Do Governments Grow When They Become More Efficient? Evidence from Tax Withholding

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Abstract

The paper examines the claim that more efficient taxes lead to bigger government by studying the effects of income tax withholding, a particular technological shock to tax efficiency. I exploit the variation in the timing of the adoption of withholding by state governments in the USA during the 1940's through 1970's. Due to better compliance and other factors, withholding immediately and permanently increased income tax collections by 22 percent at given tax rates. The governments kept this windfall of revenue for themselves as the tax rates did not significantly change in either direction. I also find that states sharply increased revenues from other taxes as they implemented withholding, which indicates that a need to raise more revenue was an important motive for the adoption of withholding. The post-withholding increases in income tax revenues are better explained by demand for bigger government rather than by a causal relationship from more efficient taxes to bigger government. However, withholding had a significant impact on the composition of tax revenues, as states started to rely more heavily on income taxes. Contrary to claims that withholding was *the* thing that enabled the post-war explosion of income taxation, I find that it did not accelerate the growth of state income taxes, and accounts for at most 15 percent of the growth of income taxes during the period in question.

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1 Introduction

Explaining the growth of government during the 20th century has been one of the vexing questions in economics.[1] One explanation, suggested for example by Kau and Rubin (1981) or Becker and Mulligan (1998), is that governments have become more efficient in raising taxes - in parlance of economic theory, that the deadweight costs of taxes have been declining. Indeed, a large class of (otherwise competing) positive models of the size of government is unanimous in the prediction that reducing the deadweight costs of taxes increases the size of government. These include Becker and Mulligan's (1998) model of interest groups, Meltzer and Richard's (1981) median voter model of pure redistribution, Hettich and Winer's (1988) model of determination of tax structure under probabilistic voting, or Brennan and Buchanan's (1980) model of Leviathan government.

In this paper I present a direct test of a causal link between tax efficiency and the size of government. I study the impact of one particular "technological shock" that increased the efficiency of taxes: the introduction of income tax withholding at the state level in the United States. As opposed to the original method of collecting income taxes (taxpayers "voluntarily" filing the tax returns at the end of the fiscal year), withholding makes tax evasion more difficult by deducting the tax immediately from workers' paychecks and collecting it from employers. Therefore it effectively broadens the tax base and enables to raise more revenue at given tax rates, or alternatively, the same amount of revenue at lower tax rates. In conventional models of optimal taxation, income taxes with relatively broader tax base and lower marginal tax rates are regarded as more efficient.[2] The impact of withholding on tax efficiency is large, immediate, and discontinuous, which makes it a particularly attractive source of identification.

Income tax withholding was first adopted at the federal level in 1943 with the goal to raise more revenue to finance the war expenditures. Later, it has been blamed for enabling the post-war expansion of federal government. As Milton Friedman, who at that time worked for the U.S. Treasury and helped to put the federal withholding in place, stated in his memoirs:

> *"Far more important, without the system of current tax collection, it would have been impossible to collect the amount of income taxes that we collected during the war. At the time, we concentrated single-mindedly on promoting the war effort. We gave next to no consideration to any longer-run consequences. It never occurred to me at the time that I was helping to develop machinery that would make possible a government that I would come to criticize severely as too large, too intrusive, too destructive of freedom."* [3]

While the expansion of the federal income tax after 1943 is indisputable, it is difficult to infer whether it was due to withholding or some other factors. The adoption of withholding at the state level, however, provides a unique set-up for identifying the effect of changes in

[1] For recent surveys, see Mueller (1989) or Holsey and Borcherding (1997).

[2] The reasons why withholding improves tax efficiency are discussed in detail in Section 3.

[3] *Friedman and Friedman, p. 123.*

tax efficiency on the size of government. Withholding was adopted state-by-state, and the variation in the timing of adoption is substantial. It spreads from 1948 (Oregon) to 1987 (North Dakota).[4] This allows to exploit the difference-in-differences estimator in a panel of state-level data. The dataset itself is unique, because most of the statistical information on state government finances for the period in question still exists only in printed form. Having typed the variables of interest into electronic form, this paper is the first (to my best knowledge) to use an annual panel of states for 1940's through 1970's with information on the composition of taxes and expenditures.

How does my approach relate to previous literature? The claim that more efficient governments are bigger has so far been subject to only few tests, all relying either on a single time series or cross-country regressions. Kau and Rubin (1981) argue that the costs of collecting taxes have declined because changes in the structure of the economy made tax collection easier. They find that factors such as the growth in female labor participation and decline in self employment explain virtually all the growth of government during 1929-70. Yet while the connection between female labor participation and size of government may be indisputable, it is arguable whether such a connection is due to lower costs of tax collection, or due to a higher demand for government induced by higher female labor participation. (For example, as more women commute to work, the demand for roads increases.) Summers, Gruber and Vergara (1995) show that labor taxes are less distortionary when labor supply decisions are made collectively by labor unions (a phenomenon they dub "corporatism"). In their empirical analysis of 17 developed countries, they find that countries with a larger degree of corporatism do indeed have higher labor taxes as a share of GDP, though they do not tax more heavily other sources of income. Becker and Mulligan (1998) find support for their interest group model by regressing the size of government on various measures of tax efficiency[5] in a cross section of countries. For most measures they find a positive correlation between tax efficiency and the size of government.

These studies contrast with the view that the growth of government has been "demand-driven".[6] In this view, the size of government is determined primarily by the demand for public goods or redistribution. Big government still can be more efficient, but the direction of causality is reversed: Bigger governments are more likely to adopt a more efficient tax system since the benefits of doing so are increasing in the amount of revenue that needs to be raised. The difference between the "efficiency" and "demand" explanations of government growth is not as much about the underlying theory of government but rather about the relative importance of efficiency versus demand factors. I contribute to this discussion by providing a simple empirical framework which allows to disentange whether changes in revenues following

[4] Table 1 chronologically lists the year in which each state adopted withholding, together with the year in which that state first imposed the income tax.

[5] For example, the share of government revenue raised from relatively more efficient taxes, or the ratio of average to marginal income tax rate.

[6] For example, Wallis (1999) argues that "A national income tax was possible at any time after 1913, but the income tax did not become an important source of national government revenue until the early 1940's. ... Even the Great Depression did not stimulate the income tax, although FDR argued for several "soak the rich" increases. ... Since income taxes did not become a broad-based tax until the World War II, it is difficult to argue the national government's ability to raise income tax revenues was the cause of the New Deal changes in social welfare policy in the 1930s."

an efficiency shock are due to demand or efficiency factors.

I derive and estimate an empirical model of technology of tax collections and demand for tax revenues. In the model, withholding affects income tax revenues through a mechanical improvement in collections, and also through its effect on the choice of tax rates. First, I show that withholding indeed made income taxes more efficient by immediately and permanently increasing the collections by 22.4 percent, holding the tax rates constant. This estimate is very robust to alternative specifications and always statistically significant. How did the states respond to this windfall? Did they return the extra revenue (in whole or in part) back to taxpayers by cutting the tax rates? Or did they increase the tax rates in order to get even more revenue from the tax that suddenly became much more efficient? I find that the states did neither - they simply kept the extra revenue. Some estimates indicate a slight increase in the tax rates occurring three years after the adoption, but this effect is insignificant. Withholding produced a once-and-for-all change in levels, but not growth rates, of income tax revenues. After accounting for other factors, income tax revenues grew at the same rate after withholding as they had before. Contrary to Milton Friedman's claim, I find that withholding cannot be blamed for enabling the post-war expansion of income taxes (provided that qualitatively same results apply to the federal income tax).

Can we interpret the permanent increase in income tax revenues as a causal link from tax efficiency to bigger government? It depends crucially upon the assumptions about the exogeneity of adoption of withholding. Withholding was not an exogenous shock, randomly superimposed upon the states. States adopted it voluntarily and for a reason, and one obvious reason for adopting a new technology that generates more tax revenue is a need to raise more revenue. If a state experiences an unobservable positive shock to the demand for expenditure and adopts withholding in order to meet that demand, the estimate of a positive effect of withholding on tax revenues would reflect the demand shock rather than a genuine response to the the change in efficiency. To address this issue, I distinguish two alternative motives for adoption: a "demand-driven" adoption (motivated by the desire to raise more revenue) and a "supply-driven" adoption (motivated by a desire to raise a given amount of revenue more efficiently). Then I derive, for each adoption motive, the observable changes in income taxes and other taxes that are predicted by models claiming a causal link from efficiency to bigger government, and contrast them to observable changes that are predicted by a "default" model in which tax revenues are determined solely by demand factors and do not respond to changes in efficiency. Each theory-motive combination leads to distinct predictions that can be discriminated in the data. Namely, other taxes should fall or remain unchanged when the adoption is supply-driven, while they should rise when adoption is demand-driven.

When I analyze the response of other taxes to withholding, I find that revenues from them increased discontinuously by 3.8 percent when withholding was adopted, and continued to grow afterwards, while they exhibited no upward trend during the years preceding the adoption. The observed results are best explained by the combination of demand-driven adoption and demand-determined size of government, and do not provide a convincing evidence that the post-withholding increase in income taxes represents a response to the efficiency shock. However, I find that withholding substantially increased the share of income tax it total tax revenues - governments started relying more heavily on the tax that become more efficient. My findings therefore do not disqualify the models of public sector that use deadweight costs of taxes as one of the determinants of the size and scope of government. Rather, my findings show that the effect of efficiency shock on the composition of taxes was far more pronounced than the effect on the levels of taxes. On the levels, the demand factors appear to be the major force driving the data.

Because the motives behind adoption are so important for interpretation of the results, I analyze them directly using standard techniques of duration analysis. The main result is that the only significant variable affecting the timing of adoption are income tax revenues themselves. A 10-percent increase in income tax revenue per capita increases the conditional probability of adopting withholding by 0.09 percent. This result would rather support the "supply" motive for withholding, because the efficiency gain from withholding is increasing, in absolute terms, in the amount of revenue collected and therefore states with large income taxes should adopt earlier. However, I find that the states adopting early actually experienced the highest increases not only in income taxes, but in other taxes as well, therefore the demand motives were strongly present also in these states.

I also explore what the governments did with the windfall of money generated by withholding. A surprising result is that federal grants were declining (after controlling for their observable determinants) in the years preceding the adoption of withholding and continued to decline afterwards. Hence some of the extra revenue from withholding was used to compensate for the decline in this important source of revenue, and the need to make up for the shortfall could have been an important demand shock motivating the adoption. Another was the need to pay off the debt - I find that the ratio of state debt to general revenues was rising sharply from 33 to 53 percent in the years preceding the adoption, but stopped growing immediately afterwards. For expenditures, the results are sensitive to specification and do not convincingly unveil particular categories of expenditures on which the windfall from withholding was spent. Finally, I asses the contribution of withholding to the overall growth of state governments. The increases in income tax revenues associated with the implementation of withholding increased total tax revenues by 5.3 percent and accounted for at most 15 percent of the growth of income tax revenues during the sample period. In terms of empirical relevance, growth in demand for expenditures seems to be a far more important reason behind the growth of government than declining costs of tax collections

The paper is organized as follows. Section 2 summarizes some of the positive models of public sector and shows that they give similar predictions about the effect of improvements in tax efficiency on the size of government. Section 3 describes the history of income tax withholding at the state level and explains in more detail why we should expect withholding to make income taxes more efficient. Section 4 describes the data sources. In section 5 I present an empirical model of technology of tax collections and demand for tax revenues, and address the endogeneity of the adoption of withholding. In section 6 I estimate the impact of withholding on income taxes and other taxes. The factors affecting the timing of adoption are analyzed in section 7. Section 8 explores the impact of withholding on specific categories of expenditures and assesses the impact of withholding on the overall size of government. Section 9 concludes.

2 Tax efficiency in the models of public sector

In this section I present a brief overview of some of the positive models of public sector and describe the mechanism that links tax efficiency and the size of government in each of these models. While the models differ markedly in their view of how political process works and how the size of governments is determined, they share some common predictions on how the tax system responds to an improvement in the efficiency of a single tax source (the income taxin our case): (1) Income tax revenues should increase. (2) Total tax revenues should increase. (3) Share of income tax in total tax revenues should increase. (4) Other taxes should decrease.

2.1 The social planner model.

While probably an unrealistic portrait of how governments actually work, the social planner model provides analytically most transparent framework for the question studied here. The model presented below is a variant on the Samuelson's (1954) original model. The government is assumed to maximize the social benefit from public goods, represented by an increasing and concave function $B(G)$, net of the deadweight costs of taxes. The government has N tax sources available, and the deadweight cost of tax source j, $C_j(T_j, \alpha_j)$ is increasing and convex in revenue T_j raised from that source.[7] The index α_j captures the efficiency of tax source j - both total and marginal deadweight costs decrease, at a given amount of revenue, when α_j increases.

The government's problem is to maximize

$$\max_{T_j, j=1...N} B(G) - \sum C_j(T_j, \alpha_j), \ s.t. \ G = \sum T_j \tag{1}$$

The first-order condition for this problem,

$$B'(G) = C'_j(T_j, \alpha_j), \ \forall j \tag{2}$$

implies a familiar result that the marginal deadweight costs should be equalized across all tax sources and should be equal to the marginal benefit from the public good. The comparative statics on the first order condition with respect to an increase in α_i (the efficiency of the income tax, for our purposes) show that

$$\frac{dG}{d\alpha_i} = \frac{1}{B''}(C''_i \frac{dT_i}{d\alpha_i} + C_{T_i \alpha_i}) > 0 \tag{3}$$

$$\frac{dC'_i}{d\alpha i} = \frac{dC'_j}{d\alpha_i} < 0, \ \forall j \neq i \tag{4}$$

$$\frac{dT_i}{d\alpha_i} > 0, \frac{dT_j}{d\alpha_i} < 0, \ \forall j \neq i \tag{5}$$

[7] This formulation assumes that deadweight cost of one tax source does not depend on the revenue raised from another tax source.

The model predicts an increase in total revenue and expenditure, an increase in the income tax revenue, and a decrease in the revenue from all other tax sources. The increase in income tax revenue thus exceeds the increase in total revenue. The marginal deadweight cost of all taxes fall. Intuitively, a reduction in the marginal deadweight costs of the income tax implies that the government should increase the income tax in order to equalize the marginal deadweight costs across tax sources. This allows the government to provide more public goods. Since the marginal benefit of public goods is lower at a new, higher quantity of public goods, all other taxes should be reduced so that their marginal deadweight costs are equalized with the new, lower marginal deadweight cost of the income tax and the marginal benefit of public goods.

2.2 Interest group competition.

The negative relationship between deadweight costs of taxes and the size of government is most explicitly stressed by Becker and Mulligan (1998). In their model of political competition between interest groups, taxpayers and subsidy recipients exert political pressure on the government with the ultimate goal to minimize their taxes or maximize subsidies, respectively. Political pressure involves voting, donations to political parties, lobbying, bribes or campaigns - any activity that may influence the government to use its coercive power in the group's favor. The final outcome of the political "game" is subsumed in the pressure function $F(A, B)$, which denotes the amount of taxes raised from taxpayers. A and B are political pressures (valued in dollars) exerted by taxpayers and subsidy recipients. Naturally, taxes are decreasing and convex in taxpayers' pressure and increasing and concave in recipients' pressure:

$$F_A < 0,\ F_{AA} > 0,\ F_B > 0,\ F_{BB} < 0$$

Government budget constraint implies that the amount given to subsidy recipients (G) must be equal to the amount taken from taxpayers (T):

$$G = F(A, B) = T$$

In order to study the effect of a change in the efficiency of a single tax source, I present a modified version of the Becker-Mulligan model that allows for multiple tax sources. Like in the social planner model, I assume N tax sources, all borne by a single taxpayer group. Each tax has its own increasing and convex deadweight costs $C_j(T_j, \alpha_j)$. Likewise, the subsidy generates some deadweight costs $S(G)$ on the recipients' side, which is increasing and convex in G. I take a natural assumption that the subsidy recipients care only about the total tax revenue, not its composition. This allows me to conveniently analyze the taxpayers' problem as a two-stage problem:

In the first-stage, for any given total revenue T, taxpayers are free to choose the composition of tax revenue $T_j,\ j = 1...N$. They want to minimize the total tax burden:

$$\min_{T_j, j=1...N} \sum (T_j + C_j(T_j, \alpha_j))\ s.t. \sum T_j = T \tag{6}$$

The convexity of deadweight costs functions guarantees a unique solution to this problem, $T_j^*(T)$, $\forall j$, in which the marginal deadweight costs are equalized across tax sources.

The "second stage" problem for the taxpayers is to choose the political pressure A that will determine the overall level of taxes. The model now becomes analytically equivalent to Becker and Mulligan's model with only one tax source. Taxpayers' goal is to minimize the overall costs of the political process, which includes the taxes paid, the deadweight costs, and the costs of political pressure:

$$\min_A \; T + \sum C_j(T_j^*(T), \alpha_j) + A \tag{7}$$

Likewise, the subsidy recipients choose their pressure B in order to maximize the net political gain from the political process, which consists of the subsidy received, minus the deadweight costs minus the costs of political pressure:

$$\max_B \; G - S(G) - B \tag{8}$$

In equilibrium, both groups exert their optimal pressures given the pressure by the other group:

$$A : F_A(1 + \sum C_j') = -1 \tag{9}$$
$$B : F_B(1 - S') = 1 \tag{10}$$

Taxpayers spend resources on pressure until the marginal dollar yields a one dollar reduction in the tax paid and in deadweight costs. Subsidy recipients spend resources on pressure until the marginal dollar yields a one dollar increase in the subsidy net of the deadweight costs.

When the marginal deadweight costs of a tax source i falls, the taxpayers choose a new composition of taxes for any given T. They choose to increase T_i and decrease $T_j, \forall j \neq i$ in order to equalize marginal deadweight costs across tax sources. The overall deadweight costs of taxes, $\sum C_j(T_j^*(T), \alpha_j)$ are reduced. As shown by Becker and Mulligan (1998), taxpayers respond by reducing their pressure, since the taxes hurt them less on the margin. As taxpayers reduce their pressure, taxes rise. Subsidy recipients may respond to this by increasing as well as reducing their pressure, which may reinforce or weaken the initial effect of reduced taxpayers' pressure. Under mild assumptions on the cross-derivative of the pressure function, taxes and subsidies are increased in the new political equilibrium. Unlike the social planner model, the interest group model does not guarantee that the other taxes must fall. The increase in overall taxes may be so large that it would override the tendency to reduce the other taxes in order to equalize the deadweight costs across tax sources, although this results requires some stronger assumptions on the cross-derivative of the pressure function $F(A, B)$. More complicated versions of the interest group model, which would include multiple taxpayer groups and tax sources whose incidence is non-uniform across group, would still yield the same basic predictions.

It is beyond the scope of this paper to discuss other models of government in detail. It is interesting to note, however, that in several of these models (Meltzer and Richard (1981), Grossman and Helpman (1996), Hettich and Winer (1988)) the political equilibrium is equivalent to the solution to the social planner's problem with different weights attached to different taxpayers. The weights reflect the "political power" of taxpayers. The relationship between the size of government and the efficiency of taxes then follows similar logic as in the planner model. A radically different approach is offered by Brennan and Buchanan (1980) in their model of Leviathan government. The government attempts to maximize the tax revenues, subject only to possible constitutional constraints on its taxing power. A reduction in deadweight costs of one tax implies that the government has an opportunity to raise more revenue from that tax. The government seizes that opportunity and moves to a higher level of revenue from that tax, without reducing other taxes.

3 The history and advantages of income tax withholding

Today, the individual income tax is (together with the general sales tax) the main source of revenue for state governments. In 2000, it represented 36 percent of states' total tax revenue. Yet back in 1932, income taxes were relatively unimportant, representing mere 4 percent of total tax revenue.[8] During the 19th and in the early 20th century, states' efforts to tax income were frustrated by their inability to effectively collect the tax. In a few states where present (Massachusetts, Virginia), income taxes were narrow-based and yielded negligible revenue. A major breakthrough occurred in 1911, when Wisconsin enacted the first modern income tax. It succeeded in getting the tax returns from taxpayers by allowing payroll costs to be counted as business expenses only if information returns for each individual workers were filed (the same applied to interests and dividends). Essentially, the state made it in the interest of some taxpayers to report the income of other taxpayers - a feature that characterizes the "success" of the modern income and value added taxes.

State individual income taxes became widespread during the 1930's, when 18 states implemented them. Yet still by 1944, they represented less than 9 percent of tax revenues in the states that were imposing them, and mere 6 percent in all states. By introducing tax withholding in 1943 the federal government made a major change in tax administration.[9] Until then, taxpayers paid their income taxes when they filed annual returns. Since then, employers have been required to withhold a certain fraction of their workers' paychecks and pay it directly to the government. Likewise, the self-employed individuals and corporations have been required to make quarterly payments based on an estimate of their total tax liability for the entire year. At the end of the fiscal year, taxpayers file income tax returns in which they compute the assessed income tax. Any difference between the assessed tax and the amount withheld during the previous year is either refunded to the taxpayer (if negative) or has to be paid to the IRS (if positive).

[8] Source: Census of Governments.

[9] United States were not the first country to implement withholding. Great Britain and Germany were withholding taxes before World War II.

At the state level, some limited forms of withholding were historically used.[10] Massachusetts, Montana, New York and Wisconsin were allowing the revenue officials to withhold special types of non-resident income when they deemed it necessary to secure collection. This provision applied mainly to elusive income such as from boxing matches, concerts or lotteries. California, Iowa and North Dakota were withholding wages from all non-resident employees. Similarly, New Jersey was withholding the ”commuter tax” from New York residents employed in New Jersey.[11]

In 1948, Oregon became the first state to require withholding on all wage and salary income. Nine states adopted withholding in the following 10 years (see Table 1). Adoption culminated during 1959-1961, when 12 states joined the withholding club. All 29 states except North Dakota that had a broad-based income tax at the end of the World War II implemented tax withholding by the early 1970's. (Perhaps surprisingly, California was the last one in 1971.) There were also 10 states that introduced individual income tax during the 1960's and 1970's.[12] *All* of these states chose to implement withholding as a method of collection from the outset. Withholding has become an "industry standard" in the tax collection business. No state has abolished it, or even considered to abolish it.

Most states imitated the federal government by withholding the wages and salaries, and by not withholding the interest and dividend income.[13] But as for other administrative arrangements, states experimented in designing their own systems. For example, while most states required withholding from paychecks in monthly intervals, some[14] allowed quarterly payments and Pennsylvania and Rhode Island required semimonthly payments. States also implemented their own formulas for computing the amount being withheld.

The transition from the traditional method of income tax collection toward withholding posed a hardship for taxpayers for the following reason: If a state adopts withholding on January 1, tax is being withheld from the current paychecks, yet in April taxpayers still have to pay the income tax liability for the previous year. While withholding does not change the tax liability, the taxpayer has to pay the tax twice during the transition year. The federal government made the transition for taxpayers easier by forgiving (the larger of) $50 or 75 percent of the smaller of taxpayer's liability for 1942 or 1943. The states were much less forgiving. Only New York, Minnesota, and Wisconsin forgave some portion of pre-adoption year tax liabilities, ranging from 65 to almost 100 percent. In all other states, taxpayers had to pay both previous year and current year taxes during the transition year.

Why is withholding a superior method of tax collection from the economic efficiency viewpoint? As I demonstrate in section 6, it enabled the governments to raise more revenue at given tax rates, or, equivalently, to raise the same revenue at lower tax rates. In conventional

[10] Most information on the history and administrative details of state withholding presented in this section is taken from Murray (1964) and Penniman (1980).

[11] Hawaii, a territory at that time, enacted an Unemployment Relief and Welfare Tax of 0.5 percent of gross wages and dividends, which was collected at source. (The tax was repealed in 1943.)

[12] Illinois, Indiana, Maine, Michigan, Nebraska, New Jersey, Ohio, Pennsylvania, Rhode Island, West Virginia.

[13] Instead, most of them required quarterly declarations and payments of all non-payroll income.

[14] Arizona, Arkansas, Kansas, Mississippi, Montana.

models of public finance, lower marginal tax rates are associated with less distortion in labor supply, effort, tax evasion, or any other margin that affects the taxable income. The reasons why withholding generates more revenue are the following:

- Improved tax collections. Withholding made tax avoidance more difficult. Under the old system, the benefit of not filing a tax return was the entire tax liability. Under withholding, the benefit is reduced to the balance between the tax liability and the amount withheld. When the taxpayer is entitled for a refund, it is actually in his interest to file a return. Even when the taxpayer owes the tax, the probability of successful evasion is reduced. The tax authority already has the information about the identity of the taxpayer and his income that is subject of withholding. Detecting evasion is a matter of matching the employer's withholding returns with the individual tax returns.[15] By reducing evasion, withholding also makes it unprofitable for taxpayers to take some costly evasive actions, ranging from moving to another state in order to leave unpaid taxes in the home state behind, to bearing the utility cost of risk that evasion would be detected.[16]

- Time shift in tax collections. Withholding causes a transitory increase in tax revenues as the government collects the tax liability from two years during the adoption year. However, when nominal incomes are rising and taxes are progressive, as was the case during the 1950's and 1960's, withholding also generates a permanent increase in tax collections due to so called "earlier realization of the growth in the tax base". As incomes are rising, more people move into higher tax brackets with higher marginal tax rates, and the average tax rate rises. Because of withholding, the government receives the *growth* of the tax liability one year earlier than it would have under the traditional regime. Figure 1 illustrates this point: The solid line depicts a hypothetical income tax revenue stream, for a government that never adopts withholding, that is increasing by 10 percent a year due to the underlying tax structure and growth in nominal incomes. The dashed line depicts the revenue of a government that adopts withholding in year 4. In that year, the government collects what it would have collected in years 4 and 5 under the traditional system. For all post-withholding years, the curve shifts to the left by one year. For example in year 7, the government revenues under withholding are equal to the revenues in year 8 under the traditional system. Note that if the revenues did not grow (constant nominal incomes, no progressivity), withholding would have had only the transitory effect, but no permanent effect.

- Overwithholding. Both the state and federal systems are designed to overwithhold. An average tax filer does not owe the tax, but receives a refund. This represents an interest-free loan from the taxpayers to the government. For example, after the 1999 fiscal year, the federal government refunded $156 billion to 92 million taxpayers, while it was owed $119 billion from 29 million taxpayers.[17]

[15] Before the arrival of computers, this was still an administratively difficult task and revenue agencies were able to match only a fraction of statements.

[16] Slemrod and Yitzhaki (2000, pp. 57-59).

[17] Statistics of Income, 1999.

The impact of withholding on the administrative costs of tax collections is unclear. On one hand, there is obviously more paperwork involved: The individual tax returns are still being filed at the end of the fiscal year, plus employers file monthly withholding returns that itemize each worker. Tax collectors still receive payments from individual workers or mail refund checks to them at the end of the fiscal year, plus they collect large monthly payments from employers. At least for some workers, the employer returns must be matched with individual returns to check compliance. Withholding creates extra new burden for employers as they have to compute the amount withheld for each employee, report it on his paycheck, and make a monthly payment to the government.[18] Ironically, for these reasons the IRS was a major *opponent* of federal withholding in 1942.[19]

On the other hand, the costs of collecting taxes from delinquent taxpayers, potential evaders, and non-residents are probably much lower under withholding. When the tax returns are due, most of the tax liabilities that would have remained unreported or owed under the traditional system are already in the government coffers. It is not surprising that before withholding was expanded to all payroll income, some states were requiring it for non-resident income, where the costs of chasing delinquent taxpayers are larger. Combining these two effects suggests that withholding has probably increased the *fixed* but reduced the *marginal* administrative costs of income tax collection. Administrative costs count as deadweight costs of taxes, and it is the marginal, not fixed deadweight cost that matters for the size of government in the models of section 2.

In addition to "real" effects, a popular argument accuses withholding of reducing the visibility of the income tax. In the traditional system, taxpayers made one large payment out of their pocket. They clearly knew how much they were paying and had every reason to hate Uncle Sam as they had to write a big check. Under withholding, taxpayers are paying smaller monthly amounts, and the money never actually goes through their hands - it is subtracted directly from their paychecks. The payment upon filing a tax return is also small, and a majority of taxpayers can actually be happy to get a refund. It is alleged that taxpayers do not perceive the tax as strongly as they did under the traditional method of collection, and they may be willing to accept higher taxes. Despite the intuitive appeal, it seems difficult to accept the view that taxpayers can be fooled all the time, and that they do not know how much they pay in taxes just because they do not pay them at once. The fact that withholding makes paying the tax more comfortable does not necessarily imply that taxpayers are willing to accept higher taxes. Moreover, the empirical literature on other aspects of fiscal illusion has found evidence that is mixed at best.[20]

There is a lot of anecdotal, as well as some rigorous, evidence that withholding did improve the efficiency of the income tax and generated more revenue. Friedman (1998) says that "If you were to ask a current official of the Internal Revenue Service whether it would be

[18] Employers' concerns with the administrative burden of withholding led Louisiana, Massachusetts, and Missouri to allow employers to retain a small percentage of the tax they withhold as a compensation for the administrative costs.

[19] Friedman and Friedman, p. 122.

[20] Oates (1991) provides an assessment of the empirical literature on fiscal illusion. For a theoretical model showing that allegedly "invisible" taxes may actually lead to a smaller government, see Dušek (2001).

possible to collect the present level of income taxes without withholding of taxes on wages at source, he would tell you in no uncertain terms that it would be impossible." Penniman (1980, p. 155) evaluates the benefits to the states in the following words: "The states have likewise claimed improved compliance, taxpayer convenience, and - to a lesser extent - better fiscal policy as beneficial result of the [withholding] system." When considering the adoption of withholding in mid-1960's, the California State Department of Financed estimated that withholding would generate 10 million dollars because of better taxpayer compliance[21] - 2.5 percent of California's income tax revenues in 1964. More precise evidence comes from Murray's (1964) survey of income tax administrators. He asked how much additional tax revenue was generated as a consequence of withholding (in the case of those states that had introduced withholding by that time) or would be generated (in the case of the states that were still contemplating the adoption).[22] The estimates of tax administrators ranged from 1 percent (South Carolina) to 25 percent (Arizona, which, prior to withholding, had a very poor record of tax compliance). The average increase reported was 9.8 percent.

4 Data

The dataset is an annual panel of 48 states from 1944 till 1980. The data on state government tax revenues (by each tax source), general expenditures (broken down into six major categories), federal grants and debt were taken from "Compendium of State Government Finances", an annual printed publication by the Bureau of Census.[23] Alaska and Hawaii are excluded because fiscal data for these states are available only since 1959 and by that time, both states already had withholding. The information on when each state implemented income tax withholding and the income tax itself comes from Murray (1964) and Penniman (1980).

The Book of the States, a biennial publication by the U.S. Bureau of Census, provided some information on the design of the income tax systems at the state level. Since 1947, the publication reports the lowest statutory tax rate, the end of the lowest income bracket, the top tax rate, and the beginning of the top income bracket, as well as some special provisions (temporary surtaxes, differential tax rates on dividend income etc.). More detailed information (total number of income brackets, exemptions or credits for single and married taxpayers and dependents, etc.) is reported only from 1960 onwards; unfortunately by this time a majority of states had adopted withholding so this information is not useful for before-after analysis. From 1947 till 1957, the tax rates are reported as in effect on July 1 of the corresponding odd year. From 1960 onwards, the tax rates are reported as in effect on January 1 of the corresponding even year. The publication alse describes legislative changes occurring in each calendar year, which makes it possible to fill in the tax rates for those years

[21] Murray (1964), p. 410.

[22] Some of the Murray's numbers also come from official government reports, such as California Department of Finance: "Current Payment Plan for Personal Income Tax"

[23] I am greatly indebted to Vlasta Buresova and in particular to my wife Daniela for helping me to transform this data into electronic form. I am also indebted to Thomas Husted for providing some of the variables for 1950-80 in the electronic form.

that are not reported in biennial tables.

In line with the previous research on state government finances (Matsusaka (1995), Lott and Kenny (1999)), I use a variety of socio-economic control variables. The data on state population, personal income, share of farm income[24], and share of interest and dividend income in state's personal income come from Bureau of Economic Analysis, Regional Accounts Data. The percentage of state population that is black, elderly (65+) and lives in urban areas were obtained from Census enumerations.[25] I also use several political variables. The data on the percentage of Democrats in the state legislature was provided by the National Council on State Legislatures.[26]. State's voting in presidential elections is documented in ICPSR study #0002, and the state's number of votes in the electoral college on the National Archives website[27]

The personal income variables were converted into real 1982 dollars by the consumer price index. Government revenue and expenditure variables were converted into real 1982 dollars by the "state and local government expenditure deflator". Both indices are published in the Economic Report of the President.

Figures 2 through 5 show the general trends in the major variables of interest. Figures 2 and 3 depict general revenue[28] and tax revenue per personal income, averaged across states. The states are divided into those that had income tax at the beginning of the sample period (29 such states in 1944) and all other states. We can see that the income tax states have consistently bigger governments than the remaining states. The state government revenues have been growing until the late 1970's when they leveled-off, starting at about 5 percent and ending at 12 percent of personal income in the income tax states. Taxes represented over one half of state government revenue, taking away almost 4 percent of personal ncome in 1944 and 6.5 percent by 1980 in the income tax states.

Figure 4 presents the evolution of the average income tax rate, defined simply as the ratio of income tax revenues to state personal income. The growth of income taxes has been much steeper than the growth of total taxes: The average tax rate has increased more than fourfold in the states that historically had the income tax. In the remaining states, the income taxes lifted off from zero during the 1960's and 1970's as many of these states started imposing income taxes. Finally, Figure 5 shows that the statutory tax rates have not changed as much as the growth of income tax revenues may have suggested. A 1 percent rate was by far most commonly applied to the lowest income tax bracket in 1948 (16 states had it). By 1980, the most common lowest rates were 2 percent (8 states) and 1 percent (4 states). The top tax rate is much more widely distributed, ranging from 1.695 percent (Massachusetts in 1947-51)

[24]The farm income is very volatile and is negative for some states in some years. Since this variable is meant to capture the long-term agricultural vs. industrial character of the state rather than short-term shocks to agricultural incomes, I use three-year moving averages of farm income in the analysis.

[25]Since Census data are decennial, observation for the years between censuses were generated by simple linear extrapolation.

[26]I am indebted to Tim Storey of NCSL for sharing this data.

[27]http://www.archives.gov/federal_register/electoral_college/votes_index.html#state

[28]General revenue is defined as all state revenue except the non-tax revenue of government trusts and enterprises (liquor stores, public utilities).

to 20.125 percent (Vermont in 1970-75).

Tables 2 contains summary statistics, dividing the states into two groups according to whether they had an income tax in at the beginning of the sample period. The last part of the table also shows the summary statistics for the income tax states one year before they adopted withholding.

5 Empirical strategy

5.1 The model

The task of the empirical sections is to estimate the effect of withholding on income tax revenues and other fiscal variables. The theory predicts an increase in the income tax revenues, yet it comes from two sources: One is the "efficiency effect" - the ability to generate more revenue holding tax rates and other features of the income tax system unchanged.[29] The other is the "political effect" - increase in revenue due to the changes in tax rates and other features that occurred as a response to the efficiency effect.

A simple econometric model of the technology of tax collections and demand for tax revenues gives the efficiency and political effects a precise meaning and shows how they can be estimated. The parameters of the model have straightforward interpretation if we assume that the adoption of withholding is exogenous. Implications of relaxing this assumption will be discussed in the next section. For expositional clarity, the model presented here abstracts from the complexities of the actual income tax schedules and assume that all income is taxed at a flat tax rate T_{it}, without any exemptions, deductions, or loopholes. The subscripts i and t denote state and year, respectively.

The technology of tax collections is a function that translates the tax rate, income, and other characteristics of the state into the revenue collected. Let y_{it} be the average income per capita. If tax collections were perfect, the government would collect $R_{it} = T_{it}y_{it}$ of revenue per capita. Due to non-compliance and delayed payments, the government is not able to collect this amount. Rather, it collects a fraction $r^T(X_{it}, y_{it}) < 1$, where X_{it} are socio-economic variables that affect the government's ability to raise revenue and the income per capita is explicitly included among these variables.[30] Withholding increases collections by a factor of α - this is the "efficiency effect", one of our parameters of interest. Let D_{it} be the dummy variable indicating whether a state has withholding, and u_{it} be the error term. The "technology" of tax revenue is thus given by

$$R_{it}^T = (1 + \alpha D_{it})T_{it}y_{it}r^T(X_{it}, y_{it})e^{u_{it}} \tag{11}$$

[29] The ideal measure of the efficiency improvement due to withholding would be change in the deadweight costs of taxation. Unfortunately, I am not able to construct these measures for the states over time with the rude data on tax structure that is currently available, and have to resort to this indirect measure.

[30] For example, in an imaginary world in which there is no withholding but the government is a perfect tax collector, $r^T = y_{it-1}/y_{it}$, since in year t the government collects taxes on income earned in year $t-1$.

The demand for income tax revenue, R_{it}^D, and demand for revenue from other taxes, R_{it}^O are functions that state how much revenue the legislators (who ultimately decide on the tax code) wish to raise from the income tax and other taxes. Their arguments are the socio-economic parameters of the state and (if the theory is correct) also the efficiency effect of withholding. Thus

$$
\begin{aligned}
R_{it}^D &= (1+\beta\alpha D_{it}) r^D(y_{it}, X_{it}, Z_{it}) e^{\varepsilon_{it}} && (12)\\
R_{it}^O &= (1+\beta^O\alpha D_{it}) r^O(y_{it}, X_{it}, Z_{it}) e^{\varepsilon_{it}^O} && (13)
\end{aligned}
$$

The parameter β is the "political effect", our second parameter of interest. It reflects the sensitivity of demand for revenue to the extra revenue brought by withholding. If $\beta = 0$, the size of government is irresponsive to efficiency - the government simply wants to raise a given amount of income tax revenue regardless of its ability to collect it. Once withholding is adopted, the tax rate shoud be reduced so that the government ends up collecting the same revenue as before. Finding of $\beta = 0$ would disqualify the theoretical models that predict a link between tax efficiency and the size of government. If $\beta \in (0,1)$, the demand for revenue is indeed sensitive to the efficiency, yet the additional revenue demanded is lower than the efficiency effect. In that case, the tax rate should be reduced, so that the government ends up with more revenue than before withholding, but less than if it kept the tax rate unchanged. If $\beta > 1$, the demand response is so strong that government will raise the tax rate and end up collecting extra revenue "on top of" the efficiency effect. A special case is $\beta = 1$, when the government simply keeps the extra revenue and does not change the tax rate. Yet it should be emphasized that no change in tax rates is also a response, and it is consistent with the theory. The theory predicts only that $\beta > 0$; the models in general do not predict whether the political effect should mitigate or overshoot the efficiency effect. In equation 12, β interacts with α because we would expect the political effect to be bigger (in absolute terms) the more revenue withholding brings in. The theory also predicts that other taxes should decline, therefore we should find that $\beta^O < 0$. As for the remaining notation in the demand equation, the function $r^D(\cdot)$ and $r^O(\cdot)$ are the pre-withholding demands, Z_{it} are variables that affect the demand for revenue but not the tax technology, and ε_{it} is the error term.

Faced with the demand and the technology function, the governments selects the tax rate T_{it} such that the income tax revenue demanded equals the revenue collected:

$$
R_{it}^D = R_{it}^T \Leftrightarrow T_{it} = \frac{(1+\beta\alpha D) r^D(y_{it}, X_{it}, Z_{it}) e^{\varepsilon_{it}}}{y_{it}(1+\alpha D) r^T(X_{it}, y_{it}) e^{u_{it}}} \tag{14}
$$

If we assume that the functions r^T, r^D and r^O are log-linear

$$
\begin{aligned}
\log r^T &= \gamma_X^T \log X + \gamma_y^T \log y\\
\log r^D &= \gamma_X^D \log X + \gamma_y^D \log y + \gamma_Z^D \log Z
\end{aligned}
$$

$$\log r^O = {}^O_X \log X + {}^O_y \log y + {}^O_Z \log Z$$

we can take logs of the equations 11, 12and 14 obtain a system of estimating equations:

$$\log R_{it} = \log(1 + k)D_{it} + \log T_{it} + (1 + {}^T_X)\log X_{it} + (1 + {}^T_y)\log y_{it} + u_{it} \quad (15)$$

$$\log T_{it} = \log\left(\frac{1 + q k}{1 + k}\right)D_{it} + ({}^D_X \quad {}^T_X)\log X_{it} + ({}^D_y \quad {}^T_y \quad 1)\log y_{it} + \quad (16)$$

$$+ {}^D_Z \log Z_{it} + Q_{it} \quad u_{it}$$

$$\log R^O_{it} = \log(1 + q^O k)D_{it} + {}^O_X \log X_{it} + {}^O_y \log y_{it} + {}^O_Z \log Z_{it} + Q^O_{it} \quad (17)$$

The system can be estimated by three-stage least squares and k, q and q^O can be identified. Identification requires variables, denoted Z, that a ect the demand for revenue but do not a ect the government's ability to collect it. I have two variables for which we can be reasonably confident that this condition is satisfied: the percentage of Democrats in the state legislature, and federal grants. The percentage of Democrats obviously reflects the tastes of voters for specfic government policies (including redistributive policies). Yet it is di ! cult to imagine how this variable could a ect the tax collections, unless more Democratic states are more likely to use some unobservable methods of tax collections (such as more frequent audits). Similarly for federal grants - they are correlated with the demand for revenue through the so called "flypaper e ect", widely documented in the literature[31], and through matching grants, when a federal grant for a given project is conditional on the state's providing a certain fraction of funds from its own sources. To be a valid instrument, the grants cannot be awarded on the basis of the state's unobserved ability to raise revenue, as would occur if the federal government "compensated" the states with a poor record of tax collection by higher grants.

The actual tax systems are not characterized by a single flat tax rate, but by a (rather large) number of parameters such as progressive tax rates, income brackets, exemptions, deductions, credits, di erential treatment of di erent sources of income, etc. We could, in principle, treat T_{it} as a vector of tax parameters, include all of them into the technology equation (15) and have a separate demand equation (16) for each parameter. This is in fact what I do to obtain the estimate of k, however, this procedure alone would produce estimates of many q's, one for each tax parameter. These are not our ultimate parameters of interest, since changes in tax rates or brackets in actual tax systems do not translate one-for-one to changes in income tax revenues. To obtain a consistent estimate of the relevant of the "true" q, I separately estimate the system of demand equations for all tax sources (12-13, in logs). The coe! cient on the withholding dummy in the income tax equation is equal to $\log(1 + k q)$, from which q can be easily recovered by substituting the estimate of k from the technology equation, and its standard error can by computed by the delta method. The term $\log(1 + k q)$ can be interpreted as the "total e ect" of withholding, since it captures the change in tax revenues due to e ciency and political e ects combined. The disadvantage of

[31] For a recent survey, see Hines and Thaler (1995).

this method is that since I have only two instruments, so I can use only two tax parameters in the technology equation. Naturally, I choose the lowest and highest tax rate.

As an alternative, I estimate the technology and demand equations separately by OLS, and include all available tax system variables in the technology equation. While OLS produces a biased estimate of α due to the correlation between αD and T, it enables me to include all available tax parameters in the regression, which should reduce the omitted variable bias. Fortunately, the estimates of α are quite insensitive to the particular estimation method used.

Another estimation issue concerns the treatment of federal grants. While they obviously determine the "demand" for tax revenues, they are not exogenous to the state's fiscal system. Rather, as Wallis (1996) shows, they are determined simultaneously with tax revenues. Therefore I add an additional estimating equation for federal grants, in which the right-hand side variables include the socio-economic variables, political variables, and also the withholding dummy, in order to allow for the possibility that the federal grants responded to the "windfall" of revenue generated by withholding. In addition to the share of Democrats in state legislature, I use another political variable that was found to be a very good predictor of federal grants in previous literature (Wallis (1996)): a "political productivity index", which captures the idea that swing states are more attractive targets for federal money than the states where either Republicans or Democrats have a safe majority. The index is constructed as follows: For each state, I take the share of democratic vote in the last ten presidential elections preceding a given year, and calculate the mean and standard deviation of that sample. Assuming a normal distribution, I then compute the difference between the probability of receiving 49 and 50 percent of the vote. Last I multiply by the state's share of electoral votes in the upcoming presidential election.

In all regressions that follow, state and year dummies are included to capture unobservable fixed effects that are constant within a state over time, or across states within a year. In OLS regressions, the standard errors are computed by the "robust" standard error estimator Kezdi (2001), where the clustering is by state. It is likely that an unobservable shock to the size of government in state s, time t, is correlated to the shocks in state s at other times, even after picking up the state fixed effect. It has been established that the failure to account for the within-unit autocorrelation in residuals leads to underestimation of the standard error of the difference-in-differences estimator (Bertrand, Duflo and Mullainathan (2001)). The robust estimator eliminates this concern.

5.2 Testable predictions under endogenous withholding

The estimates of the parameters of the model would have a straightforward interpretation if withholding was an exogenous shock, randomly superimposed upon the states. If we found (as in fact I do in section 6) that withholding permanently increased income tax revenues ($\beta > 0$), we could conclude that the theory is correct and governments get bigger when they become more efficient.

The assumption that withholding was exogenous is, of course, unrealistic. States adopted it voluntarily and for a reason. One possible reason is a desire to improve taxpayer compliance and to raise the given amount of revenue more efficiently (a "supply-driven" adoption). One of the benefits of doing this is the possibility to raise the given amount of revenue at lower statutory tax rates, thus providing a benefit to taxpayers who had solid compliance prior to withholding. An alternative reason, one that perhaps better resonates with conventional wisdom and also with the federal experience, for adopting a technology that will generate more revenue is a need to raise more revenue (a "demand-driven" adoption). If a state experiences an *unobservable* positive shock to the demand for income tax revenue and adopts withholding in order to meet the demand, we would estimate that $\beta > 0$, but the estimate would be biased upward - it would capture the demand shock rather than a genuine response to the efficiency improvement.

To address this issue, I derive what predictions for observed changes in taxes and other taxes the theory generates under each adoption motive. Then I derive, for each adoption motive, the predictions generated by the alternative theory that tax revenues are determined solely by demand factors and do not respond to changes in efficiency. Each theory-motive combination leads to distinct predictions that can be discriminated in the data.

Under supply-driven adoption, the government implements withholding with no intention to increase the income tax revenues. If the theory is wrong, the government should, upon discovering the revenue windfall, return the entire windfall back to taxpayers. That is, it should reduce the tax rates (or alter other parameters of the tax system) so that it ends up collecting the same amount of revenue as before withholding. Other taxes should not change. If the theory is correct, the political effect should increase tax revenues above the pre-withholding level; that is, we should observe $\beta > 0$. We cannot predict whether tax rates will fall ($\beta \in (0, 1)$, meaning that the government will return some of the windfall back to taxpayers through lower taxes) or rise ($\beta > 1$, implying a very strong political affect, when the government keeps the efficiency effect and increases the income tax "on top" of it). Other taxes should fall ($\beta^O < 0$). Observe that for supply-driven adoption, the predictions are identical to those of section 2, where we tacitly assumed exogenous shocks to tax efficiency.

The speed of the responses should also be considered. The theoretical models discussed in section 2 have no time dimension; the political process adjusts to a shock simultaneously. Yet in the real world the political process probably does respond to a shock with a lag. It takes some time (perhaps a few fiscal years) for the interest groups, voters and legislators to observe the shock and learn about its magnitude; it takes additional time until their responses to the shock translate into legislative changes in the tax structure. For example, procedural guidelines slow down the legislative process. The new vote-maximizing tax policy may be discovered by a party that is not currently in power, hence the new policy gets implemented only after the party wins the next election. Instantaneous response would require, at the very least, a perfect foresight of the efficiency effect. It turned out, however, that withholding was a bigger success than originally expected. In his survey of revenue officials, Murray (1964) asked whether the improvements in tax collections due to withholding met their expectations, and found that "eight of the fourteen answers to this question indicate that the estimates were too low and only one records an overly optimistic estimate." Therefore even if the political process reacts instantaneously, we should expect the adjustments in tax parameters to occur with some lag. I will be distinguishing "short run" responses (those that we observe for the adoption year and shortly afterwards) from "long run" (those that occur several years later).

The discussion of demand-driven adoption is more involved and requires additional notation. Suppose the government faces an (unobservable) shock to the demand for expenditure, equal to Δ and therefore needs to increase taxes by the same amount. It adopts withholding as one possible way of boosting revenues and receives a windfall of αR^T due to the efficiency effect. The efficiency effect may, however, fall short of, be equal to, or exceed the demand shock. How would the governments respond under each case?

1) $\alpha R^T < \Delta$. The government receives less revenue from withholding than it needs, so it has to increase other taxes to make up the difference. (It may also increase the income taxes over and above the efficiency effect). Provided that the government has a correct prediction of the efficiency effect of withholding, these increases should occur simultaneously with the adoption of withholding. If the theory is wrong, there should be no further adjustments, therefore we should observe $\beta_{LR} = \beta_{SR} \geq 1$ and $\beta^O_{LR} = \beta^O_{SR} > 0$. If the theory is correct, the political effect will now respond to the improved efficiency of the income tax. The income tax revenues should rise and and revenues from other taxes fall relative to their levels at which they were immediately after the adoption. Due to policy lags, this is likely to occur some time after the adoption. Therefore we should observe $\beta_{LR} > \beta_{SR} > 1$, and $\beta^O_{LR} < \beta^O_{SR} > 0$. Note that we cannot sign the long run effect for other taxes.

2) $\alpha R^T = \Delta$. Withholding brings exactly the revenue that the government needs. If the theory is wrong, we should see no further adjustments in income taxes or other taxes: $\beta_{LR} = \beta_{SR} = 1$ and $\beta^O_{LR} = \beta^O_{SR} = 0$. If the theory is correct, the government will, probably with some lag, respond by increasing income taxes and reducing other taxes, and the total increase in revenue will exceed the technological effect of withholding. In the data, we should therefore observe $\beta_{LR} > \beta_{SR} = 1$ and $\beta^O_{LR} < \beta_{SR} = 0$.

3) $\alpha R^T > \Delta$. The efficiency effect actually brings more revenue than the government needs. To equalize the revenue collected and demanded, the government should return the excess windfall back to taxpayers by cutting other taxes and possibly also the income taxes. Provided that the government has a correct prediction of the efficiency effect, these tax cuts should occur simultaneously with the adoption of withholding. If the theory is wrong, there should be no further adjustments, and we should observe $\beta_{LR} = \beta_{SR} \leq 1$ and $\beta^O_{LR} = \beta^O_{SR} < 0$. If the theory is correct, the political effect should then increase income tax revenues, although we cannot say whether in the long run they will be above or below the level at which they were immediately after adoption. Other taxes should decline even further. Therefore we should observe that $\beta_{LR} > \beta_{SR} \leq 1$ and $\beta^O_{LR} < \beta_{SR} < 0$.

The preditions are summarized in Table 3. The key implications of endogenous adoption are that other taxes should fall or remain unchanged when adoption is supply-driven, while they should rise when adoption is demand-driven; when adoption is demand driven and taxes do respond to efficiency, the long-run increase in income taxes should exceed the efficiency effect.

Table 3 Testable predictions under endogenous adoption		
	Taxes respond to efficiency	Taxes determined by demand only
Supply-driven adoption	$\beta_{LR} > 0$ $\beta^O_{LR} < 0$	$\beta_{LR} = 0$ $\beta^O_{LR} = \beta^O_{SR} = 0$
Demand-driven adoption: $\alpha R^T < \Delta$	$\beta_{LR} > \beta_{SR} > 1$ $\beta^O_{LR} < \beta^O_{SR} > 0$	$\beta_{LR} = \beta_{SR} \geq 1$ $\beta^O_{LR} = \beta^O_{SR} > 0$
$\alpha R^T = \Delta$	$\beta_{LR} > \beta_{SR} = 1$ $\beta^O_{LR} < \beta^O_{SR} = 0$	$\beta_{LR} = \beta_{SR} = 1$ $\beta^O_{LR} = \beta^O_{SR} = 0$
$\alpha R^T > \Delta$	$\beta_{LR} > \beta_{SR} < 1$ $\beta^O_{LR} < \beta^O_{SR} < 0$	$\beta_{LR} = \beta_{SR} < 1$ $\beta^O_{LR} = \beta^O_{SR} < 0$

6 Results: income taxes and other taxes

Figure 6 provides a cursory exploration into the impact of withholding on income tax revenues. The vertical axis shows the ratio of income tax revenues to the state's personal income, averaged across the 29 states which had income tax in 1944. All state years on the horizontal axis are normalized so that year zero is the fiscal year in which a state implemented withholding. While the figures have to be read with caution since no other factors affecting tax revenues are controlled for, they strongly suggest that withholding indeed increased income tax revenues and their share in total revenues. Income tax revenues grow steadily before withholding until they reach 0.66 percent of personal income, then they discontinuously jump up to 1 percent immediately after withholding is adopted, and later continue to grow at a slightly higher rate.

In the same vein, Figure 7 show the evolution of the sum of sales, corporation income, property and license taxes before and after withholding. Contrary to what the theory predicts, these major revenue alternatives to the income tax do not fall in absolute terms after withholding. They do not follow any clear pattern before withholding and they start growing steadily once withholding is adopted, rising from 3.76 percent of personal income to 4.29 percent in eight years. This would suggest that either the theory is outright wrong or that adoption of withholding was accompanied by a positive shock to the demand for government revenues, which manifested itself in the growth of all taxes, and not just the income tax.

Table 4 presents the OLS estimates of the efficiency and political effects of withholding on the income taxes.[32] The first two columns estimate the efficiency effect by including tax

[32] Sample period is shortened to 1947-1980, since the tax rate information is not available for the years preceding 1947.

variables in the regression; regression in column (1) includes only the lowest and top tax rate, while the regression in column (2) also include the lowest and top income bracket and their interactions with tax rates. The estimates confirm that withholding was indeed a profound improvement in the tax collection technology - it generated 26.4 or 24 percent more revenue, respectively, at given tax rates. In both regressions the coefficients on the withholding dummy are significant at 1 percent level. However, the fact that the coefficient declines when more tax parameters are included may raise a concern that it would decline further if more parameters were observable.

Other significant determinants of the level of tax collections are, not surprisingly, the top tax rate and personal income per capita. The coefficient on the interaction between the top tax rate and top tax bracket is also significant and, as one should predict, negative since at a given rate, higher bracket implies that less income is being taxed at that rate and therefore less revenue is collected. Somewhat surprisingly, the effect of the lowest tax rate is not significant. Also, states whose residents derive a larger share of income from sources that are presumably more difficult to tax (farm income, capital income) do not collect significantly less in income taxes. The only significant socio-economic control is the percentage of elderly population, whose effect on the tax technology is negative.

As withholding provided the governments with a windfall of revenue, how did they respond? Did they return the extra revenue (in whole or in part) back to taxpayers by cutting the tax rates? Or did they increase the tax rates in order to get even more revenue from the tax that suddenly became much more efficient? Column (3) of Table 4 provides OLS estimates of the demand for income tax revenue, by removing the tax variables from the right-hand side of the equation and adding federal grants and the percentage of Democrats in state legislature as additional determinants of demand. The coefficient on the withholding dummy has the interpretation of the total effect and is equal to 0.28. It would suggest that the governments have actually increased tax rates and obtained additional revenue on top of the efficiency effect. The magnitude of this response is small, however. The implied estimate of β (shown at the bottom of column (3)) is 1.22 and significantly greater than zero, but not significantly greater than one.

Table 5 presents estimates of the three-stage least squares model of tax technology and tax rates, as described in section 5.1 with separate equations for the top and lowest tax rates and federal grants, which provides estimates of the efficiency effect and the changes in tax rates. Table 6 estimates the system of demand equations for all taxes. The first half of Table 6 contains separate equations for individual income, sales, corporation income, property, license, and other (miscellaneous) taxes. The second half aggregates the sales, corporation, property and license taxes into a single category for reasons explained below. The demand equation for income taxes (column (8) in Table 6) is replicated as column (5) of Table 5 to provide a direct comparison between the efficiency and total effect. The coefficient on the withholding dummy from this equation is also used to compute the estimate of β, which is shown at the bottom of column (5) of Table 5. The coefficient on the withholding dummy in the technology equation is 0.224; instrumenting for the tax rate thus produces an estimate of α that is virtually identical to OLS. The fact that the estimates of the efficiency effect are so similar and always significant across different specifications gives great confidence that withholding indeed made income taxes much more efficient.[33]

In the tax rate equations (column (2) and (3)), the coefficient on the withholding dummy is negative but insignificant (-0.034) for the top tax rate and also negative (-0.158) and significant for the lowest rate. The negative effect of the lowest rate actually implies an increase in tax revenues, since in the technology equation, the effect of the lowest rate is negative.[34] Several socio-economic variables significantly affect the top tax rate. Namely, higher income per capita is associated with a lower top tax rate; the same is true for the share of black population and urban population. Higher share of Democrats in the state legislature is associated, as one might expect, with a higher top rate. In the federal grants equation (column (4)), both identifying variables (share of Democrats in state legislature and the political productivity index) are significant determinants of the federal grants. An interesting result is the negative (-0.062) and significant effect of withholding on the federal grants. It appears that the federal grants have declined after the introduction of withholding - a result that is found in other regressions and will be discussed in section 8.

The demand equation (column (5)) shows the estimate of the total effect. It is much larger than the efficiency effect (0.377), and implies an estimate of β equal to 1.82. However, it is not significantly greater than one, although it is significantly greater than zero at 1-percent level. The magnitude of β is much larger than one would expect from the impact on tax rates; however, there could be other changes in tax parameters that I do not observe. The model explains most of the variation in income tax revenues and federal grants, but has a poorer fit for the tax rates.

How did other taxes respond to the income tax windfall? From Table 6, we can see that the only tax category that declined was "miscellaneous taxes". They include death and gift, severance, document and stock transfer, and poll taxes. These are minor tax sources[35]; moreover, the poll taxes were abandoned for civil rights reasons by several states during this period and eventually prohibited by the 24th Amendment. For the serious alternatives to the income tax, namely the sales taxes (which represented, on average, 34 percent of tax revenues one year prior to withholding), the impact of withholding is positive but never significant. The magnitude of the increase is quite high, however, for the corporation income tax and the property tax (8.5 and 11.4 percent increases, respectively). Suspecting that insignificant coefficients of the same sign could turn out significant in the aggregate, I sum the sales, corporation, property and license taxes into a single variable. The estimates of the system of demand equations is presented in columns (8)-(11) of Table 6. The estimate of the total effect on income taxes is unchanged, and the impact on the sum of other taxes

[33] As another robustness test, I estimated the three-stage least squares model without controlling for the endogeneity of the federal grants, and obtained an identical estimate of 0.229. I also re-estimated the models in a linear form, and always obtained positive and significant estimates of the efficiency effect. They implied an increase in tax revenue per capita by 11-14 dollars, depending on specification.

[34] This should not be interpreted that cutting the lowest rate actually increases the tax revenues. The negative sign is probably a consequence of the fact that I am not able to control for exemptions. Reductions in the lowest tax rate are frequently associated with "deepening" of the income tax, that is, an introduction of new tax brackets for lower levels of income - a measure which increases tax revenues because it broadens the tax base.

[35] An average, they represented 6.6 percent of tax revenues one year prior to withholding.

is indistinguishable from zero.

To translate the percentage changes into dollars, I estimate the same system in linear specification. The results for particular taxes are different than in the log specification, namely the corporation income taxes now exhibit a significant increase by \$12.6, and the coefficient on miscellaneous taxes is now positive but insignificant. In the aggregate, the sales, corporation, property and license taxes have declined by \$4.4, but the coefficient has a very large standard error. The large percentage estimate of the total effect on income tax revenues, found in the log regressions, translates into \$53.

How do the results support or reject the theory? Referring to the testable predictions in Table 3, the results are inconsistent with the combination of supply-driven adoption and taxes irresponsive to efficiency shocks, since the income taxes have increased. They are also inconsistent with demand-driven adoption when the efficiency effect exceeds the demand shock ($\alpha T > \Delta$), since other taxes should have declined, while I find (at least for the major tax sources) that they did not change relative to their pre-withholding levels.

Analyzing the speed of response of tax revenues to withholding provides additional insights and allows to further discriminate between the testable predictions. I estimate the same systems of equations as in Tables 4-7, but replace the withholding dummy with dummy variables each representing the year of adoption, the 1st, 2nd, etc. up to 8th year after adoption, and a dummy variable equal to 1 for 9 and more years after adoption. I also include dummy variables for the 1st, 2nd, etc. up to 9 and more years prior to withholding. They allow me to check whether there was any effect on revenues in the years just preceding the adoption of withholding, an effect that may have been due to some other factor that operated before the adoption. The effect of this spurious factor would be mistakenly attributed to withholding in regressions with a simple dummy variable for withholding. The dummy variable representing the last year before adoption is taken out of the regression so that this year serves as the baseline. Complete results from the regressions are shown in Tables 8 and 9; for expositional clarity, the coefficients on the dummy variables from selected equations and their 95% confidence intervals are plotted against the time axes in figures 9 through 13.

Figure 9 plots the estimated efficiency effects from the three-stage model (column (3) of Table 8). It shows that the efficiency effect of withholding was immediate: Income tax revenues (holding the tax rates constant) rose by 31.7 percent in the adoption year. The efficiency effect then declines until it reaches 18.3 percent 3 years after adoption. The reason for this decline is that the increase in the adoption year is represented in large part by the one-time forward shift in payments of taxes. This effect appears not only in the adoption year, but also in the first year after, because in many states withholding came into force on January 1, while in almost all states the fiscal year begins on July 1. Hence the forward shift in tax collections that occurs in the first 12 months after adoption is accounted for in two fiscal years. After the 3rd year, the technological effect rebounds back to 33 percent during the next five years. This is somewhat puzzling, since we would expect withholding to be a once-and-for-all improvement in tax collection technology. One possible explanation for this growth is that the states learned over time how to use the withholding system and gradually improved collections. We can speculate that after appreciating the benefits of withholding, the states expanded its use to the sources of income not initially covered (small firms, the self-employed), although I do not a direct evidence of that. The other explanation is that the growth is picking up unobservable changes in the tax structure, and therefore we are overestimating the technological effect. It is worth noting that for the years preceding the adoption, all coefficients are indistinguishable from zero, so there is no evidence of some spurious effect operating prior to withholding.

Figure 10 presents a crucial result. It shows the total effect of withholding on income tax revenues ($\log(1 + \alpha\beta)$) by plotting the coefficients from the demand equation (column(1), Table 9). It shows that there was already an upward trend in the demand for income tax revenues prior to adoption - the "pre-effect" of withholding grows steadily from -0.2 to zero during the eight years that precede adoption. Once withholding is adopted, income tax revenues immediately rise by 30 percent, decline somewhat (due to overlapping) to 25 percent above the pre-withholding level three years later and then steadily grow again to 40 percent above the pre-withholding level 9 and more years after adoption. The slopes of the trend before and after are virtually identical. The presence of the trend helps to explain the estimates of $\beta > 1$ in the previous regressions with a simple dummy variable - the dummy was picking up not only the discontinuous jump at the adoption year, but also the difference between the average levels of the trend before and after. However, in the presence of prior trend, we can hardly interpret the post-withholding growth of income tax revenue as a causal effect of withholding. From Figure 10, it appears that withholding only mechanically increased the tax revenues by the efficiency effect, and generated no significant adjustment thereafter. Figure 11 provides a direct comparison between the efficiency and total effects from the three-stage model by plotting them into same graph. For expositional clarity, the confidence intervals are not shown. Although the total effect is above the efficiency effect from 2 years after withholding onwards, the difference is not statistically insignificant and can be attributed to the continuation of the pre-existing trend. That is, $\beta_{LR} \simeq \beta_{SR} \simeq 1$.

We thus obtain an interesting finding about the real world: Although withholding increased income tax revenues at the time of adoption, it did not provide a stimulus for accelerating their growth. In other words, it had only a level effect, but not a growth effect, on income tax revenues.[36]

How do these results support or reject the theory? Finding that $\beta_{LR} \simeq \beta_{SR} \simeq 1$ is consistent with the case when governments respond to efficiency and adoption is supply-driven, yet it is also consistent with the case when governments do not respond to efficiency, adoption is demand driven and the efficiency effect is not high enough to cover the demand shock ($\alpha R^T \leq \Delta$). We need to turn to the evolution of other taxes to further discriminate between these cases.

Figure 7 already suggested that other taxes also grew when withholding was adopted, which would be indicative of an increase in demand for government expenditure. This finding continues to hold when I control for other variables in regressions. The three-stage least squares estimates of the demand for tax revenues are shown in Table 9. As before, I first

[36] If federal withholding had the same impact on the federal income tax, we can assert that Milton Friedman gives withholding too much blame for the growth of federal government.

estimate the system with a separate equation for each tax source, and then I estimated with a single equation for the sum of sales, corporation, property and license taxes. The coefficients on the pre- and post- withholding dummies for this tax aggregate are plotted in Figure 12. It shows that other taxes were actually on a downward trend (after controlling for other demand determinants) before withholding. The trend reverses exactly when withholding is adopted - other taxes jump up by 3.8 percent and then continue to grow at a slower rate. Nine years after adoption, they are 8.6 percent above the level at which they were one year before adoption. The coefficients become significantly greater than zero 6 years after adoption. The switch in the trend for other taxes, and especially their discrete jump up in the adoption year, indicate that the governments needed more revenue as withholding was adopted. They were increasing all taxes. Withholding fits into this picture as one of several measures (although the most important one) that were implemented with the purpose of generating more revenue. Comparing the absolute levels also supports this point. One year before withholding, the sales, corporation, property and license tax revenues were, on average $257 per capita (Table 1.3). The discontinuous increase by 3.8 percent in the adoption year hence represents an increase by 9.76 dollars. On the other hand, the income taxes were $58 one year before adoption, so the efficiency effect of 22.4 percent[37] implies a 13 dollar increase.

Finally, I plot the coefficients for the "other and miscellaneous" taxes in Figure 13. These were the only taxes that exhibited a significant decline in the regressions where withholding was represented by a simple dummy variable. However, the figure shows that they were on a steady decline before as well as after withholding, and we cannot interpret this decline as a "response" to the withholding shock. If anything, the decline has slowed down slightly around the adoption year, which would be consistent with the need to raise more revenue.

Referring to the testable predictions of Table 3, we can see that increases in other taxes at the time of adoption, and their continuing growth afterwards, could occur only if the adoption was demand-driven, and the efficiency effect was insufficient to cover the increased demand. The fact that there was no visible increase in income tax revenues "on top of" the efficiency effect later on, but rather a continuation of the pre-existing trend, leads to a conclusion that the data do not provide a convincing evidence that withholding caused an increase in income taxes and an absolute decline in other taxes. While the post-withholding increases in income tax revenue are indisputable, they are better explained by unobservable shocks to demand for revenue rather than a genuine response to the efficiency shock.

However, the results strongly support another prediction of the theory: That the share of income tax in tax revenues should increase. If the governments wanted to raise more revenue, but keep the proportion of the income tax and other taxes constant, the percentage increases in the income tax and other taxes should be the same. Comparison between columns (8) and (9) reveals that the increases in income taxes are substantially higher than increases in other taxes. In Figure 14 I plot the difference between the coefficients from income tax equation and the sales, corporation, property and license taxes equation, together with the 95 percent confidence intervals. In all years following the adoption, the increses in income

[37] It would be inappropriate to use the jump in income tax revenues in the adoption year (30 percent) for this comparison. This jump reflects also the once-and-for-all shift in the timing of tax payments, and the governments knew it would wane off the next year.

taxes significantly exceed the increases in other taxes. The magnitude of the gap ranges from 22 percentage points (2 years after adoption) to 38 percentage poinst (9 years after adoption), althought the growth in the later years can again be attributed to continuation of the pre-existing trend.

The change in the composition of tax revenues shows that governments do respond to changes in tax efficiency - they start relying more heavily on the tax that becomes more efficient. My findings therefore should not be interpreted as a refutal of the models of public sector that use deadweight costs of taxes as one of the determinants of the size and scope of government. Rather, they show that the governments' response to efficiency shock on the "size" margin is statistically indiscernible, while the response on the "scope" margin is quite substantial. On the size margin, the demand factors appear to be the major force driving the data.

7 Results: timing of adoption

Since the motives behind the adoption of withholding are so crucial for the interpretation of the observed increases in taxes, I also explore them directly in this section. First, there is anecdotal evidence. In his survey, Murray (1964) asked state revenue officials to "identify and rank in order of importance the reasons behind the adoption of withholding in their state." The two reasons most often listed were a need for additional revenue and a desire for improved compliance. Hence both the demand and supply motives were present, although the demand motives ranked higher in the revenue officials' self-assessments. The relative importance of these motives may have changed over time, however. Murray reports that "eight of the first eleven [states that adopted withholding] list compliance considerations ahead of revenue while eight of the remaining fourteen list revenue first." There is indeed an interesting difference in the response of income taxes as well as other taxes between the two groups: I estimated the "demand for revenue" equations with dummies representing each year before and after adoption separately for the first 11 adopters and the remaining states. The estimates of the total effect are plotted against the time axis in Figures 15 (income taxes) and 16 (sales, corporation, property and license taxes)[38]. We can see that for the later adopters, the total effect of withholding on income tax revenues stabilized at around 22 percent above the pre-withholding level, after the initial jump due to the time shift in collections had waned off. In the states that adopted early, the total effect of withholding is similar to early adopters in the first three years after adoption. Afterwards, it grows sharply until it reaches 0.77 nine and more years after adoption. As if the early adopters discovered the great revenue raising potential of the withholding technology and responded exactly as the theory predicts, while the late adopters simply "cashed in" the efficiency effect and then did not respond at all. The response of other taxes, however, reveals that the early adopters were increasing these taxes simultaneously with the adoption of withholding, and then increased them again exactly at the same time when the growth of income taxes also accelerated. Therefore the accelerated growth of income taxes in the early adopters

[38] These are OLS estimates. Due to a small sample size, the 3SLS procedure produced implausible estimates with large standard errors for one of the groups.

that occurs three years after adoption cannot be attributed to a response to the efficiency improvement in income taxes but rather to a shock to the demand for government spending that manifested in the growth of all taxes. Why there was another demand shock three years after adoption in this subgroup remains an open question. In the late adopters, other taxes also jump up in the adoption year and then grow at a slower rate.

Somewhat paradoxically, the states that claimed that revenue considerations were a secondary motive behind the adoption (the early adopters) experienced higher increases both in income taxes and in other taxes than the states that openly claimed to have adopted withholding with the windfall of revenue in mind.

I use standard techniques of duration analysis to explore factors that influenced the timing of adoption. While the results only answer the question "when" rather than "why" states adopt withholding, they at least provide more hints for the motives behind.

The relationship between the explanatory variables and the timing of adoption depends on whether the adoption of withholding is motivated primarily by "demand" or "supply" considerations. The demand-driven adoption would be supported by finding that high levels of debt or low federal grants increase the likelihood of adoption. Both factors would be a signal of a need to raise more revenue either to pay off the debt or to compensate for low federal grants. Similarly, the adoption would be demand-driven if states with high level of taxes other than income tax were adopting early because high levels of other taxes would indicate a positive demand shock. If states with a high share of income that is difficult to tax and generally not subject to withholding (capital income and farm income) are more likely to adopt, that would also be consistent with the demand-driven adoption. The need to raise more revenue would induce pressure to improve collections from the tax base that is easier to tax - that is, wage income. On the other hand, the supply-driven adoption would be supported if states with a high share of capital and farm income adopted later - the efficiency benefit of withholding would be relatively smaller since the tax base that is primarily affected by withholding (wage income) is smaller. Under the supply explanation, higher income tax revenues per capita should increase the likelihood of adoption since the efficiency benefit of withholding is increasing in the amount of revenue that is to be raised. The same should hold for population, since the total efficiency gain from withholding depends not only on the revenue raised per capita, but also on the number of people from whom the tax is collected. Percentage of population that is urban is a variable that captures perhaps too many aspects. It is correlated with the size of government itself for "supply" as well as "demand" reasons.[39] It may also affect the benefits of withholding if the administration of withholding is easier in urban, industrial areas than in rural areas.

I estimate two alternative duration models. The first is the logit discrete-time hazard model with time-varying covariates, described in Allison (1984) and used, for example, by Fischback and Kantor (1998) to analyze the adoption of workers' compensation laws:

[39]Most empirical studies find a negative correlation between urban population and the size of government. This is generally explained as a scale effect: due to the public good aspects of many categories of government spending, the price of public goods per capita is lower in more densely populated areas. But people living in cities may also have a different demand for public goods.

$$\log[P(t|X)/(1 - P(t|X))] = a + bX + e$$

where $P(t|X)$ is the conditional probability of adoption in a discrete point in time t given that adoption did not occur prior to t and given the vector of covariates X. a and b are parameters of the model and e is the error term. Dummy variables representing distinct five-year intervals are included among the covariates to capture the baseline hazard.[40] The second model is the Weibull proportional hazard model with time-varying covariates. I chose 1943 as the origin of the time scale because since that was the year when withholding was "discovered" by the federal government and since then the states had the technology available for copying. A secular growth in most of the explanatory variables presents a potential concern: A government with an 8 percent ratio of general revenue to personal income, adopting withholding in 1960, would be considered relatively large in that year, while equally big government adopting withholding in 1970 would be considered relatively small. Therefore I estimate each model with the current values of regressors and also with their detrended values. The detrending is done as follows: For every fiscal variable y, I regress that variable on the withholding dummy, state and year dummies, and socio-economic controls. Then I compute the detrended value of $\widehat{y}_{it} = y_{it} - \hat{\lambda}_t$, where $\hat{\lambda}_t$ is the estimate of the year fixed effect. This method removes the time component from y_{it}. In the same way I detrended the socio economic variables, the only difference being that they were regressed only on state and year dummies since I have no good predictors of these variables.

Results are reported in Table 10. For logit estimates, the table reports the marginal effects of regressors on the hazard rate.[41] For Weibull estimates, the table reports the hazard ratios. The results are fairly robust to the use of current versus detrended values of regressors and to model specification. A sharp finding emerges: higher income tax revenues significantly increase the hazard rate, and they are the only variable that has a significant effect on adoption in all specifications. The only other regressor that is significant in more than one specification is population, which has a negative effect on the hazard rate. The effect of population is, however, largely driven by California, which is a large state but adopts withholding as late as 1971. If California is taken out of the regression, the estimated marginal effect of population (in the logit model) has the same magnitude but is not significant. The estimated marginal effect of income tax revenues is quite substantial: a 10-percent increase in income taxes per capita (which, in pre-withholding years, would represent 4.5 dollars on average) increases the hazard rate by 0.0905. Since the average hazard rate in the sample is 0.055, this represents a 17-percent increase in the hazard rate.

The finding of a positive effect of income taxes on the likelihood of adoption is consistent with the "supply-driven" explanation for adoption. The states that already had large income taxes have turned to withholding early since for them the benefits of doing so were greatest. On the other hand, the finding of a negative effect of population on adoption is somewhat puzzling

[40] The use of year dummies would be inappropriate since there are many years when no state adopts withholding. In such years the year dummies would fully "explain" non-adoption. Clustering into five year intervals smoothes out these implausible jumps in the estimated baseline hazard.

[41] The marginal effects are computed for each observation and then averaged across observations.

since it goes against the supply explanation. How do we reconcile these results with increases in all taxes that accompanied withholding, which point out so strongly toward the demand-driven adoption? First, Figure 10 has revealed that there was a growth trend in income tax revenues in the years before withholding. It mechanically leads to the result that higher income taxes increase the hazard rate, while in fact it may be a manifestation of the demand shock that induced the adoption of withholding. Second, the presence of demand motives was revealed from the evolution of tax revenues after the adoption of withholding, while the duration analysis truncates the data upon failure, so the post-withholding observations on taxes did not enter the duration analysis. Lastly, the pre- and post-withholding dummies that identified demand motives in the regressions are picking up changes in the demand for tax revenues due to unobservable variables correlated with withholding. It is not therefore surprising that we did not discover demand motives from observable variables in the duration analysis.

8 Results: expenditures, federal grants, and debt

In this section I analyze how income tax withholding changed the composition of expenditures, federal grants, and debt, and assess its contribution to the overall size and growth of state governments. Having found that withholding substantially increased the income tax revenues, and was associated with increases in other taxes, a natural question emerges: What did the states do with the extra money? An answer to this question would reveal where the demand shocks that motivated the adoption of withholding came from. It also provides an additional opportunity to discriminate between exogenous vs. endogenous adoption. If the adoption of withholding were supply-driven, we should expect the revenue windfall to be distributed roughly equally across expenditure categories. However, if adoption was demand-driven, we should expect the demand shock to come from only some expenditure categories, say welfare or education, and therefore withholding should have increased expenditures only in selected categories.

I estimate a simple system of demand for expenditures equations:

$$\begin{aligned} y_{it}^{j} &= \alpha^{j} D_{it} + \beta^{j} X_{it} + \gamma^{j} G_{it} + \lambda_{i}^{j} + \lambda_{t}^{j} + \varepsilon_{it}^{j},\ j = 1...K \\ G_{it} &= \alpha^{g} D_{it} + \beta^{g} X_{it} + \gamma^{g} Z_{it} + \lambda_{i}^{g} + \lambda_{t}^{g} + \varepsilon_{it}^{g} \end{aligned}$$

where the superscript j denotes a j^{th} category of expenditures, D is the withholding dummy, X is a vector of socio-economic controls, G denotes federal grants, $\lambda' s$ are state and year dummies and Z is the political productivity index, an instrument for the federal grants. The expenditure categories studied are: Education, health and hospitals, public welfare, highways, natural resources, public safety, and other general expenditure.[42] All fiscal variables are measured in per capita terms. I estimate the system both in log and linear specification.

[42] General expenditure is defined as all state expenditure other than expenditure on state liquor stores, public utilities, and insurance trust expenditure.

Results are shown in Tables 11 and 12. The log specification shows a significant decline in education expenditures by 14 percent, and a significant rise in welfare expenditures by 38 percent. In the linear specification, the education expenditure per capita have actually risen by $7 but the effect is insignificant, the same is true for welfare expenditure which rose by $6. On the other hand, the linear specification shows a statistically significant decline in expenditures on natural resources (by $2.4) and public safety ($1.6), and an increase in highway expenditures ($10). The estimated increases are smaller than the extra revenue from the income tax minus the decline in federal grants, so this analysis does not fully capture what the states did with the money.

The speed of response for each expenditure category is shown in figure 17. They plot coefficients on the before- and after-year dummies from the log specification. They show that the educational expenditures were declining[43] before withholding, and they levelled-off afterwards. So the negative coefficient from table X column (1) cannot be interpreted that withholding cause a decline in educational expenditures but rather that it prevented a further decline. Expenditures on health and hospitals start growing three years after withholding. Welfare expenditures increased sharply (by 30 percent) in the last four years preceding the adoption, then continued to grow, although withholding appears to have slowed down their growth. This result can be interpreted, however, that the pre-withholding growth of welfare expenditures (which accelerated just before adoption) stimulated the adoption so that additional revenues would cover the increased demand for welfare expenditures. Finally, the expenditures on highways and public safety do not show any response to withholding, and expenditures on natural resources start actually declining after withholding.

Overall, the results are too weak to identify specific expenditure categories on which the windfall of income tax revenues was spent and ascertain with confidence where the demand shocks came from.

There were also sources of demand motives that do not appear in the general expenditure. An interesting by-product of the regressions is the decline in federal grants that is associated with withholding. It appeared already in the tax regressions and shows again in the expenditure regressions. The magnitude of the estimated decline ranges from 3.8 to 7.3 percent in log specifications; in linear specifications, it is approximately $18.5 per capita in all regressions. Figure 19 shows the speed of adjustment of federal grants. They were declining, conditional on their observable determinants, already before the adoption, and the decline slowed down after adoption. The need to compensate for the federal grants may have been a relevant demand motive behind the adoption of withholding.

Another demand motive was probably rising state debt and the need to repay it. Figure 18 shows the ratio of debt to general revenue, averaged across states with the income tax, for each year before and after withholding. We can see that debt was growing fast in the years prior to withholding. In particular, the ratio of debt to general revenue rose sharply just the last year before the adoption of withholding, from 44 to 53 percent. If we abstract from

[43] Using the word "declining" is a slight abuse of language. The expenditures were in fact rising in absolute terms. Instead, they were only declining relative to what we predict they should be based on the observable explanatory variables.

the accumulation of interest on the previous debt, this means that the states have spent 9 percent more money than they collected before withholding. After withholding, state debt stops growing and stabilizes at around 50 percent of revenues. The states were clearly running short of revenues and withholding, accompanied by increases in other taxes, helped stabilize the budgets. The rising debt may also explain some of the patterns of spending in Figure 17. The increases in public welfare, natural resources, and public safety spending that occurred between the fourth and first year before the adoption were the likely factors behind the growing debt. We can speculate that the reason why they did not continue to grow after withholding was the need to stop the growth of debt.

Finally, I would like to assess the contribution of withholding to the overall growth of state governments. One important results was mentioned in section 6: Withholding produced only a one-time shift in the level of income taxes, but did not accelerate their growth. How important was the level effect? The estimates of the total effect from column (5) of Table 5 tell us that income tax revenues increased by 37.7 percent above their pre-witholding level. This number is in fact an overestimate of the level effect as it captures also the continuing growth trend in income tax revenues. Since the ratio of income tax revenues to personal income was, on average, 0.67 percent one year before adoption, the level effect added 0.25 percentage points. During the sample period, the ratio of income taxes to personal income increased from 0.31 percent to 1.93 percent. So even if we did attribute the level effect to a causal relationship between tax efficiency and size of government, we would still explain only 15 percent of the overall growth in income tax revenues. And this was most likely the single biggest improvement in the tax collection technology during the period were are studying. In terms of empirical relevance, growth in demand for government seems to be a far more important reason behind the growth of income taxes than declining costs of tax collections.

Because income taxes represented 15.2 percent of total tax revenues prior to adoption, withholding contributed an accordingly smaller amount to the overall growth of total tax revenues. The change of income taxes/personal income ratio by 0.25 percentage points represents a 5.3 percent increase in total tax revenues. Over the sample period, the ratio of state tax revenues to personal income has increased from 3.7 percent to 6.4, a 73-percent increase, therefore the increases in income tax revenues associated with withholding account for about 9 percent of the growth of government during the 1944-1980 period.

9 Conclusions

The paper uses the historical experience with income tax withholding at the state level to test a common prediction of positive models of public sector that governments should get bigger when they become more efficient in raising taxes. The main results are that withholding indeed made state income taxes much more efficient, and generated about 22 percent of additional revenue at given tax rates. The governments did not return any of this windfall back to taxpayers by cutting income tax rates, so income tax revenues permanently increased. Since the adoption of withholding was accompanied by increases in other taxes, the direction of causality was more likely from the need to raise more revenue to withholding, rather than the other way around. The data thus fail to show a significant effect of improved efficiency of taxes on the size of government. However, I find that withholding had a large impact on the composition of revenues, as governments started to rely more heavily on the tax that had suddenly become much more efficient. This prediction of positive models of public sector is strongly supported. An important contribution toward explaining the real world is that, despite popular beliefs, withholding did not accelarate the growth of income taxes.

References

[1] Allison, Paul D.: Even History Analysis: Regression for Longitudinal Event Data, Sage 1984.

[2] Becker, Gary S. and Casey B. Mulligan: Deadweight Costs and the Size of Government, NBER Working Paper 6789, 1998.

[3] Becker, Gary S. and Casey B. Mulligan: Accounting for the Growth of Government, manuscript, 1999.

[4] Bertrand, Marianne, Esther Duflo and Sendhil Mullainathan: How Much Should We Trust the Difference-in-Differences Estimates?, MIT working paper, mimeo 2001.

[5] Borcherding, Thomas E. and Robert T. Deacon: The Demand for the Services of Non-Federal Governments, The American Economic Review, Vol. 62, No. 5. (Dec., 1972), pp. 891-901.

[6] Brennan, Geoffrey and James M. Buchanan: The Power to Tax, Cambridge University Press, 1980.

[7] Dušek, Libor: Visibility of Taxes and the Size of Government, University of Chicago working paper, mimeo 2001.

[8] Fishback, Price V. and Shawn Everett Kantor: The Adoption of Workers' Compensation in the United States, 1900-1930, Journal of Law and Economics, Vol. 41 (October 1998), pp. 305-341.

[9] Friedman, Milton and Rose D. Friedman: Two Lucky People: Memoirs, University of Chicago Press, 1998.

[10] Grossman, Gene M. and Elhanan Helpman: Electoral Competition and Special Interest Politics, The Review of Economic Studies, Vol. 63, No. 2 (Apr., 1996), pp. 265-286.

[11] Hettich, Walter and Stanley L. Winer: Economic and Political Foundations of Tax Structure, American Economic Review, Vol. 78, No. 4. (Sep., 1988), pp. 701-712.

[12] Hines, James R.Jr., and Richard H. Thaler: Anomalies: The Flypaper Effect, The Journal of Economic Perspectives, Vol. 9, No. 4. (Autumn, 1995), pp. 217-226.

[13] Holsey, Cheryl M. and Thomas E. Borcherding: Why does government's share of national income grow? An assessment of the recent literature on the U.S. experience, in Mueller, Dennis C. (ed.): Perspectives on public choice: a handbook, Cambridge University Press, 1997.

[14] Husted, Thomas A. and Lawrence W. Kenny: The Effect of the Expansion of the Voting Franchise on the Size of Government, Journal of Political Economy, Vol. 105, No. 1. (Feb 1997), pp. 54-82.

[15] Kau, James B. and Paul H. Rubin: The Size of Government, Public Choice, Vol. 37 (1981), pp. 261-274.

[16] Kezdi, Gabor: Robust Standard Error Estimation in Fixed-Effects Panel Models, University of Michigan working paper, mimeo 2001.

[17] Lott, John R., and Lawrence W. Kenny: Did Women's Suffrage Change the Size and Scope of Government?, Journal of Political Economy, Vol.107, No.6. (December 1999), pp. 1163-1198.

[18] Matsusaka, John G.: The Effects of the Voter Initiative: Evidence from the Last 30 Years, Journal of Political Economy, Vol.103, No.3. (June 1995), pp. 587-623.

[19] Meltzer, Allan H. and Scott F. Richards: A Rational Theory of the Size of Government, Journal of Political Economy, Vol.89, No.5. (Oct 1981), pp. 914-927.

[20] Mueller, Dennis C.: Public Choice II, Chapter 17 (?), Cambridge University Press, 1989.

[21] Murray, Alan P.: Wage Withholding and State Income Taxes, National Tax Journal, Vol.17, No. 4 (1964), pp. 403-417.

[22] Oates, Wallace E.: On the Nature and Measurement of Fiscal Illusion: A Survey, reprinted in Oates, Wallace E. (ed.): Studies in Fiscal Federalism, Edward Elgar Publishing 1991, pp. 431-448.

[23] Peltzman, Sam: The Growth of Government, Journal of Law and Economics, Vol.23, No. 2 (Oct 1980), pp. 209-87.

[24] Penniman, Clara: State income taxation, Johns Hopkins University Press 1980.

[25] Samuelson, Paul A.: The Pure Theory of Public Expenditure, The Review of Economics and Statistics, Vol.36, No. 4. (Nov 1954), pp. 387-389.

[26] Slemrod, Joel and Shlomo Yitzhaki: Tax Avoidance, Evasion and Administration, NBER Working Paper 7473.

[27] Summers, Lawrence, Jonathan Gruber and Rodrigo Vergara: Taxation and the Structure of Labor Markets: The Case of Corporatism, Quarterly Journal of Economics, Vol. 108, No. 2. (May 1993), pp. 385-411.

[28] Wallis, John J.: American Government Finance in the Long Run: 1790 to 1990, Journal of Economic Perspectives, Vol.14, No.1. (Winter 2000), pp. 61-82.

[29] Wallis, John J.: What Determines the Allocation of National Government Grants to the States? NBER working paper H0090 (July 1996).

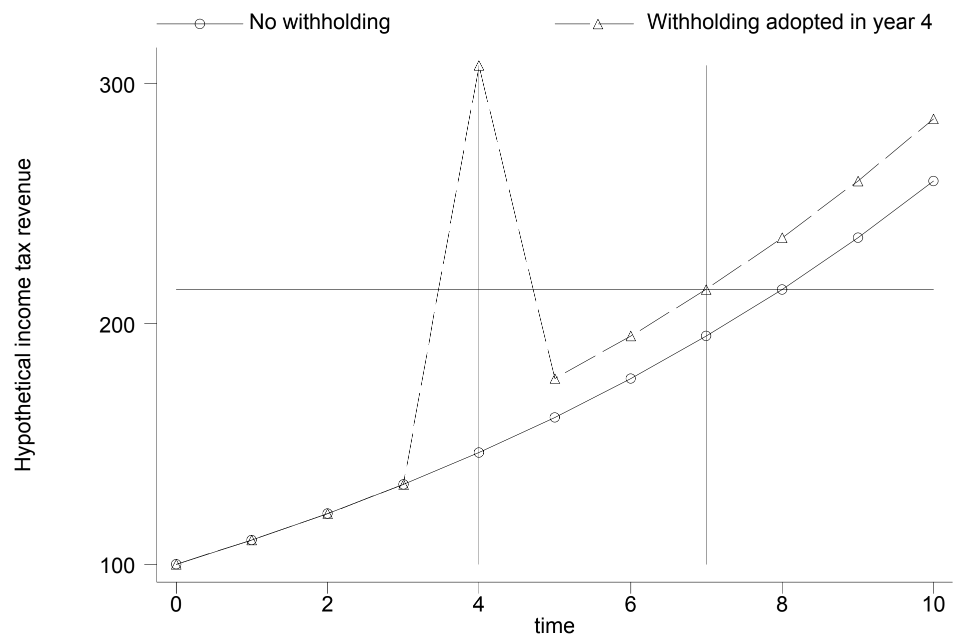

Figure 1: Time shift in tax collections

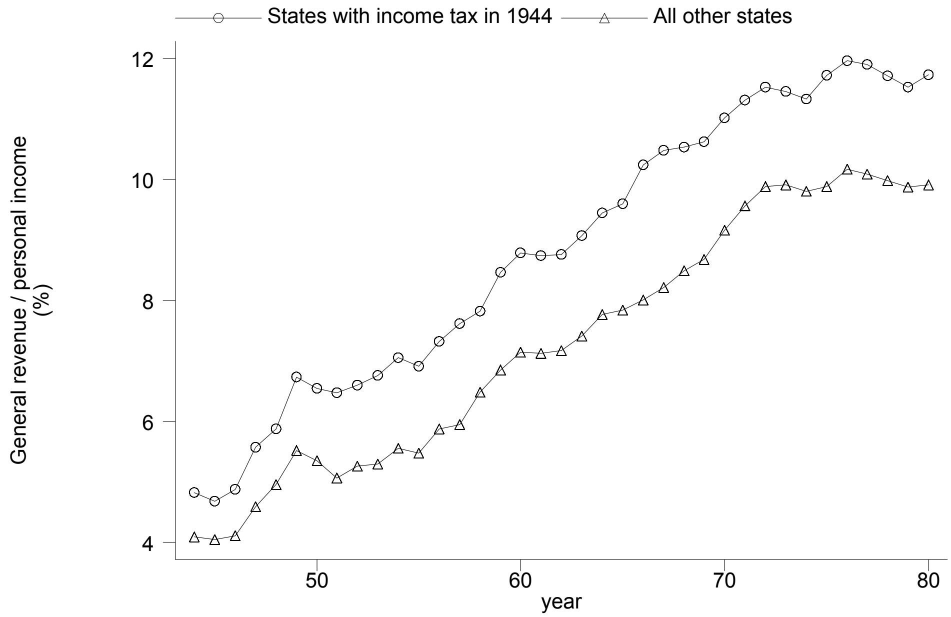

Figure 2: General revenue / personal income, average across states

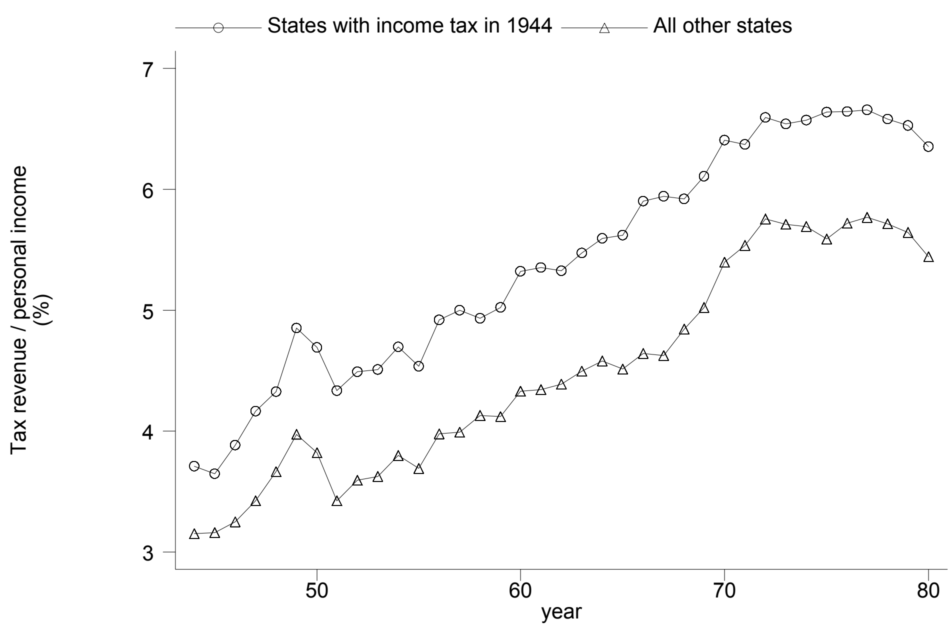

Figure 3: Tax revenue / personal income, average across states

Figure 4: Income tax revenue / personal income, average across states

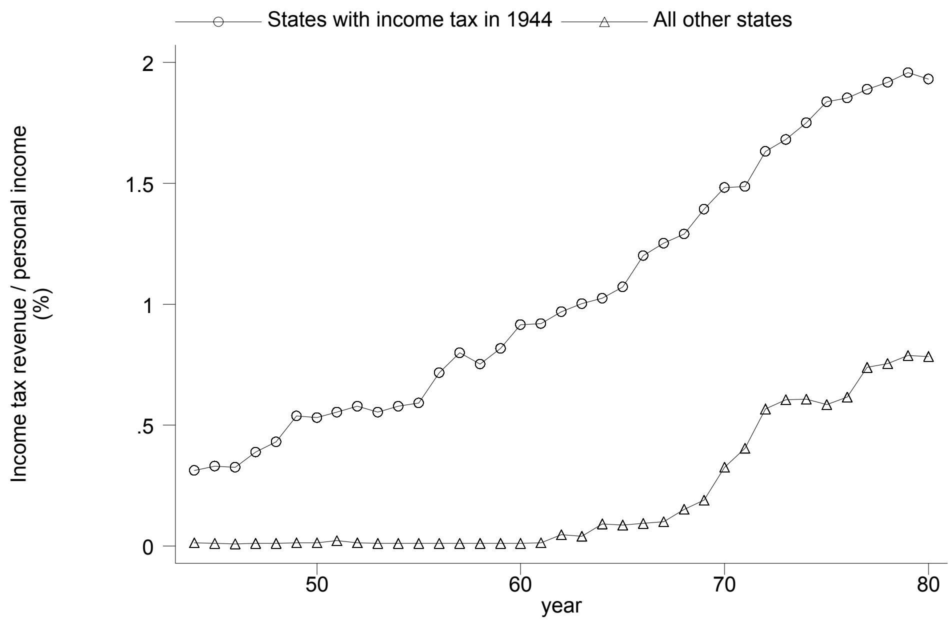

Figure 5: Statutory tax rates, average across states

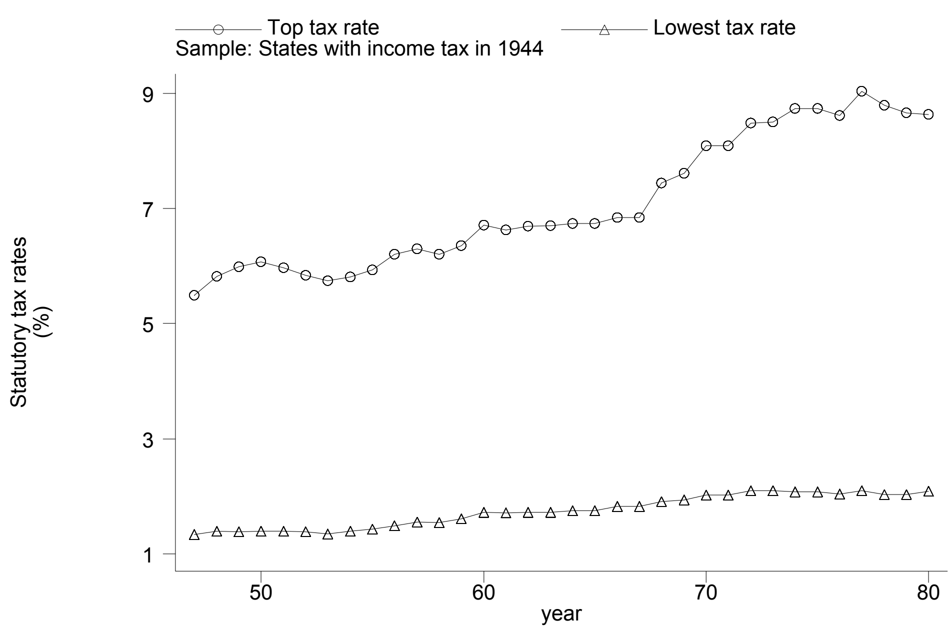

Figure 6: Income tax revenues before and after withholding (raw data)

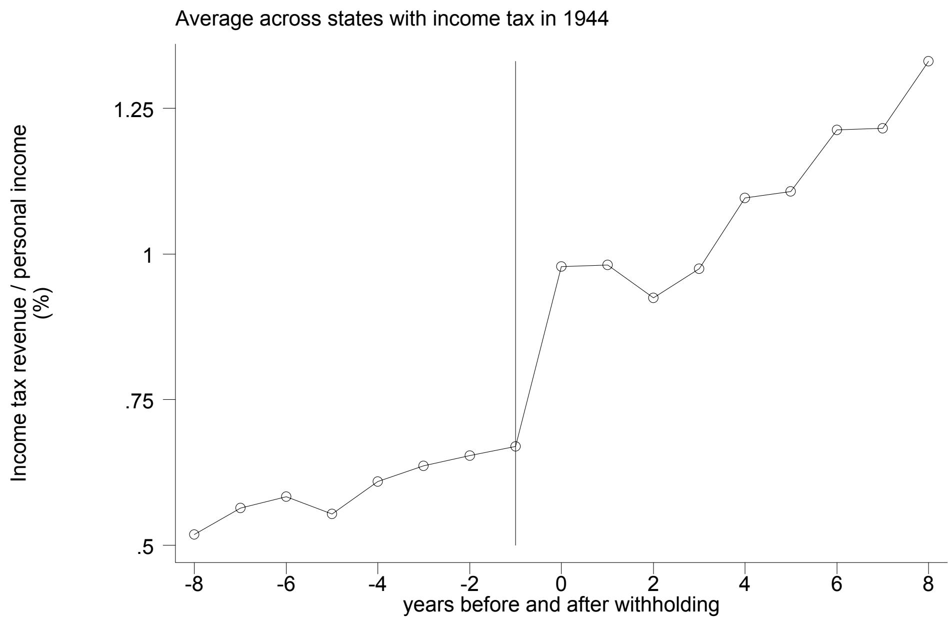

Figure 7: Sales, corporation, property and license taxes before and after withholding (raw data)

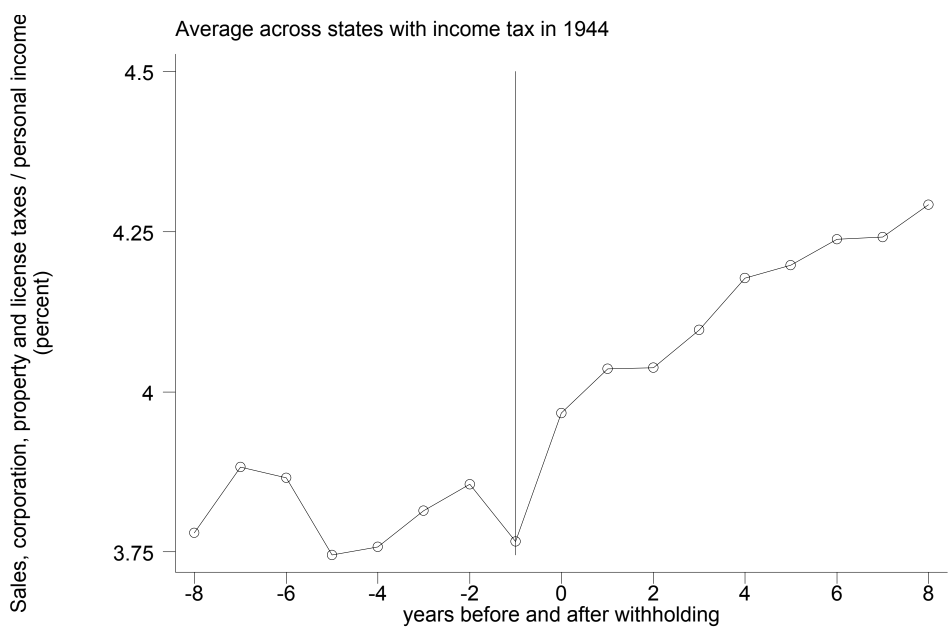

Figure 8: Growth rate of income tax revenues before and after withholding (raw data)

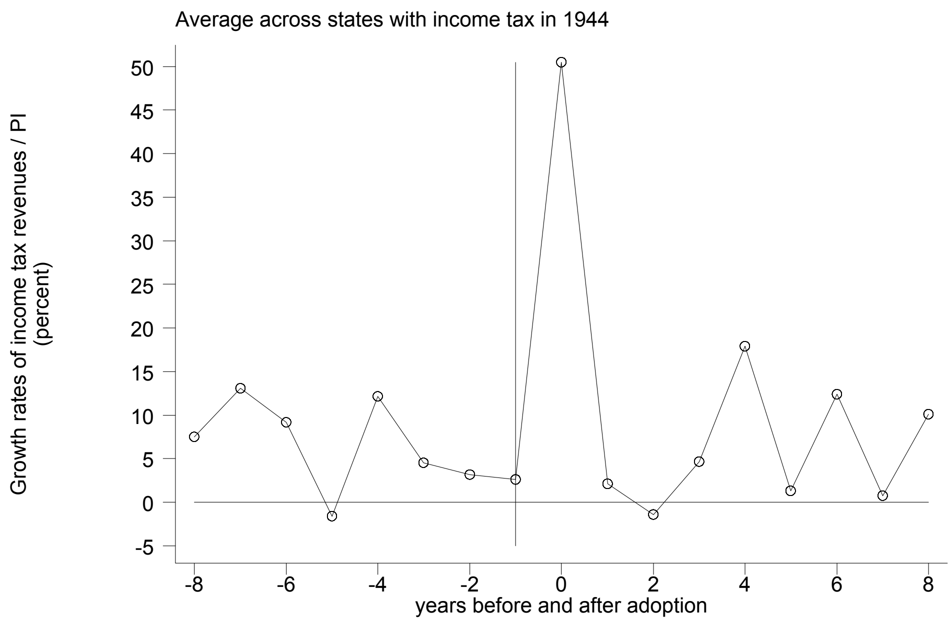

Figure 9: Efficiency effect, speed of response to withholding

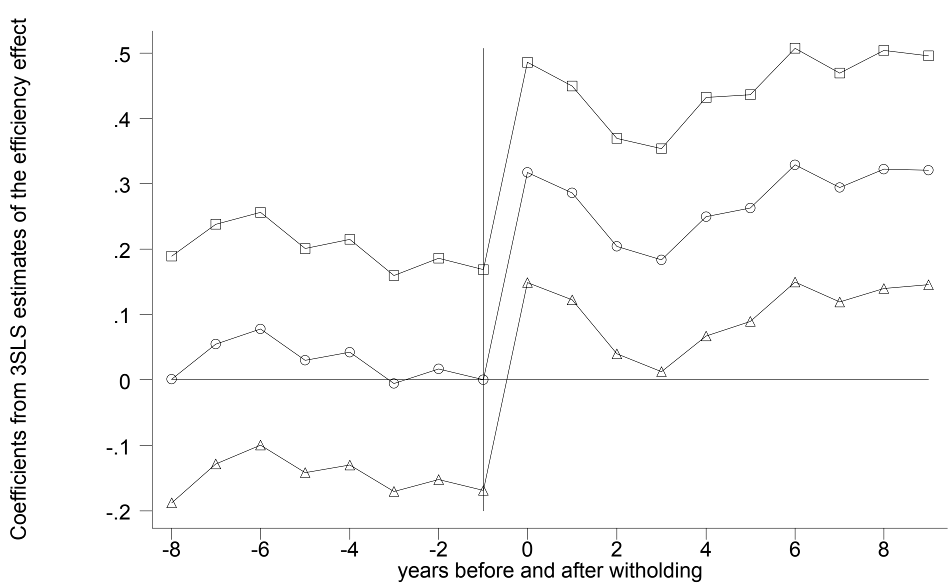

Figure 10: Demand for income tax revenues, speed of response to withholding

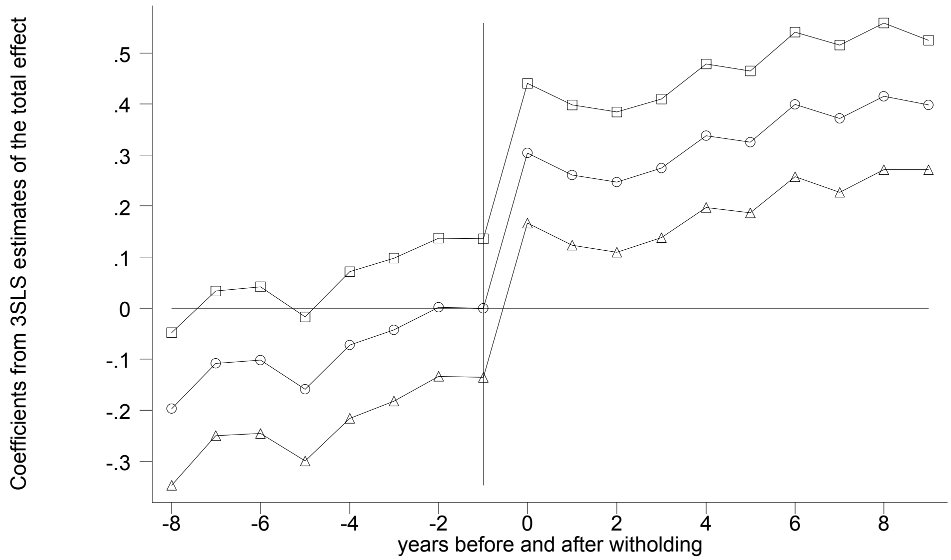

Figure 11: Efficiency effect and demand for income tax revenue, speed of response

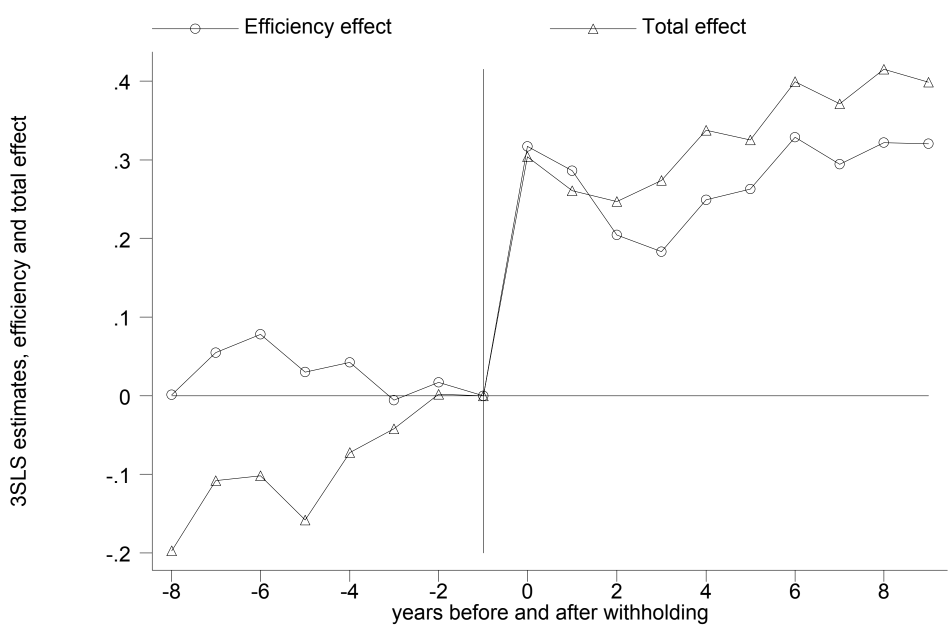

Figure 12: Response of sales, corporation, property and license taxes

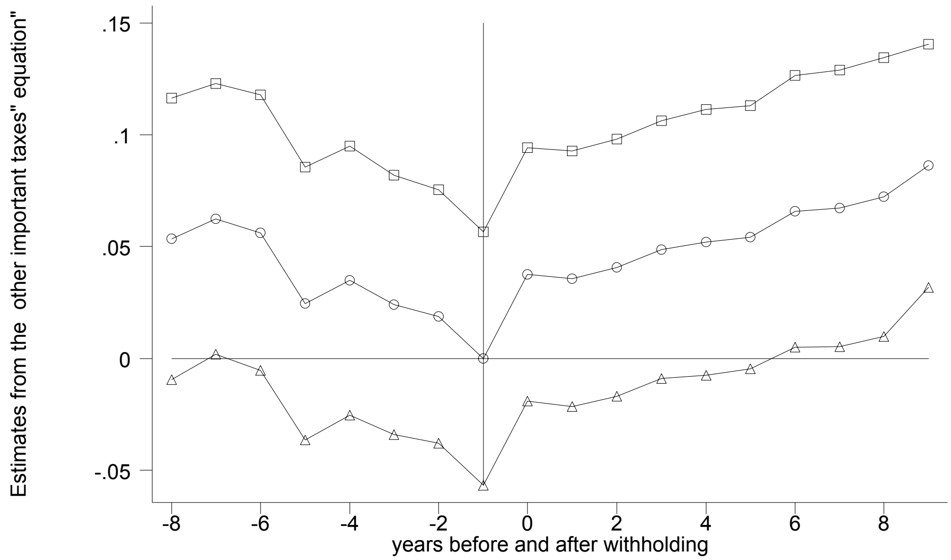

Figure 13: Response of miscellaneous taxes

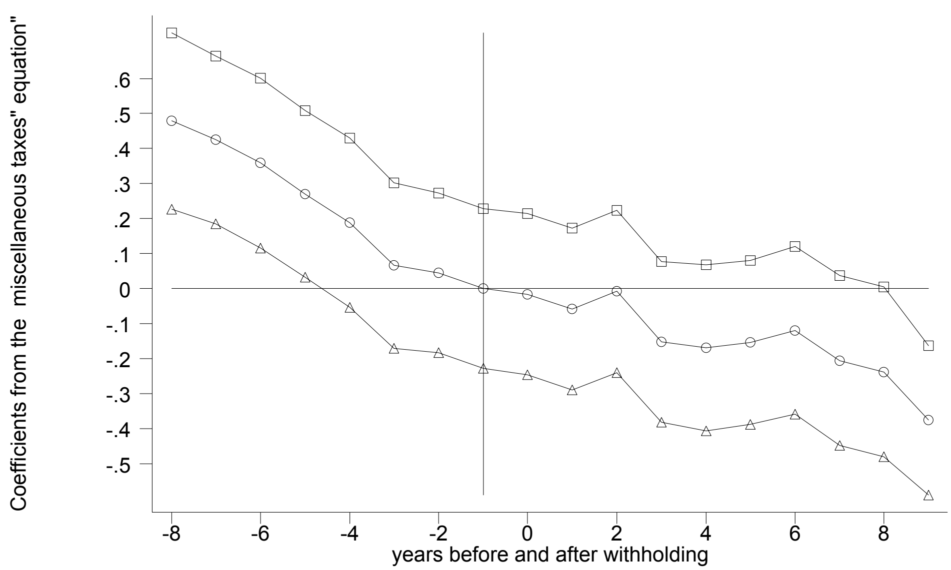

Figure 14: The impact of withholding on the share of income tax in tax revenues

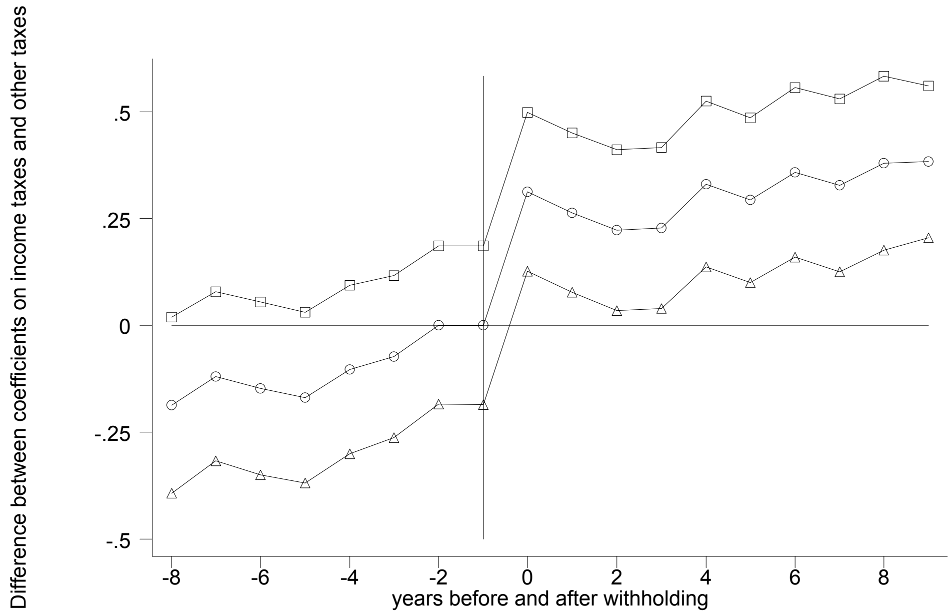

Figure 15: Demand for income tax revenue, early vs. late adopters

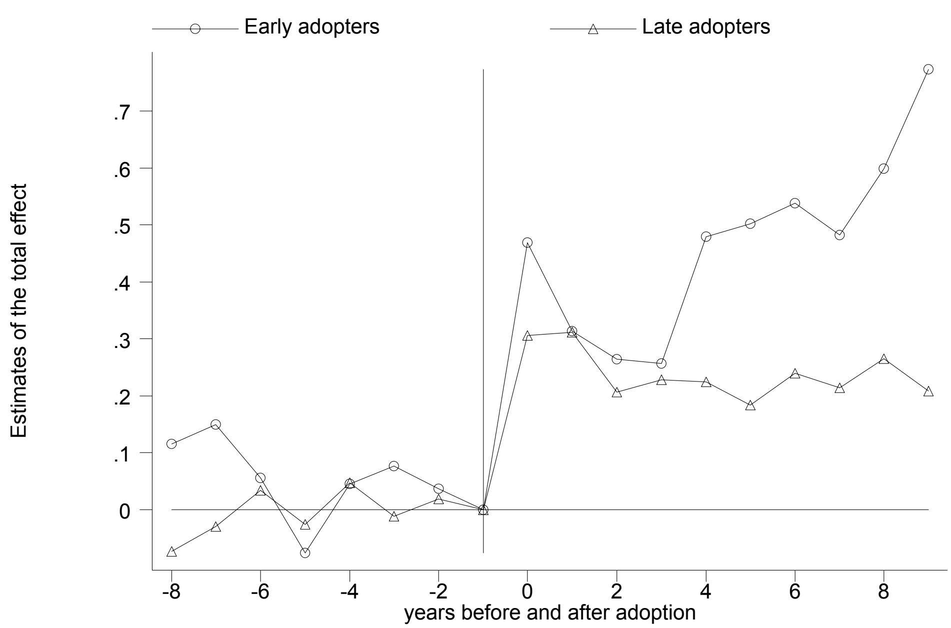

Figure 16: Response of sales, corporation, property and license taxes, early vs. late adopters

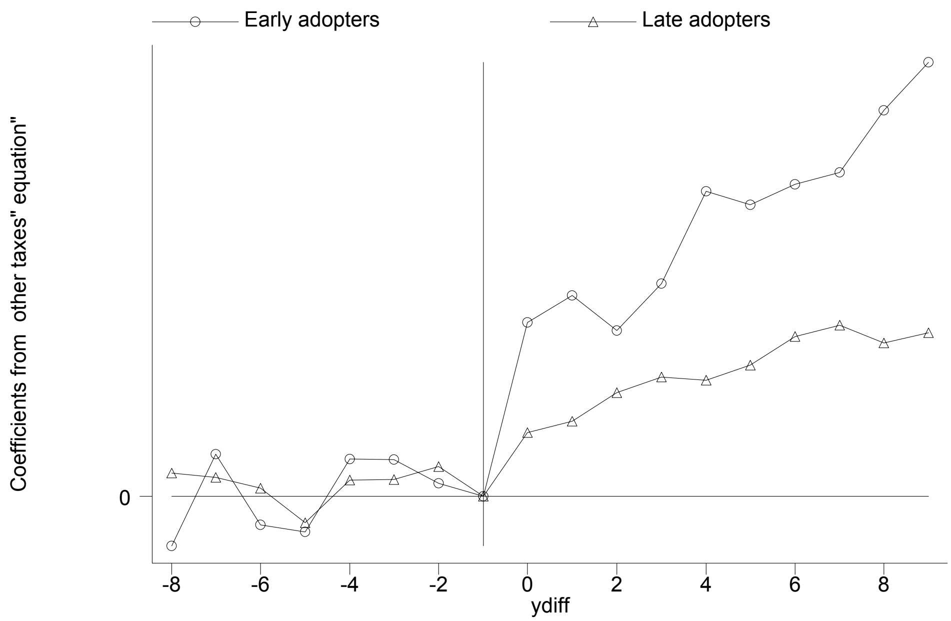

Figure 17: Response of expenditures, by category

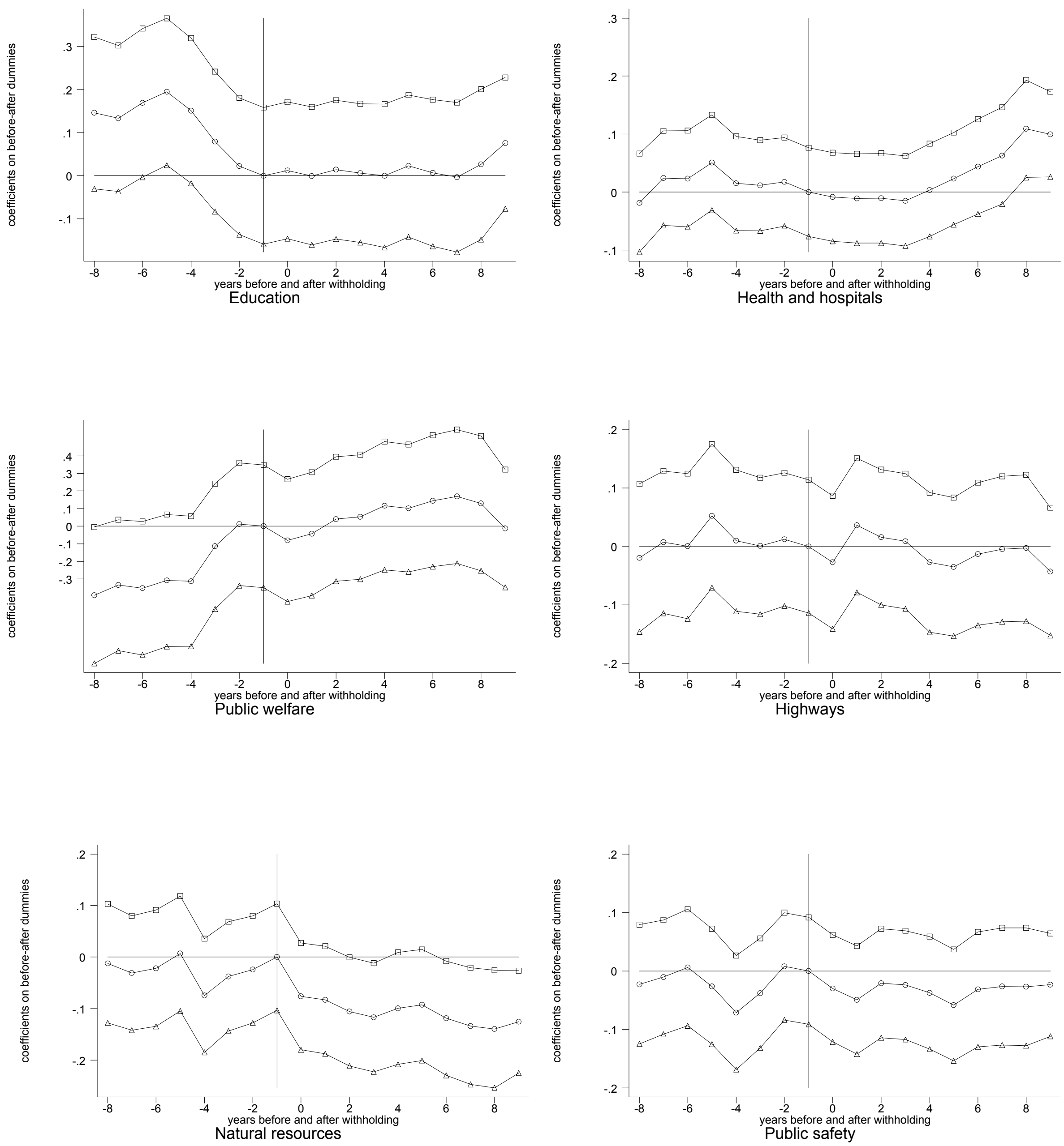

Figure 18: Ratio of debt to general revenue (raw data)

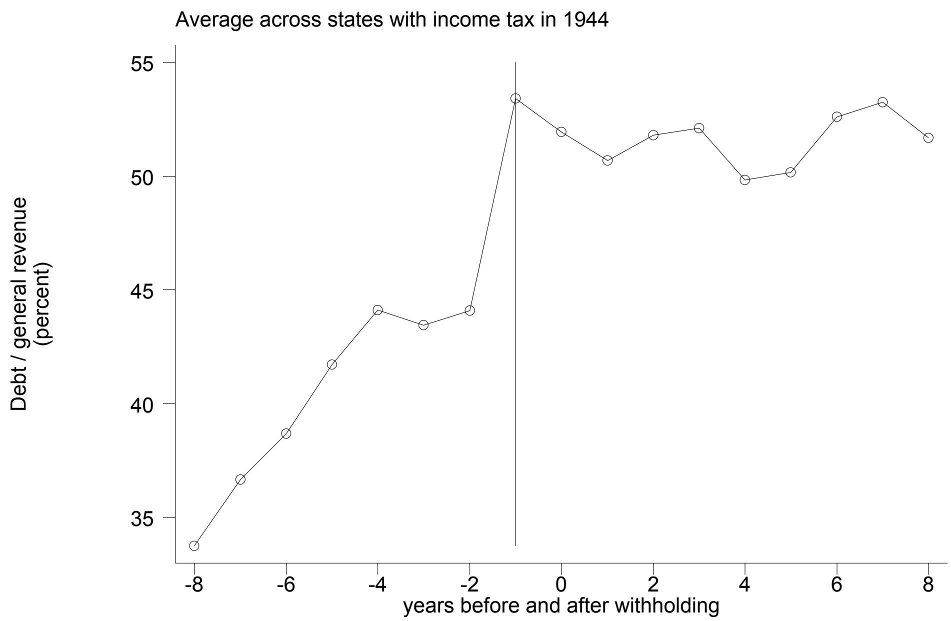

Figure 19: Response of federal grants

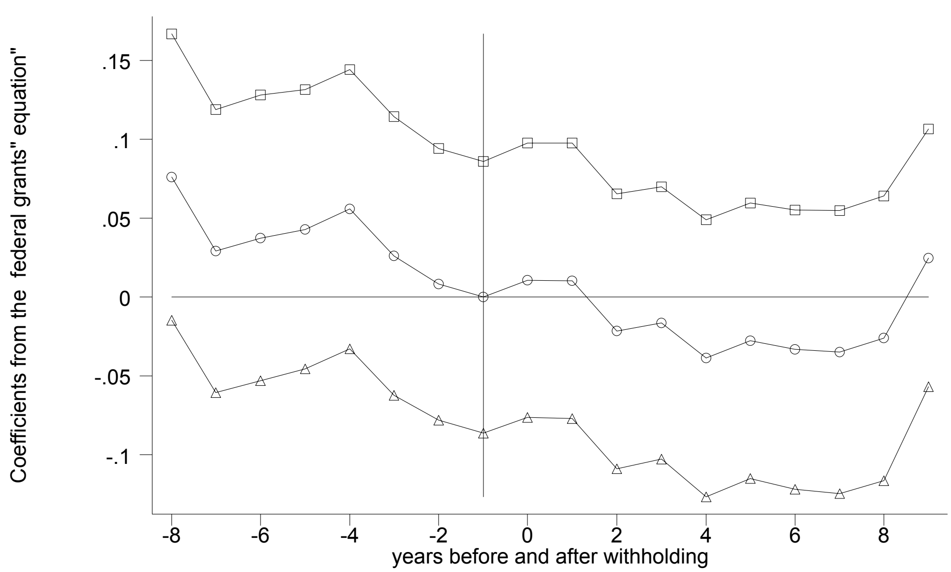

Table 1

Adoption of income tax withholding

Year	States adopting withholding
1948	Oregon (1930)
1949	Delaware (1917)
1951	Vermont (1931)
1954	Arizona (1933), Colorado (1937), Kentucky (1936)
1955	Idaho (1931), Maryland (1937), Montana (1933)
1956	Alabama (1933)
1959	Massachusetts (1916), North Carolina (1921), New York (1919), South Carolina (1922), Utah (1931)
1960	Georgia (1929)
1961	Louisiana (1934), Minnesota (1933), Missouri (1917), New Mexico (1933), Oklahoma (1915), West Virginia (1961)
1962	Wisconsin (1911)
1963	Indiana (1963), Virginia (1931)
1966	Arkansas (1929), Iowa (1934), Kansas (1933)
1967	Michigan (1967), Nebraska (1967)
1968	Mississippi (1912)
1969	Illinois (1969), Maine (1969)
1971	California (1935), Ohio (1971), Pennsylvania (1971), Rhode Island (1971)
1976	New Jersey (1976)
1987	North Dakota (1919)

States with narrow - based income tax:
Connecticut, New Hampsire, Tennessee

States without income tax:
Florida , Nevada, Wyoming
South Dakota, Texas, Washington

(Numbers in parentheses indicate the year in which a state adopted the individual income tax.)

Table 2

Summary statistics

States that had a broad-based income tax in 1944, years 1944-1980

Variable	obs	mean	std. dev	min	max
Withholding dummy	1073	0.56	0.50	0.00	1.00
General revenue per capita	1073	788	327	260	1,767
General revenue / personal income	1073	8.85	3.04	3.07	18.03
Federal grants per capita	1073	201	118	18	596
Federal grants / personal income	1073	2.26	1.23	0.22	6.28
Tax revenue per capita	1073	480	165	202	1,064
Tax revenue / personal income	1073	5.41	1.37	2.26	8.88
Income tax revenue per capita	1073	103	91	7	467
Income tax revenue / personal income	1073	1.06	0.78	0.10	3.77
Share of income tax in tax revenue	1073	19.14	11.82	1.90	59.64
Lowest statutory tax rate	982	1.74	0.86	0.50	5.74
Top statutory tax rate	982	7.09	3.17	1.70	20.13
Lowest tax bracket	926	2,193	2,262	500	10,000
Top tax bracket	926	19,548	25,598	3,000	106,000
Sales taxes per capita	1073	136	33	43	293
Corporation income taxes per capita	1073	103	91	7	467
Property taxes per capita	1073	15	16	0	97
License taxes per capita	1073	55	35	14	328
Education expenditure per capita	1073	271	179	6	803
Health and hospital expenditure per capita	1073	53	26	9	154
Welfare expenditure per capita	1073	113	72	1	400
Highway expenditure per capita	1073	151	83	7	490
Natural resources expenditure per capita	1073	27	14	3	90
Public safety expenditure per capita	1073	21	12	4	77
Population	1073	3,442,578	3,927,576	285,000	23,700,000
Income per capita	1073	7,684	2,459	2,859	14,417
Percent black	1073	11.0	12.2	0.0	47.6
Percent elderly	1073	9.0	1.9	4.5	13.7
Percent urban	1073	58.6	15.6	23.0	91.3
Farm income / personal income	1073	8.0	7.6	0.2	58.5
Interest and divident income / total income	1073	12.5	2.8	5.0	24.0
Share of Democrats in state legislature	1073	63.1	27.0	1.2	100.0
Index of political productivity	1073	0.0005	0.0006	0.0000	0.0052

Note: Fiscal variables per capita are in real (1982) dollars.

Table 2 - cont.
Summary statistics

All other states, years 1944-1980

Variable	obs	mean	std. dev	min	max
Withholding dummy	703	0.16	0.36	0.00	1.00
General revenue per capita	703	720	319	240	1,981
General revenue / personal income	703	7.31	2.83	2.24	16.19
Federal grants per capita	703	185	131	22	779
Federal grants / personal income	703	1.88	1.29	0.18	8.18
Tax revenue per capita	703	443	162	177	971
Tax revenue / personal income	703	4.50	1.33	1.62	8.53
Income tax revenue per capita	703	22	51	0	270
Income tax revenue / personal income	703	0.21	0.46	0.00	2.17
Share of income tax in tax revenue	703	3.70	7.67	0.00	32.30
Lowest statutory tax rate	108	1.97	0.93	0.50	4.60
Top statutory tax rate	108	5.11	3.17	1.90	13.30
Lowest tax bracket	67	2,928	4,573	0	20,000
Top tax bracket	67	97,418	74,315	0	200,000
Sales taxes per capita	703	153	47	53	391
Corporation income taxes per capita	703	22	51	0	270
Property taxes per capita	703	19	26	0	195
License taxes per capita	703	59	21	14	151
Education expenditure per capita	703	225	156	8	652
Health and hospital expenditure per capita	703	50	24	10	169
Welfare expenditure per capita	703	103	67	3	372
Highway expenditure per capita	703	159	109	7	733
Natural resources expenditure per capita	703	25	20	4	203
Public safety expenditure per capita	703	20	10	6	88
Population	703	4,286,133	3,807,542	143,000	14,200,000
Income per capita	703	8,463	2,430	3,856	14,583
Percent black	703	6.3	5.4	0.1	25.0
Percent elderly	703	9.6	1.9	5.4	17.3
Percent urban	703	65.3	15.1	28.0	89.0
Farm income / personal income	703	5.3	6.9	0.1	49.1
Interest and divident income / total income	703	13.1	2.6	5.7	25.4
Share of Democrats in state legislature	703	52.7	21.8	1.8	10.0
Index of political productivity	703	0.0009	0.0008	0.0001	0.0033

Note: Fiscal variables per capita are in real (1982) dollars.

Table 2 - cont.

Summary statistics

States with an income tax, one year before adoption of withholding

Variable	obs	mean	std. dev	min	max
Withholding dummy	28	0.00	0.00	0.00	0.00
General revenue per capita	28	615	189	343	1,178
General revenue / personal income	28	7.67	2.54	4.02	13.94
Federal grants per capita	28	157	76	43	381
Federal grants / personal income	28	1.97	0.97	0.44	3.95
Tax revenue per capita	28	383	90	230	666
Tax revenue / personal income	28	4.76	1.23	2.98	8.22
Income tax revenue per capita	28	58	38	14	149
Income tax revenue / personal income	28	0.67	0.34	0.22	1.48
Share of income tax in tax revenue	28	15.23	8.39	2.76	35.67
Lowest statutory tax rate	27	1.52	0.63	0.75	3.08
Top statutory tax rate	27	5.82	2.31	2.00	12.08
Lowest tax bracket	25	2,440	2,489	500	10,000
Top tax bracket	25	15,980	21,432	4,000	100,000
Sales taxes per capita	28	132	22	71	170
Corporation income taxes per capita	28	58	38	14	149
Property taxes per capita	28	14	14	0	57
License taxes per capita	28	53	22	22	129
Education expenditure per capita	28	192	92	41	397
Health and hospital expenditure per capita	28	45	17	23	90
Welfare expenditure per capita	28	99	70	21	360
Highway expenditure per capita	28	163	53	32	246
Natural resources expenditure per capita	28	27	12	10	58
Public safety expenditure per capita	28	17	6	7	35
Population	28	3,561,605	4,461,838	316,000	20,300,000
Income per capita	28	6,667	1,574	4,584	11,995
Percent black	28	11.3	12.4	0.1	37.8
Percent elderly	28	8.8	1.9	5.6	12.2
Percent urban	28	59.0	14.3	36.6	90.9
Farm income / personal income	28	7.2	4.6	0.6	17.7
Interest and divident income / total income	28	12.5	2.7	8.2	22.3
Share of Democrats in state legislature	28	66.0	28.5	7.8	100.0
Index of political productivity	28	0.0006	0.0007	0.0001	0.0039

Note: Fiscal variables per capita are in real (1982) dollars.

Table 4

OLS estimates of the impact of withholding on income taxes

Sample: states that had income tax in 1944, years 1944-1980

Dependent variable:	OLS Income tax revenue (technology)	OLS Income tax revenue (technology)	OLS Income tax revenue (demand)
	(1)	(2)	(3)
Withholding dummy	**0.264**	**0.24**	**0.285**
	[0.061]*	***[0.055]****	***[0.068]****
Lowest tax rate	0.041	-0.514	
	[0.062]	*[0.557]*	
Top tax rate	0.443	1.466	
	*[0.094]**	*[0.342]**	
Lowest tax bracket		-0.059	
		[0.075]	
Top tax bracket		0.1	
		[0.083]	
Lowest bracket * lowest rate		0.077	
		[0.075]	
Top bracket * top rate		-0.095	
		[0.035]	
Income per capita	1.577	1.648	1.079
	*[0.240]**	*[0.212]**	*[0.257]**
Share of farm income	0.047	0.024	0.099
	[0.062]	*[0.063]*	*[0.070]*
Share of capital income	-0.013	0.064	0.011
	[0.174]	*[0.191]*	*[0.233]*
Population	0.108	-0.012	0.305
	[0.163]	*[0.156]*	*[0.185]*
Percent elderly	-0.628	-0.761	-0.642
	[0.333]	*[0.337]*	*[0.390]*
Percent black	0.025	0.046	-0.094
	[0.069]	*[0.080]*	*[0.090]*
Percent urban	0.882	0.731	0.291
	[0.400]	*[0.446]*	*[0.438]*
Share of Democrats			0.002
in state legislature			*[0.002]*
Federal grants per capita			0.171
			[0.101]
Observations	982	982	982
Adjusted R-squared	0.95	0.95	0.95
Alpha		**0.271**	
		[0.070]**	
Beta			**1.218**
			[0.457]*

Robust standard errors in brackets

* significant at 5%; ** significant at 1%

Year and state dummies included (coefficients not shown).

Fiscal and socio-economic variables are in logs. Fiscal variables are in per-capita terms.

Table 5

3SLS estimates of the impact of withholding on income tax revenues

Dependent variable:	Income tax revenue (technology)	Top rate	Lowest rate	Federal grants	Income tax revenue (demand)
	(1)	(2)	(3)	(4)	(5)
Withholding dummy	**0.224**	**-0.034**	**-0.158**	**-0.062**	**0.377**
	[0.046]*	***[0.047]***	***[0.076]****	***[0.020]****	**[0.059]****
Lowest tax rate	-1.172				
	*[0.387]***				
Top tax rate	0.929				
	[0.585]				
Income per capita	1.982	-1.048	-0.023	0.019	0.946
	*[0.643]***	*[0.178]***	*[0.288]*	*[0.111]*	[0.329]**
Share of farm income	0.021	-0.16	-0.468	-0.229	1.036
	[0.068]	*[0.128]*	*[0.207]**	*[0.030]***	[0.224]**
Share of capital income	0.43	-0.533	-0.603	-0.424	-0.1
	[0.221]	*[0.257]**	*[0.417]*	*[0.068]***	[0.058]
Population	0.5	-0.294	-0.613	-0.495	-1.549
	*[0.178]***	*[0.260]*	*[0.422]*	*[0.073]***	[0.481]**
Percent elderly	-1.29	0.729	0.798	0.61	1.517
	*[0.326]***	*[0.381]*	*[0.618]*	*[0.114]***	[0.623]*
Percent black	0.323	-0.219	0.188	0.007	0.42
	[0.167]	*[0.046]***	*[0.074]**	*[0.029]*	[0.161]**
Percent urban	1.244	-2.581	-2.279	-0.805	0.642
	[1.049]	*[0.493]***	*[0.800]***	*[0.122]***	[0.324]*
Share of Democrats		0.005	0.005	0.002	1.7
in state legislature		*[0.002]***	*[0.003]*	*[0.001]***	[0.712]*
Federal grants per capita		-0.986	-2.232		-0.001
		[0.564]	*[0.915]**		[0.002]
Index of political productivity				55.755	
				*[19.695]***	
Observations	982	982	982	982	982
"R-squared"	0.87	0.66	0.25	0.93	0.87
Alpha	**0.252**				
	[0.057]**				
Beta					**1.822**
					[0.538]**

Robust standard errors in brackets

* significant at 5%; ** significant at 1%

Year and state dummies included (coefficients not shown).

Fiscal and socio-economic variables are in logs. Fiscal variables are in per-capita terms.

Table 6

3SLS estimates of the impact of withholding on tax revenues, by tax source

(Log specification)

	Detailed composition of taxes							Major taxes aggregated			
	Income taxes (demand)	Sales taxes	Corporate income taxes	Property taxes	License taxes	Misc. taxes	Federal grants	Income taxes	Sales, corp. property and license taxes	Misc. taxes	Federal grants
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Withholding dummy	**0.397**	**0.014**	**0.085**	**0.114**	**0.01**	**-0.201**	**-0.038**	**0.377**	**-0.006**	**-0.145**	**-0.062**
	[0.082]**	**[0.044]**	**[0.055]**	**[0.192]**	**[0.040]**	**[0.068]****	**[0.019]***	**[0.059]****	**[0.026]**	**[0.071]***	**[0.020]****
Population	1.766	-1.086	-0.988	3.534	0.467	-0.35	-0.632	0.946	-0.496	-0.346	-0.495
	[0.877]*	[0.467]*	[0.591]	[2.056]	[0.432]	[0.735]	[0.069]**	[0.329]**	[0.147]**	[0.396]	[0.073]**
Income per capita	1.218	0.724	0.351	-2.147	0.294	-0.744	-0.044	1.036	0.363	-0.502	0.019
	[0.358]**	[0.191]**	[0.241]	[0.839]*	[0.176]	[0.300]*	[0.111]	[0.224]**	[0.100]**	[0.271]	[0.111]
Percent black	0.002	0.115	-0.063	-0.626	-0.045	0.163	-0.026	-0.1	-0.001	0.137	0.007
	[0.099]	[0.053]*	[0.067]	[0.232]**	[0.049]	[0.083]	[0.028]	[0.058]	[0.026]	[0.069]*	[0.029]
Percent elderly	-1.957	1.323	-0.642	2.252	-0.798	0.475	0.632	-1.549	0.547	0.466	0.61
	[0.970]*	[0.517]*	[0.654]	[2.273]	[0.477]	[0.813]	[0.109]**	[0.481]**	[0.215]*	[0.579]	[0.114]**
Percent urban	2.622	-2.188	0.264	3.619	1.924	1.494	-0.996	1.517	-0.702	1.377	-0.805
	[1.503]	[0.801]**	[1.013]	[3.524]	[0.740]**	[1.260]	[0.116]**	[0.623]*	[0.279]*	[0.750]	[0.122]**
Share of farm income	0.67	-0.323	0.087	0.898	0.368	-0.296	-0.216	0.42	-0.125	-0.309	-0.229
	[0.310]*	[0.165]	[0.209]	[0.727]	[0.153]*	[0.260]	[0.029]**	[0.161]**	[0.072]	[0.195]	[0.030]**
Share of interest and	1.27	-0.53	0.036	1.995	0.813	-0.144	-0.398	0.642	-0.398	-0.202	-0.424
dividend income	[0.635]*	[0.339]	[0.428]	[1.490]	[0.313]**	[0.533]	[0.074]**	[0.324]*	[0.145]**	[0.391]	[0.068]**
Federal grants	2.891	-1.11	-0.136	5.684	1.059	0.391		1.7	-0.435	0.143	
	[1.476]	[0.786]	[0.995]	[3.459]	[0.726]	[1.237]		[0.712]*	[0.319]	[0.859]	
Share of Democrats	-0.003	-0.001	0.002	0.014	-0.004	0.005	0.001	-0.001	0	0.006	0.002
in state legislature	[0.003]	[0.002]	[0.002]	[0.007]*	[0.001]**	[0.002]	[0.001]	[0.002]	[0.001]	[0.003]*	[0.001]**
Index of political							39.279				55.755
productivity							[18.389]*				[19.695]**
Observations	905	905	905	905	905	905	905	982	982	982	982
"R-squared"	0.74	0.63	0.81	0.70	0.75	0.86	0.95	0.87	0.75	0.87	0.93

Robust standard errors in brackets

* significant at 5%; ** significant at 1%

Fiscal and socio-economic variables are in logs. Fiscal variables are in per-capita terms.

Year and state dummies included (coefficients not shown).

Table 7
3SLS estimates of the impact of withholding on tax revenues, by tax source
(Linear specification)

	Detailed composition of taxes							Major taxes aggregated			
	Income taxes (demand)	Sales taxes	Corporate income taxes	Property taxes	License taxes	Misc. taxes	Federal grants	Income taxes	Sales, corp property and license taxes	Misc. taxes	Federal grants
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Withholding dummy	**53.036**	**-2.498**	**12.596**	**-1.374**	**9.31**	**10.727**	**-18.558**	**53.036**	**-4.445**	**10.727**	**-18.558**
	[20.286]**	**[1.876]**	**[5.884]***	**[3.031]**	**[7.692]**	**[6.618]**	**[4.143]****	**[20.286]****	**[11.508]**	**[6.618]**	**[4.143]****
Population	0	0	0	0	0	0	0	0	0	0	0
	[0.000]	[0.000]	[0.000]	[0.000]**	[0.000]	[0.000]**	[0.000]	[0.000]	[0.000]	[0.000]**	[0.000]
Income per capita	0.063	-0.002	0.016	-0.006	0.01	0.016	-0.023	0.063	0.004	0.016	-0.023
	[0.024]**	[0.002]	[0.007]*	[0.004]	[0.009]	[0.008]*	[0.003]**	[0.024]**	[0.013]	[0.008]*	[0.003]**
Percent black	6.856	-0.365	0.768	0.137	1.57	-0.245	0.035	6.856	-1.174	-0.245	0.035
	[1.797]**	[0.166]*	[0.521]	[0.268]	[0.681]*	[0.586]	[0.820]	[1.797]**	[1.019]	[0.586]	[0.820]
Percent elderly	-0.802	0.952	-0.996	2.372	1.886	0.895	-1.168	-0.802	12.782	0.895	-1.168
	[5.382]	[0.498]	[1.561]	[0.804]**	[2.041]	[1.756]	[2.278]	[5.382]	[3.053]**	[1.756]	[2.278]
Percent urban	1.265	-0.532	0.753	-0.411	2.097	2.423	-2.212	1.265	-2.886	2.423	-2.212
	[2.228]	[0.206]**	[0.646]	[0.333]	[0.845]*	[0.727]**	[0.447]**	[2.228]	[1.264]*	[0.727]**	[0.447]**
Share of farm income	2.016	-0.065	-0.32	0.15	-1.6	-0.531	-0.363	2.016	-2.425	-0.531	-0.363
	[1.228]	[0.114]	[0.356]	[0.183]	[0.466]**	[0.401]	[0.504]	[1.228]	[0.697]**	[0.401]	[0.504]
Share of interest and	-4.459	0.111	-2.645	0.374	-7.277	-0.469	-0.005	-4.459	-8.442	-0.469	-0.005
dividend income	[2.332]	[0.216]	[0.677]**	[0.348]	[0.884]**	[0.761]	[1.060]	[2.332]	[1.323]**	[0.761]	[1.060]
Federal grants	2.159	-0.159	0.549	-0.225	0.734	0.56		2.159	-0.527	0.56	
	[0.983]*	[0.091]	[0.285]	[0.147]	[0.373]*	[0.321]		[0.983]*	[0.558]	[0.321]	
Share of Democrats	-0.76	0.051	-0.203	0.116	-0.512	-0.173	0.441	-0.76	-0.093	-0.173	0.441
in state legislature	[0.572]	[0.053]	[0.166]	[0.085]	[0.217]*	[0.187]	[0.130]**	[0.572]	[0.325]	[0.187]	[0.130]**
Index of political							14704.76				14704.76
productivity							[6,570.404]*				[6,570.404]*
Observations	1073	1073	1073	1073	1073	1073	1073	1073	1073	1073	1073
"R-squared"											

Robust standard errors in brackets
* significant at 5%; ** significant at 1%
All variable are in levels. Fiscal variables are in per capita terms.
Year and state dummies included (coefficients not shown).

Table 8
Speed of response of income taxes to withholding

	OLS Income tax revenue (technology)	OLS Income tax revenue (demand)	3SLS Income tax revenue (technology)	Top tax rate	Lowest tax rate	Federal grants
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy for 9 and more years before	-0.09	-0.114	-0.086	0.122	0.252	0.178
	[0.091]	*[0.096]*	*[0.095]*	*[0.059]**	*[0.090]***	*[0.042]***
Dummy for 8 years before	-0.017	-0.029	0.001	0.079	0.17	0.097
	[0.082]	*[0.085]*	*[0.096]*	*[0.058]*	*[0.088]*	*[0.046]**
Dummy for 7 years before	0.033	0.023	0.055	0.065	0.141	0.07
	[0.074]	*[0.071]*	*[0.093]*	*[0.055]*	*[0.084]*	*[0.045]*
Dummy for 6 years before	0.056	0.034	0.078	0.044	0.138	0.076
	[0.071]	*[0.066]*	*[0.091]*	*[0.056]*	*[0.086]*	*[0.045]*
Dummy for 5 years before	-0.017	-0.046	0.03	0.022	0.154	0.079
	[0.059]	*[0.061]*	*[0.087]*	*[0.055]*	*[0.084]*	*[0.044]*
Dummy for 4 year before	0.035	0.034	0.042	0.057	0.118	0.075
	[0.054]	*[0.058]*	*[0.088]*	*[0.055]*	*[0.084]*	*[0.044]*
Dummy for 3 year before	0.000	-0.002	-0.005	0.015	0.034	0.03
	[0.044]	*[0.042]*	*[0.084]*	*[0.052]*	*[0.080]*	*[0.044]*
Dummy for 2 years before	0.039	0.024	0.017	-0.033	-0.042	-0.007
	[0.032]	*[0.023]*	*[0.086]*	*[0.051]*	*[0.078]*	*[0.043]*
Dummy for 1 year before adoption	0	0	0	0	0	0
	[0]	*[0]*	*[0]*	*[0]*	*[0]*	*[0]*
Dummy for the adoption year	0.336	0.36	0.317	0.045	-0.001	-0.001
	*[0.048]***	*[0.050]***	*[0.086]***	*[0.051]*	*[0.078]*	*[0.043]*
Dummy for 1 year after adoption	0.294	0.304	0.286	0.007	-0.014	-0.007
	*[0.076]***	*[0.073]***	*[0.083]***	*[0.051]*	*[0.078]*	*[0.043]*
Dummy for 2 years after	0.222	0.246	0.204	0.005	-0.062	-0.032
	*[0.055]***	*[0.056]***	*[0.084]**	*[0.052]*	*[0.079]*	*[0.043]*
Dummy for 3 years after	0.21	0.253	0.183	0.039	-0.058	-0.03
	*[0.056]***	*[0.067]***	*[0.087]**	*[0.052]*	*[0.079]*	*[0.043]*
Dummy for 4 years after	0.279	0.343	0.249	0.058	-0.078	-0.048
	*[0.077]***	*[0.085]***	*[0.093]***	*[0.054]*	*[0.082]*	*[0.044]*
Dummy for 5 years after	0.256	0.309	0.262	0.041	-0.042	-0.035
	*[0.085]***	*[0.091]***	*[0.088]***	*[0.053]*	*[0.081]*	*[0.044]*
Dummy for 6 years after	0.303	0.372	0.329	0.045	-0.048	-0.05
	*[0.079]***	*[0.092]***	*[0.091]***	*[0.055]*	*[0.084]*	*[0.045]*
Dummy for 7 years after	0.277	0.338	0.294	0.022	-0.071	-0.049
	*[0.087]***	*[0.101]***	*[0.089]***	*[0.056]*	*[0.085]*	*[0.045]*
Dummy for 8 years after	0.323	0.398	0.322	0.042	-0.08	-0.042
	*[0.097]***	*[0.118]***	*[0.093]***	*[0.056]*	*[0.086]*	*[0.046]*
Dummy for 9 and more years after	0.339	0.416	0.321	0.071	-0.051	-0.004
	*[0.108]***	*[0.128]***	*[0.089]***	*[0.050]*	*[0.077]*	*[0.042]*
Lowest tax rate	-0.33		-1.022			
	[0.631]		*[0.317]***			
Top tax rate	1.411		0.929			
	*[0.380]***		*[0.560]*			
Lowest tax bracket	-0.053					
	[0.078]					
Top tax bracket	0.089					
	[0.086]					
Lowest bracket * lowest rate	0.052					

Table 8

Speed of response of income taxes to withholding

	[0.086]					
Top bracket * top rate	-0.089					
	*[0.038]**					
Income per capita	1.61	1.035	1.956	-1.025	0.035	0.075
	*[0.210]***	*[0.270]***	*[0.609]***	*[0.132]***	*[0.201]*	*[0.109]*
Share of farm income	0.034	0.111	0.026	0.005	-0.247	-0.236
	[0.060]	*[0.067]*	*[0.066]*	*[0.060]*	*[0.092]***	*[0.030]***
Share of capital income	0.034	-0.018	0.36	-0.211	-0.14	-0.403
	[0.191]	*[0.247]*	*[0.183]**	*[0.122]*	*[0.186]*	*[0.067]***
Population	0.021	0.358	0.493	-0.026	-0.273	-0.617
	[0.159]	*[0.191]*	*[0.158]***	*[0.137]*	*[0.209]*	*[0.074]***
Percent elderly	-0.766	-0.668	-1.219	0.286	0.215	0.625
	*[0.339]**	*[0.408]*	*[0.274]***	*[0.196]*	*[0.299]*	*[0.111]***
Percent black	0.066	-0.065	0.321	-0.233	0.158	-0.009
	[0.082]	*[0.098]*	*[0.140]**	*[0.034]***	*[0.052]***	*[0.028]*
Percent urban	0.849	0.431	1.377	-1.953	-1.527	-0.797
	[0.457]	*[0.481]*	*[1.059]*	*[0.247]***	*[0.377]***	*[0.125]***
Share of Democrats		0.003		0.003	0.002	0.002
in state legislature		*[0.002]*		*[0.001]***	*[0.002]*	*[0.001]**
Index of political productivity						104.017
						*[21.053]***
Federal grants per capita		0.184		-0.246	-1.231	
		[0.104]		*[0.241]*	*[0.368]***	
Observations	982	982	982	982	982	982
Adjusted R-squared	0.95	0.95	0.89	0.82	0.65	0.94

Robust standard errors in brackets

* significant at 5%; ** significant at 1%

Fiscal and socio-economic variables are in logs. Fiscal variables are in per-capita terms.

Year and state dummies included (coefficients not shown).

Table 9

Speed of response of all taxes to withholding

	Detailed composition of taxes							Major taxes aggregated			
	Income taxes (demand)	Sales taxes	Corporate income taxes	Property taxes	License taxes	Misc. taxes	Federal grants	Income taxes	Sales, corp. property and license taxes	Misc. taxes	Federal grants
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Dummy for 9 and more years before	-0.339	-0.033	0.102	-0.066	0.057	0.495	0.152	-0.253	0.041	0.447	0.191
	[0.076]**	[0.053]	[0.108]	[0.290]	[0.059]	[0.129]**	[0.041]**	[0.074]**	[0.033]	[0.126]**	[0.041]**
Dummy for 8 years before	-0.197	0.003	0.112	0.042	0.033	0.479	0.076	-0.133	0.053	0.451	0.098
	[0.076]**	[0.053]	[0.108]	[0.290]	[0.059]	[0.129]**	[0.046]	[0.073]	[0.032]	[0.125]**	[0.047]*
Dummy for 7 years before	-0.108	0.002	0.09	-0.105	0.059	0.425	0.029	-0.057	0.062	0.39	0.069
	[0.072]	[0.050]	[0.102]	[0.275]	[0.056]	[0.122]**	[0.046]	[0.070]	[0.031]*	[0.120]**	[0.046]
Dummy for 6 years before	-0.102	0.009	0.052	-0.142	0.053	0.358	0.038	-0.091	0.056	0.256	0.087
	[0.073]	[0.051]	[0.104]	[0.279]	[0.057]	[0.124]**	[0.046]	[0.072]	[0.031]	[0.122]*	[0.046]
Dummy for 5 years before	-0.159	-0.015	-0.001	-0.285	0.031	0.27	0.043	-0.145	0.024	0.182	0.09
	[0.072]*	[0.050]	[0.102]	[0.274]	[0.056]	[0.121]*	[0.045]	[0.071]*	[0.031]	[0.121]	[0.045]*
Dummy for 4 year before	-0.072	0.002	0.052	0.024	0.036	0.188	0.056	-0.068	0.035	0.197	0.085
	[0.073]	[0.051]	[0.103]	[0.278]	[0.057]	[0.123]	[0.045]	[0.070]	[0.031]	[0.119]	[0.045]
Dummy for 3 year before	-0.042	-0.005	0.093	0.106	0.026	0.066	0.026	-0.049	0.024	0.069	0.042
	[0.071]	[0.049]	[0.101]	[0.271]	[0.055]	[0.120]	[0.045]	[0.067]	[0.030]	[0.115]	[0.045]
Dummy for 2 years before	0.002	0.017	0.04	-0.007	0.013	0.045	0.008	0.02	0.019	0.019	-0.004
	[0.069]	[0.048]	[0.098]	[0.262]	[0.054]	[0.116]	[0.044]	[0.066]	[0.029]	[0.112]	[0.045]
Dummy for 1 year before adoption	0	0	0	0	0	0	0	0	0	0	0
	[0]	[0]	[0]	[0]	[0]	[0]	[0]	[0]	[0]	[0]	[0]
Dummy for the adoption year	0.304	0.038	0.114	-0.024	0.019	-0.017	0.011	0.35	0.038	0.02	-0.002
	[0.070]**	[0.048]	[0.098]	[0.265]	[0.054]	[0.117]	[0.044]	[0.066]**	[0.029]	[0.112]	[0.045]
Dummy for 1 year after adoption	0.261	0.039	0.123	-0.079	0	-0.058	0.01	0.299	0.036	-0.014	-0.007
	[0.070]**	[0.048]	[0.099]	[0.266]	[0.054]	[0.118]	[0.045]	[0.066]**	[0.029]	[0.113]	[0.045]
Dummy for 2 years after	0.247	0.051	0.14	-0.054	0.032	-0.008	-0.022	0.263	0.041	-0.019	-0.033
	[0.070]**	[0.049]	[0.099]	[0.267]	[0.054]	[0.118]	[0.044]	[0.067]**	[0.029]	[0.114]	[0.045]
Dummy for 3 years after	0.274	0.054	0.16	-0.017	0	-0.153	-0.016	0.276	0.049	-0.125	-0.032
	[0.069]**	[0.048]	[0.098]	[0.264]	[0.054]	[0.117]	[0.044]	[0.067]**	[0.029]	[0.114]	[0.045]
Dummy for 4 years after	0.338	0.051	0.177	-0.104	0.007	-0.169	-0.039	0.382	0.052	-0.079	-0.051
	[0.072]**	[0.050]	[0.101]	[0.273]	[0.056]	[0.121]	[0.045]	[0.069]**	[0.030]	[0.118]	[0.046]
Dummy for 5 years after	0.326	0.052	0.186	-0.109	0.006	-0.154	-0.028	0.347	0.054	-0.138	-0.038
	[0.071]**	[0.049]	[0.100]	[0.270]	[0.055]	[0.120]	[0.045]	[0.068]**	[0.030]	[0.117]	[0.046]
Dummy for 6 years after	0.399	0.087	0.18	-0.213	0.008	-0.12	-0.033	0.424	0.066	-0.076	-0.053
	[0.072]**	[0.050]	[0.102]	[0.275]	[0.056]	[0.122]	[0.045]	[0.070]**	[0.031]*	[0.120]	[0.046]
Dummy for 7 years after	0.371	0.102	0.176	-0.239	-0.02	-0.206	-0.035	0.395	0.067	-0.196	-0.053

Table 9

Speed of response of all taxes to withholding

	[0.074]**	[0.051]*	[0.104]	[0.279]	[0.057]	[0.124]	[0.046]	[0.072]**	[0.032]*	[0.123]	[0.047]
Dummy for 8 years after	0.415	0.118	0.147	-0.196	-0.056	-0.238	-0.026	0.452	0.072	-0.217	-0.046
	[0.073]**	[0.051]*	[0.104]	[0.279]	[0.057]	[0.124]	[0.046]	[0.072]**	[0.032]*	[0.123]	[0.048]
Dummy for 9 and more years after	0.399	0.171	0.24	-0.573	-0.121	-0.376	0.025	0.469	0.086	-0.32	0
	[0.065]**	[0.045]**	[0.091]**	[0.246]*	[0.050]*	[0.109]**	[0.042]	[0.063]**	[0.028]**	[0.108]**	[0.043]
Income per capita	1.197	0.677	0.306	-1.592	0.372	-0.591	-0.086	1.018	0.355	-0.297	0.036
	[0.173]**	[0.119]**	[0.244]	[0.656]*	[0.134]**	[0.291]*	[0.108]	[0.160]**	[0.070]**	[0.273]	[0.108]
Share of farm income	0.22	-0.116	0.144	0.053	0.225	-0.402	-0.176	0.205	-0.003	-0.364	-0.186
	[0.066]**	[0.046]*	[0.093]	[0.251]	[0.051]**	[0.112]**	[0.028]**	[0.059]**	[0.026]	[0.101]**	[0.030]**
Share of capital income	0.317	-0.204	-0.075	1.144	0.648	-0.387	-0.306	0.034	-0.111	-0.414	-0.311
	[0.142]*	[0.098]*	[0.201]	[0.540]*	[0.110]**	[0.240]	[0.065]**	[0.116]	[0.051]*	[0.197]*	[0.060]**
Population	0.707	-0.634	-0.836	2.157	0.248	-0.739	-0.741	0.654	-0.312	-0.601	-0.635
	[0.230]**	[0.159]**	[0.324]**	[0.872]*	[0.178]	[0.387]	[0.066]**	[0.158]**	[0.070]**	[0.270]*	[0.069]**
Percent elderly	-0.752	0.55	-0.807	3.561	-0.482	0.992	0.568	-1.027	0.061	0.688	0.566
	[0.242]**	[0.167]**	[0.342]*	[0.919]**	[0.187]*	[0.408]*	[0.105]**	[0.212]**	[0.093]	[0.362]	[0.108]**
Percent black	0.064	0.067	-0.084	-0.575	0.011	0.106	-0.094	0.003	-0.033	0.092	-0.065
	[0.051]	[0.035]	[0.072]	[0.195]**	[0.040]	[0.086]	[0.024]**	[0.041]	[0.018]	[0.071]	[0.025]*
Percent urban	0.453	-0.797	0.355	-0.709	0.978	0.861	-0.561	0.758	-0.062	1.18	-0.469
	[0.257]	[0.178]**	[0.363]	[0.977]	[0.199]**	[0.433]*	[0.108]**	[0.212]**	[0.093]	[0.361]**	[0.112]**
Federal grants per capita	0.972	-0.32	0.042	1.761	0.568	0.011		0.857	0.018	0.063	
	[0.337]**	[0.233]	[0.475]	[1.277]	[0.261]*	[0.567]		[0.266]**	[0.117]	[0.453]	
Share of Democrats	0	-0.001	0.002	0.018	-0.004	0.005	0.001	0.001	-0.001	0.005	0.002
in state legislature	[0.001]	[0.001]	[0.002]	[0.005]**	[0.001]**	[0.002]*	[0.001]	[0.001]	[0.001]	[0.002]*	[0.001]*
Index of political productivity							89.421				112.833
							[19.150]**				[20.356]**
Observations	987	987	987	987	987	987	987	1073	1073	1073	1073
Adjusted R-squared											

Robust standard errors in brackets
* significant at 5%; ** significant at 1%
Fiscal and socio-economic variables are in logs. Fiscal variables are in per-capita terms.
Year and state dummies included (coefficients not shown).

Table 10

Impact of explanatory variables on the probability of adopting withholding

Model:	Logit current-valued regressors	Logit detrended regressors	Weibull current-valued regressors	Weibull detrended regressors
Explanatory variables:				
Population (millions)	-0.0121	-0.0122	0.888	0.844
	[0.0035]**	[0.0039]**	[0.058]	[0.0724]*
Percent elderly	0.0080	0.0116	1.056	1.214
	[0.0068]	[0.0106]	[0.164]	[0.1699]
Percent black	-0.0003	0.0014	0.988	1.025
	[0.0017]	[0.0019]	[0.028]	[0.0399]
Percent urban	-0.0023	-0.0032	1.003	0.984
	[0.0023]	[0.0041]	[0.045]	[0.0558]
Income per capita	0.0000	0.0000	0.999	1.000
	[0.0000]	[0.0000]	[0.000]	[0.0004]
Share of farm income	-0.0080	-0.0099	0.901	0.857
	[0.0051]	[0.0084]	[0.106]	[0.1110]
Share of dividend	-0.0032	-0.0002	1.026	0.862
and interest income	[0.0056]	[0.0106]	[0.205]	[0.1481]
Share of democrats	0.0006	0.0011	1.010	1.017
in state legislature	[0.0007]	[0.0010]	[0.018]	[0.0215]
Income tax revenue	0.0021	0.0013	1.028	1.018
per capita	[0.0005]**	[0.0003]**	[0.007]**	[0.0031]**
All other taxes	0.0002	-0.0001	1.003	0.995
per capita	[0.0002]	[0.0002]	[0.003]	[0.0049]
Federal grants	0.0003	0.0006	1.001	1.011
per capita	[0.0003]	[0.0003]*	[0.006]	[0.0056]
Debt / general revenue	0.0003	0.0001	1.006	1.003
	[0.0003]	[0.0002]	[0.005]	[0.0042]
Dummy for 1944-48	0.0195	-0.3023		
	[0.1113]	[0.1259]*		
Dummy for 1949-53	0.0106	-0.1821		
	[0.1078]	[0.0679]**		
Dummy for 1954-58	0.0433	-0.0964		
	[0.0972]	[0.0524]*		
Dummy for 1959-63	0.0656	-0.0443		
	[0.0888]	[0.0534]		
Dummy for 1964-68	0.0523	-0.0126		
	[0.0671]	[0.0439]		
estmate of p			2.79	3.74
			[1.192]	[0.639]

Robust standard errors in brackets
* significant at 5%; ** significant at 1%
Marginal effects are reported for the logit estimates.
Hazard ratios are reported for the Weibull estimates.

Table 11

3SLS estimates of the impact of withholding on expenditures

(Log specification)

	Expenditure categories: Education	Health and hospitals	Public welfare	Highways	Natural resources	Public safety	Other general expend.	Federal grants
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Withholding dummy	**-0.145**	**-0.027**	**0.379**	**0.002**	**-0.066**	**-0.027**	**-0.052**	**-0.073**
	[0.071]*	**[0.025]**	**[0.174]***	**[0.039]**	**[0.034]**	**[0.029]**	**[0.049]**	**[0.021]****
Population	-1.186	0.02	2.415	-0.058	-0.581	0.187	-0.368	-0.536
	[0.345]**	[0.120]	[0.843]**	[0.188]	[0.165]**	[0.141]	[0.237]	[0.068]**
Income per capita	0.707	0.583	1.806	0.501	0.303	0.339	0.272	-0.038
	[0.268]**	[0.094]**	[0.654]**	[0.146]**	[0.128]*	[0.110]**	[0.184]	[0.110]
Percent black	-0.012	-0.055	0.508	-0.014	-0.102	-0.28	0.083	-0.051
	[0.071]	[0.025]*	[0.175]**	[0.039]	[0.034]**	[0.029]**	[0.049]	[0.025]*
Percent elderly	1.451	0.59	-2.48	-0.458	-0.85	-0.105	0.061	0.542
	[0.444]**	[0.155]**	[1.086]*	[0.242]	[0.212]**	[0.182]	[0.306]	[0.111]**
Percent urban	-2.064	-0.49	0.484	0.518	0.663	0.27	-0.957	-0.456
	[0.412]**	[0.144]**	[1.009]	[0.225]*	[0.197]**	[0.169]	[0.284]**	[0.111]**
Share of farm income	-0.399	-0.062	0.461	0.1	-0.028	0.011	-0.047	-0.181
	[0.130]**	[0.045]	[0.318]	[0.071]	[0.062]	[0.053]	[0.090]	[0.030]**
Share of interest and dividend income	-0.639	0.145	0.397	0.344	0.153	-0.044	0.004	-0.319
	[0.253]*	[0.088]	[0.618]	[0.138]*	[0.121]	[0.103]	[0.174]	[0.062]**
Federal grants	-1.796	0.138	6.196	0.738	0.15	0.212	-0.585	
	[0.681]**	[0.238]	[1.666]**	[0.371]*	[0.326]	[0.279]	[0.469]	
Share of Democrats in state legislature	0.004	0	-0.01	-0.002	0.001	0	-0.001	0.002
	[0.002]	[0.001]	[0.006]	[0.001]	[0.001]	[0.001]	[0.002]	[0.001]**
Index of political productivity								68.98
								[19.31]**
Observations	1073	1073	1073	1073	1073	1073	1073	1073
"R-squared"	0.85	0.93	-0.04	0.93	0.89	0.90	0.85	0.94

Robust standard errors in brackets

* significant at 5%; ** significant at 1%

Fiscal variables are in per capita terms

Table 12

3SLS estimates of the impact of withholding on expenditures

(Linear specification)

	Expenditure categories: Education	Health and hospitals	Public welfare	Highways	Natural resources	Public safety	Other general expend.	Federal grants
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Withholding dummy	**7.401**	**-0.819**	**6.04**	**10.116**	**-2.398**	**-1.601**	**0.787**	**-18.568**
	[4.743]	**[0.947]**	**[3.551]**	**[3.572]****	**[0.704]****	**[0.605]****	**[4.864]**	**[4.143]****
Population	0	0	0	0	0	0	0	0
	[0.000]**	[0.000]	[0.000]**	[0.000]**	[0.000]	[0.000]	[0.000]**	[0.000]
Income per capita	0.007	0.002	0.018	0.009	0	0	0.012	-0.023
	[0.004]	[0.001]*	[0.003]**	[0.003]**	[0.001]	[0.000]	[0.004]**	[0.003]**
Percent black	5.638	-0.671	1.323	0.6	-0.316	0.092	2.309	0.07
	[0.901]**	[0.180]**	[0.674]*	[0.678]	[0.134]*	[0.115]	[0.924]*	[0.820]
Percent elderly	-13.435	2.364	12.082	-1.099	-1.835	-1.003	6.596	-1.084
	[2.525]**	[0.504]**	[1.890]**	[1.902]	[0.375]**	[0.322]**	[2.590]*	[2.278]
Percent urban	4.105	-0.789	-3.378	0.949	0.009	-0.093	-4.522	-2.225
	[0.505]**	[0.101]**	[0.378]**	[0.380]*	[0.075]	[0.064]	[0.518]**	[0.447]**
Share of farm income	-0.495	0.785	0.851	-2.312	-0.628	-0.082	-2.284	-0.347
	[0.562]	[0.112]**	[0.421]*	[0.424]**	[0.084]**	[0.072]	[0.577]**	[0.504]
Share of interest and dividend income	-4.532	-0.042	-5.065	1.942	0.096	-1.439	-3.126	-0.002
	[1.202]**	[0.240]	[0.900]**	[0.905]*	[0.179]	[0.153]**	[1.233]*	[1.060]
Federal grants	0.388	0.004	0.439	0.349	0.029	0.01	0.311	
	[0.035]**	[0.007]	[0.026]**	[0.026]**	[0.005]**	[0.004]*	[0.035]**	
Share of Democrats in state legislature	-0.208	-0.06	0.513	-0.131	0.041	-0.102	-0.341	0.436
	[0.145]	[0.029]*	[0.109]**	[0.109]	[0.022]	[0.018]**	[0.149]*	[0.130]**
Index of political productivity								15828
								[6,569]*
Observations	1073	1073	1073	1073	1073	1073	1073	1073
"R-squared"	0.95	0.92	0.85	0.88	0.84	0.83	0.85	0.92

Robust standard errors in brackets

* significant at 5%; ** significant at 1%

Fiscal variables are in per capita terms