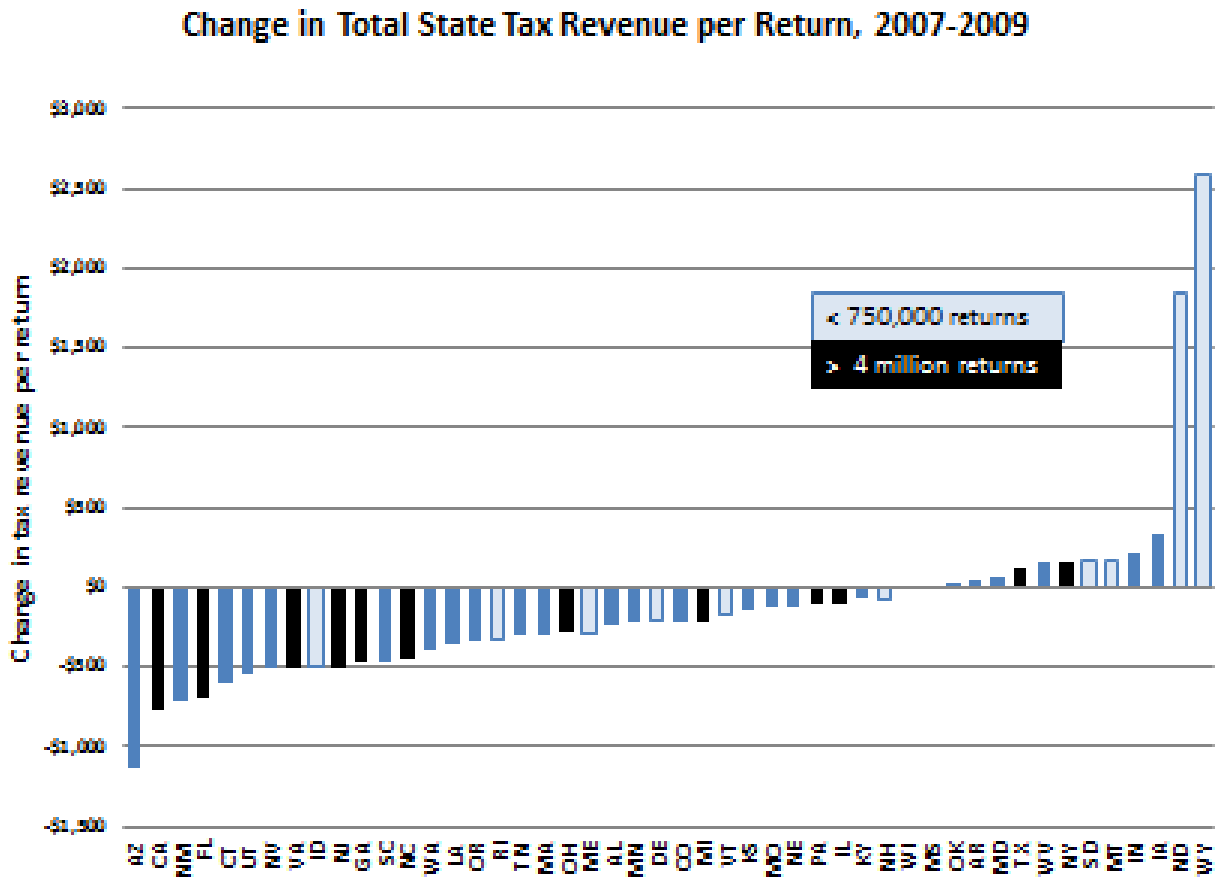
Change in Total State Tax Revenue per Return, 2007-2009
Change in tax revenue per return
$3,000
$2,500
$2,000
$1,500
$1,000
$500
$0
-$500
-$1,000
-$1,500
< 750,000 returns
> 4 million returns
AZ CA NM FL CO NV VA ID NJ GA SC MI WA UT OR RI TN MA OH ME AL MN DE IL MD VT KS MO NE PA HI KY NH WI MS OK AR ND TX WV NY SD MT IN IA ND WY

Figure 2

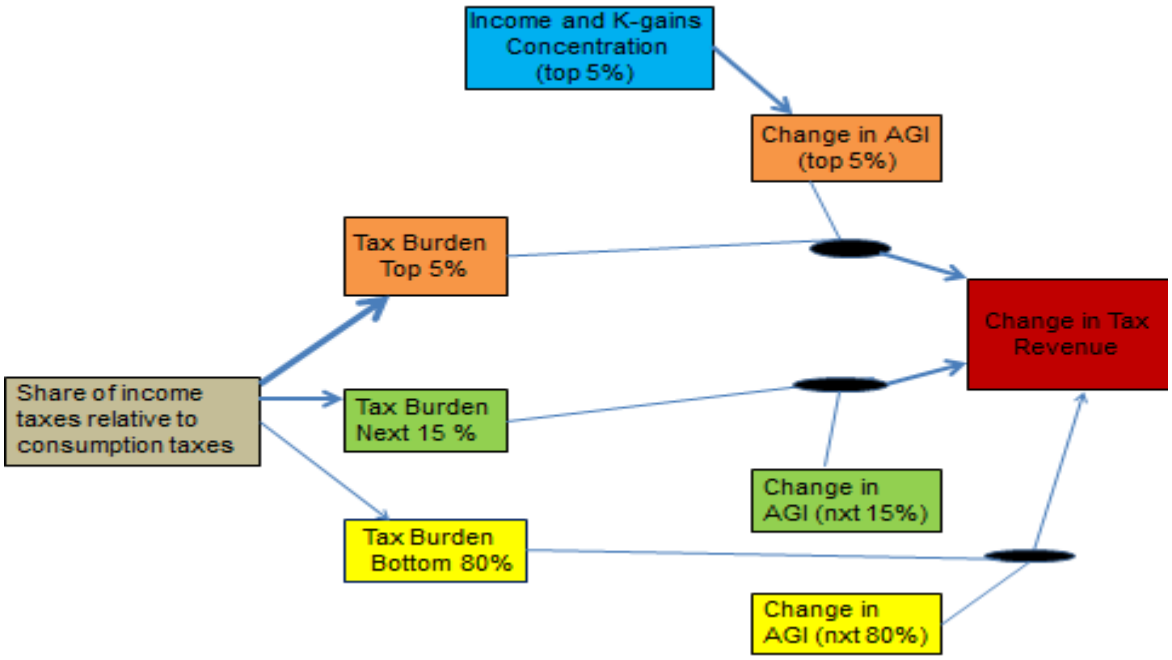
Income and K-gains Concentration (top 5%)
Change in AGI (top 5%)
Tax Burden Top 5%
Change in Tax Revenue
Share of income taxes relative to consumption taxes
Tax Burden Next 15 %
Change in AGI (nxt 15%)
Tax Burden Bottom 80%
Change in AGI (nxt 80%)

Figure 3

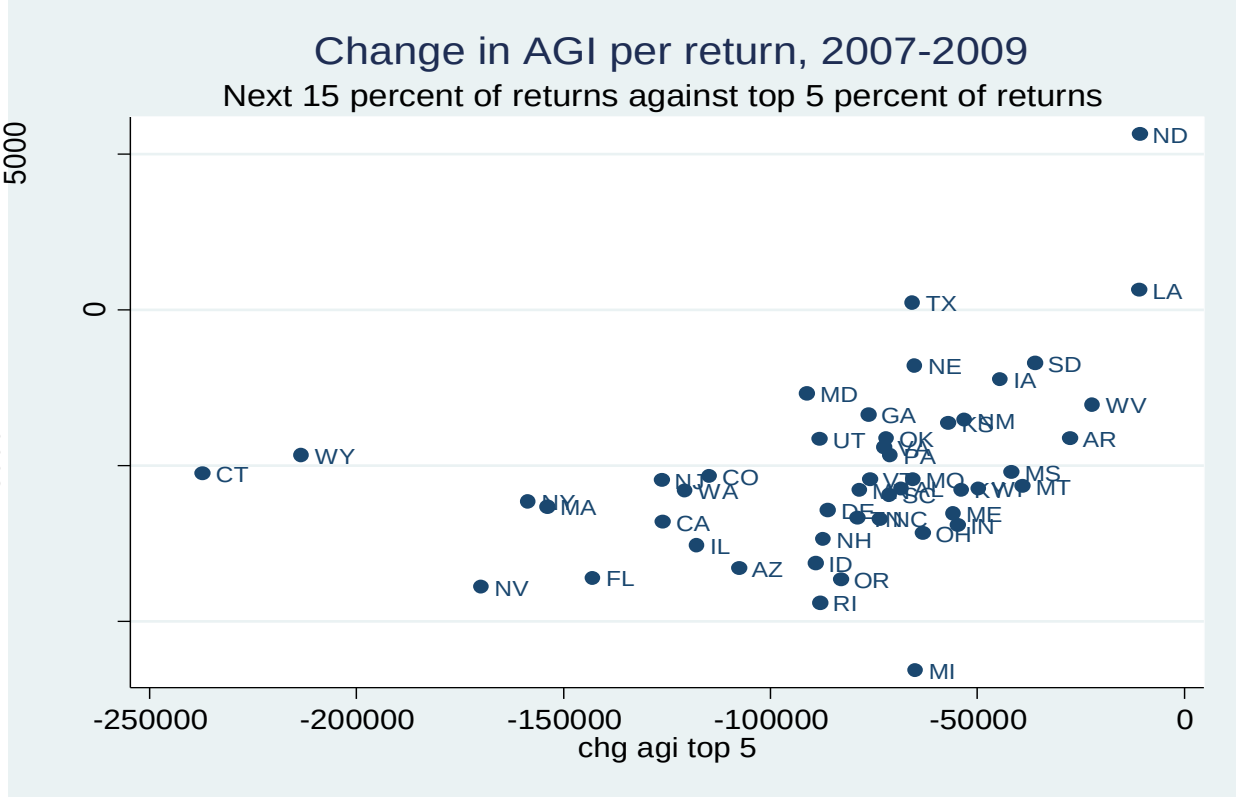
Change in AGI per return, 2007-2009
Next 15 percent of returns against top 5 percent of returns
5000
0
-250000
-200000
-150000
-100000
-50000
0
chg agi top 5
ND
LA
TX
NE
SD
IA
MD
WV
GA
KS
NM
UT
AR
WY
CT
NJ
CO
WA
MS
MT
MA
CA
ME
IL
NH
OH
AZ
ID
NV
FL
OR
RI
MI

Table 1
Descriptive Statistics

Variable	Mean	Std Dev	Min	Max
Change in total state tax revenue 2007–2009, per 2007 return[1,2]	−138	582	−1,128	2,596
Total state tax burden on top 5%, 2007[3]	0.066	0.019	0.023	0.101
Total state tax burden on next 15%, 2007[3]	0.085	0.016	0.045	0.127
Total state tax burden on bottom 80%. 2007[3]	0.093	0.014	0.06	0.116
Personal income tax share of total tax revenue, 2007	0.322	0.173	0	0.723
Consumption taxes share of total tax revenue, 2007	0.467	0.156	0.101	0.813
Selective sales (excise) taxes share of total tax revenue, 2007	0.164	0.056	0.063	0.337
General sales tax share of total tax revenue, 2007	0.303	0.144	0	0.610
Severance tax share of total tax revenue, 2007	0.029	0.071	0	0.397
Average state tax burden. 2007[3]	0.082	0.015	0.042	0.112
Change in AGI per return in top 5% of returns. 2007-2009[2]	−83,774	46,787	−237,197	−10,729
Change in AGI per return in next 15% of returns. 2007-2009[2]	−5,257	2,857	−11,571	5,633
Change in AGI per return in bottom 80% of returns. 2007-2009[2]	1,108	787	−821	2,938

Source notes:

[1]U.S. Census Bureau, 2007 & 2009.

[2]Internal Revenue Service, various years; and authors' calculations.

[3]Institute for Taxation and Economic Policy, 2009.

Table 2
Regression Models for Change in Total Tax Revenue per Return
as a Function of Shares of Tax Revenue in 2007

Dependent Variable: Change in State Tax Revenue, 2007-2009, per 2007 Return
[t-statistics in brackets]
*p<.10, **p<.05,***p<.01

Variable	**Model (1)**	**Model (2)**	**Model (3)**	**Model (4)**
Personal income tax share of tax revenue	-919.9 *		-2460.5 ***	-436.0
	[-1.93]		[-3.82]	[-0.73]
Sales+excise taxes share of tax revenue		-297.5	-2317.0 ***	-490.2
		[-0.54]	[-3.24]	[-0.79]
Severance tax share of tax revenue				5738.4 ***
				[5.89]
Constant	158.8	1.499	1737.7 ***	66.95
	[0.91]	[0.01]	[3.39]	[0.14]
No. of observations	48	48	48	48
Adjusted R-squared	0.055	-0.015	0.216	0.552

Table 3
Regression Models for Tax Burdens by Segment of the AGI Distribution
as a Function of Shares of Tax Revenue in 2007
[t-statistics in brackets]
*p<.10, **p<.05, ***p<.01

Variable	(1) Burden, top 5%	(2) Burden, next 15%	(3) Burden, bottom 80%
Personal income tax share of tax revenue	0.0895 ***	0.0837 ***	0.0683 ***
	[6.30]	[5.61]	[4.34]
Sales+excise taxes share of tax revenue	0.0227	0.0428 ***	0.0732 ***
	[1.50]	[2.69]	[4.37]
Severance tax share of tax revenue	-0.0562 **	-0.0501 **	-0.0296
	[-2.38]	[-2.02]	[-1.13]
Total tax revenue/personal income	0.6159 ***	0.4678 ***	0.3182 **
	[5.54]	[4.01]	[2.59]
Constant	-0.0136	0.0075	0.0162
	[-0.93]	[0.49]	[1.00]
No. of observations	48	48	48
Adjusted R-squared	0.762	0.645	0.434

Table 4
Predicted Net Effect of Change in Income-Tax Share of Revenue on Change in Burdens, Taking Account of Change in Consumption Tax Share

$$\Delta(\text{burd}_{\text{top5}}) = .067 * \text{taxshr}_{\text{pit+cons}} * \Delta(\text{adj taxshr}_{\text{pit}})$$

$$\Delta(\text{burd}_{\text{nxt15}}) = .041 * \text{taxshr}_{\text{pit+cons}} * \Delta(\text{adj taxshr}_{\text{pit}})$$

$$\Delta(\text{burd}_{\text{nxt80}}) = -.005 * \text{taxshr}_{\text{pit+cons}} * \Delta(\text{adj taxshr}_{\text{pit}})$$

where $\text{adj taxshr}_{\text{pit}} = \text{PIT}/(\text{PIT} + \text{cons tax})$

Table 5
Regression Model for Change in Total Tax Revenue per Return
as a Function of Changes in AGI & Tax Burdens by Income Segment

Dependent Variable: Change in State Tax Revenue, 2007-2009, per 2007 Return
[t-statistics in brackets]
*p<.10, **p<.05, ***p<.01

Variable	Coeff	Variable	Coeff
Change in AGI per return, top 5%	-0.020 *** [-5.10]	Tax burden on bottom 80%	-16339 [-1.38]
Change in AGI per return, next 15%	0.575 *** [3.34]	Change in AGI * Burden, top 5%	0.296 *** [5.00]
Change in AGI per return, bottom 80%	0.403 [0.43]	Change in AGI * Burden, next 15%	-6.116 *** [-3.11]
Tax burden on top 5%	16277 [1.41]	Change in AGI * Burden, bottom 80%	-3.114 [-0.34]
Tax burden on next 15%	-9935 [-0.50]	Constant	1181 [0.69]
No. of observations	48		
Adjusted R-squared	0.583		

Table 6
Simulated Tax Revenue Change 2007-2009 & Means of Other Variables, Under Alternative Scenarios
States with Above-Median PIT Shares of Combined PIT+Consumption Taxes (N=24)

Type of Tax Change	Average	Standard Deviation	Largest Decrease	Largest Increase	Average Tax Burden	Personal Income Tax Share of Total Taxes	Consumption Tax Share of Total Taxes	Personal Income Tax Share of PIT+ Cons Taxes	Tax Burden, Top 5% of Returns	Tax Burden, Next 15% of Returns	Tax Burden, Next 80% of Returns
Actual	-246	276	-780	335	0.088	0.450	0.375	0.549	0.077	0.092	0.094
Predicted w/ actual burdens	-220	198	-629	250	0.088	0.450	0.375	0.549	0.077	0.092	0.094
Predicted w/ predicted burdens, actual PIT & cons tax shares	-218	164	-771	36	0.088	0.450	0.375	0.549	0.076	0.092	0.096
Predicted w/ predicted burdens, nat'l average PIT shares of PIT+cons, allowing average burden to change	-252	129	-558	12	0.084	0.329	0.496	0.399	0.068	0.087	0.096
Predicted w/ adjusted pred burdens, nat'l average PIT shares of PIT+cons, constant average tax burden	-319	191	-866	-67	0.088	0.329	0.496	0.399	0.071	0.091	0.100

Table 7
Simulated Tax Revenue Change 2007-2009 & Means of Other Variables, Under Alternative Scenarios
States with Below-Median PIT Shares of Combined PIT+Consumption Taxes, Excluding ND & WY (N=22)

Type of Tax Change	Average	Standard Deviation	Largest Decrease	Largest Increase	Average Tax Burden	Personal Income Tax Share of Total Taxes	Consumption Tax Share of Total Taxes	Personal Income Tax Share of PIT+ Cons Taxes	Tax Burden, Top 5% of Returns	Tax Burden, Next 15% of Returns	Tax Burden, Next 80% of Returns
Actual	-233	330	-1128	217	0.078	0.204	0.571	0.260	0.057	0.080	0.094
Predicted w/ actual burdens	-217	332	-836	608	0.078	0.204	0.571	0.260	0.057	0.080	0.094
Predicted w/ predicted burdens, actual PIT & cons tax shares	-228	333	-887	753	0.078	0.204	0.571	0.260	0.058	0.080	0.093
Predicted w/ predicted burdens, nat'l average PIT shares of PIT+cons, allowing average burden to change	-202	298	-811	575	0.081	0.309	0.466	0.399	0.065	0.084	0.092
Predicted w/ adjusted pred burdens, nat'l average PIT shares of PIT+cons, constant average tax burden	-161	325	-589	724	0.078	0.309	0.466	0.399	0.063	0.081	0.089

Table 8
Simulated Tax Revenue Change 2007-2009 & Means of Other Variables, Under Alternative Scenarios
5 States with Largest Personal Income Tax Shares of Combined Personal Income + Consumption Taxes (OR,DE,MA,NY,VA)

Type of Tax Change	Average	Standard Deviation	Largest Decrease	Largest Increase	Average Tax Burden	Personal Income Tax Share of Total Taxes	Consumption Tax Share of Total Taxes	Personal Income Tax Share of PIT+ Cons Taxes	Tax Burden, Top 5% of Returns	Tax Burden, Next 15% of Returns	Tax Burden, Next 80% of Returns
Actual	-237	248	-513	161	0.084	0.544	0.237	0.698	0.075	0.092	0.090
Predicted w/ actual burdens	-251	202	-543	-9	0.084	0.544	0.237	0.698	0.075	0.092	0.090
Predicted w/ predicted burdens, actual PIT & cons tax shares	-224	179	-433	-51	0.084	0.544	0.237	0.698	0.082	0.095	0.092
Predicted w/ predicted burdens, nat'l average PIT shares of PIT+cons, allowing average burden to change	-302	151	-558	-158	0.081	0.312	0.469	0.399	0.066	0.085	0.093
Predicted w/ adjusted pred burdens, nat'l average PIT shares of PIT+cons, constant average tax burden	-419	283	-866	-127	0.084	0.312	0.469	0.399	0.069	0.089	0.097

Table 9
Simulated Tax Revenue Change 2007-2009 & Means of Other Variables, Under Alternative Scenarios
States with No Personal Income Tax, Excluding WY (FL,NV,SD,TX,WA)

Type of Tax Change	Average	Standard Deviation	Largest Decrease	Largest Increase	Average Tax Burden	Personal Income Tax Share of Total Taxes	Consumption Tax Share of Total Taxes	Personal Income Tax Share of PIT+ Cons Taxes	Tax Burden, Top 5% of Returns	Tax Burden, Next 15% of Returns	Tax Burden, Next 80% of Returns
Actual	-261	388	-697	163	0.061	0	0.796	0	0.034	0.064	0.087
Predicted w/ actual burdens	6	386	-362	608	0.061	0	0.796	0	0.034	0.064	0.087
Predicted w/ predicted burdens, actual PIT & cons tax shares	-43	465	-423	753	0.061	0	0.796	0	0.037	0.066	0.091
Predicted w/ predicted burdens, nat'l average PIT shares of PIT+cons, allowing average burden to change	-74	418	-429	575	0.075	0.318	0.478	0.399	0.059	0.079	0.090
Predicted w/ adjusted pred burdens, nat'l average PIT shares of PIT+cons, constant average tax burden	24	528	-445	724	0.061	0.318	0.478	0.399	0.047	0.064	0.073