

**Tax salience and cyclical asymmetry in tax rate adjustments:
Testing the indirect tax hypothesis**

Sunjoo Kwak

Jongmin Shon

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ABSTRACT

In this paper, we explore the hypothesis that politicians prefer using direct taxes with relatively high salience for tax cuts during booms, while they prefer using indirect taxes with relatively low salience for tax increases during recessions. Using a panel data set of U.S. states from 1992 to 2014, we analyzed how cyclical fluctuations in resource availability affect the statutory rates of five major state taxes: general sales tax, personal income tax, corporate income tax, and two excise taxes (gasoline and cigarette taxes). Our results suggest that cyclical improvements in resource availability during booms lead to reductions in personal income tax rates, whereas cyclical deteriorations in resource availability during recessions result in increases in general sales tax rates.

Keywords: tax salience, tax rate adjustments, cyclical asymmetry, state tax policy, political economy

JEL Code: H20, P16

INTRODUCTION

Tax salience refers to how visible the costs imposed by taxation are to taxpayers and, consequently, to what extent the taxpayers account for the costs of taxation when making economic choices and political judgments.¹ The concept of tax salience assumes that people's attitudes toward taxes can be determined not by the amounts actually paid, but by their perceptions of the tax system and subjective interpretations of the tax burdens ([Congdon, Kling, & Mullainathan, 2011](#)). As a result, people respond differently to taxes with the same monetary value, depending on how they are presented or imposed ([Saez, 2009](#)). As a subfield of behavioral economics that explores actual human behavior ([McCaffery & Slemrod, 2006](#)), tax salience research attempts to show that economic agents can behave in a way that deviates from the rational and utility-maximization assumptions of neoclassical economic theory.

The theoretical literature conceptually distinguishes between market salience and political salience. The former focuses on the effects of tax salience on market decisions and economic behavior, while the latter is concerned with the effects on voting behavior and policy outcomes ([Gamage & Shanske, 2011](#)). The literature suggests that these two dimensions should be treated separately, because changes in tax design do not necessarily have the same effects on both.

Over the last decade, an increasing body of evidence has accumulated to suggest that market salience influences people's purchasing and labor-supply decisions. The most cited study in the market salience literature ([Chetty, Looney, & Kroft, 2009](#)) find that commodity taxes that are incorporated into posted prices reduce demand significantly, as compared to taxes that are

¹ Gamage and Shanske (2011) find such terms as “fiscal illusion” or “hidden taxes” that are frequently used as alternative terms for tax salience “emotion-laden and potentially misleading in the intuitive responses they invoke,” and instead argue that it is more appropriate to use the “market salience” and “political salience” of taxation that are considered more neutral and more precise.

not (i.e., taxes added at the register).² Some studies ([Fochmann & Weimann, 2013](#); [Hayashi, Nakamura, & Gamage, 2013](#)) also extended this literature to the labor supply context. Using an experimental design, the former study shows that with labor supply differing across income tax schemes, subjects in the wage subsidy treatment are less willing to work, and the latter finds that participants who are offered a higher gross wage tend to increase their work efforts for the same net wage.³

Unlike the market salience literature that has produced quite clear results for salience effects in the market, the empirical literature on political salience remains inconclusive ([Gamage & Shanske, 2011](#)). An important reason for this is that as public choice theory suggests, the mechanism through which public decisions are made is much more complicated than that of individual economic agents' choices, thereby making it difficult to separate out the effects of political salience from other relevant factors ([Dollery & Worthington, 1996](#); [Sausgruber & Tyran, 2005](#)). Despite this challenge, the political salience literature has provided useful insights into salience effects in the political domain.⁴ The most well-known factor that determines the

² In a similar manner, Feldman and Ruffle (2015) find that subjects spend significantly more under tax-exclusive prices than under tax-inclusive and tax-rebate prices, showing that consumers fail to take various price components into account. Bradley and Feldman (2018) conduct a study for airline ticket taxes, finding that the more prominent display of tax-inclusive prices significantly reduces consumer tax incidence and ticket demand.

³ Goldin and Listokin (2014), Abeler and Jäger (2015), and Miller and Mumford (2015) found evidence with respect to specific income tax provisions that taxpayers are not fully aware of tax subsidies and incentives that they are eligible for and tax policy changes that affect their tax liabilities. In the case of property taxes, Bradley (2013) finds that the degree of salience of property tax obligations reduces the probability and magnitude of property tax delinquency.

⁴ Wagner (1976), for example, finds that an increased complexity in a government's revenue structure leads voters to underestimate their tax burdens and consequently support higher levels of public expenditure. Noting that drivers who pay tolls electronically are substantially less aware of toll rates than those who pay with cash, Finkelstein (2009) analyzes the effect of the adoption of electronic toll collection on toll rates, finding that a less salient tax system leads to a higher tax rate. Exploiting conditionally random variation in tax escrow as a measure of salience, Cabral and Hoxby (2012) find that property taxes tend to be higher in areas where the property tax is less salient. These studies show that such factors as tax complexity, compliance costs, and withholding determine the political salience of taxation and ultimately influence political judgments and policy outcomes.

degree of political salience is the indirectness of taxation. Assuming that indirect taxes have lower salience than equivalent direct taxes, the empirical literature has explored the fiscal consequences of this difference. One strand of research ([Keen & Lockwood, 2006](#); [Lee, Kim, & Borcharding, 2013](#); [McCaffery & Baron, 2006](#); [Sausgruber & Tyran, 2005](#)) focuses on the question of whether greater reliance on indirect taxes leads to higher government spending. Another line of research addresses the question of whether the difference in salience between direct and indirect taxes influences the design of tax structures. For example, Bracco, Porcelli, and Redoano ([2019](#)) demonstrate that tight political competition induces elected politicians to substitute salient taxes with less salient ones.

Although evidence documenting the policy consequences of the differing salience of direct and indirect taxes is accumulating, our knowledge on this topic remains incomplete. In particular, there have been relatively few studies aimed at determining the effects of political salience on revenue actions. Bracco, Porcelli, and Redoano ([2019](#)) examine the composition of direct and indirect taxes rather than specific revenue actions on them. By contrast, Finkelstein ([2009](#)) and Cabral and Hoxby ([2012](#)) look at changes in toll rates and property tax rates, but they do so in the context of a single tax instrument rather than that of a mix of tax instruments.

The present study attempts to fill this gap in the literature by addressing the question of how the salience difference between direct and indirect taxes affects policymakers' choice between the available tax instruments in making fiscal adjustments. This question is motivated by the literature on the procyclicality of fiscal policy – another relevant literature that offers insights into explaining changes in tax policy. This literature has produced considerable evidence of governments making fiscal adjustments in a way that reinforces the business cycle (i.e.,

governments choosing to increase government spending and reduce taxes during an economic expansion but reduce spending and increase taxes during a recession).

This finding has important implications for the political salience literature, because multiple tax instruments are available to the government, with each differing in their degree of salience, and decisions as to which taxes to use for tax increases or cuts are left to the discretion of policymakers ([Bracco, Lockwood, Porcelli, & Redoano, 2015](#); [Bracco et al., 2019](#); [Dixit & Londregan, 1998](#)). One research question that naturally arises from these two literatures is how policymakers exploit the higher or lower salience of direct and indirect taxes in making fiscal adjustments across the ups and downs of the business cycle; more specifically, the question is whether policymakers prefer using more salient taxes for tax increases and less salient taxes for tax cuts.

In the present study, we test this idea by empirically examining how cyclical fluctuations in resource availability affect the statutory rates of five major state taxes: general sales tax, personal income tax, corporate income tax, and two excise taxes (gasoline and cigarette taxes).⁵ As discussed later, these tax instruments vary in political salience and, therefore, they are expected to be used differently when making tax rate adjustments during boom and bust cycles. The unique fiscal and tax environments of U.S. state governments provide a natural experimental setting for this analysis. U.S. states generate revenue through a mix of tax instruments that vary in not only political salience but also revenue volatility owing to differences in the economic and tax structures ([Dye & McGuire, 1991](#); [Sobel & Holcombe, 1996](#)).

⁵ The *State Government Finance* series published by the U.S. Census Bureau classifies sales tax as “general sales tax” and “selective sales tax.” The latter includes excise taxes such as gasoline tax, cigarette tax, alcohol tax, and so on. For simplicity, this study uses the terms “sales tax” to refer to general sales tax and “excise taxes” to refer to selective sales taxes. Thus, the study refers to gasoline and cigarette taxes as excise taxes.

This paper is organized as follows: the next sections provide some theoretical backgrounds on the procyclicality of fiscal policy and the direct versus indirect tax hypothesis, and then present our data and empirical strategy. The last sections offer main results, discussion, and conclusions.

TAX SALIENCE AND CYCLICAL ASYMMETRY IN THE CHOICE OF TOOLS FOR TAX RATE ADJUSTMENTS

The political salience research has developed a number of hypotheses, among which the most well-known is the direct versus indirect tax hypothesis (the indirect tax hypothesis hereafter). This hypothesis posits that indirect taxes have lower salience than equivalent direct taxes ([Gamage & Shanske, 2011](#)). As the name suggests, direct taxes are paid directly to the government by taxpayers. Examples include income tax, corporation tax, inheritance/gift taxes, and so on. Indirect taxes are imposed on the sales of goods and services and include sales taxes and a variety of excise taxes. Indirect taxes are considered less visible, because they are included in market prices and dispersed across economic transactions. Furthermore, they are collected by intermediaries from the persons upon which the taxes are levied. The intermediaries later remit the tax collections to the government. Because taxpayers do not personally make the payments, they are, in general, less aware of these taxes than equivalent direct taxes. Thus, it is widely believed that voters are less sensitive to higher levels of taxation and spending when the government relies more heavily on indirect taxes.

As outlined in the Introduction, this study attempts to test the indirect tax hypothesis by drawing on insights from the literature on procyclical fiscal policy, which need to be reviewed briefly. The tax smoothing model ([Barro, 1979](#); [Bohn, 1998](#); [Lucas Jr & Stokey, 1983](#)) has been

used as a normative benchmark by positive models of fiscal policy. The model suggests that it is optimal in utility terms to keep tax rates constant (i.e., *acyclical* tax policy), because the costs incurred by tax distortions become greater than the benefits gained from lower taxes, due to decreasing marginal utilities ([Alesina & Perotti, 1995](#)). Tax smoothing is desirable with respect to fiscal management and economic stabilization as well, because, given a certain level of spending, revenue shortfalls during recessions are offset, at least in theory, by revenue windfalls during boom periods ([Dothan & Thompson, 2009](#); [Schunk & Woodward, 2005](#)).

Principles, however, do not always translate into action ([Alesina, Campante, & Tabellini, 2008](#); [Horney & Stone, 2010](#)). In the U.S. context, many studies have reported evidence of procyclical tax rate adjustments at the state level. It has been found that state governments tend to enact tax cuts during an economic expansion overheating the economy and tax increases during a recession worsening economic situation (i.e. [Edwards, Moore, & Kerpen, 2003](#); [Johnson, 2002](#); [Johnson & Farkas, 2006](#); [Johnson, Schiess, & Llobrera, 2003](#); [Knight, Kusko, & Rubin, 2003](#); [Moore, 1991](#); [Schunk & Woodward, 2005](#)). A number of recent studies extend beyond anecdotal evidence by empirically examining the procyclicality of state tax policy (e.g. [Crain, 2003](#); [Holcombe & Sobel, 1997](#); [Kwak, 2013](#)).

Integrating the literatures on tax salience and procyclical tax policy, we consider the following questions: Is the procyclicality of state tax policy symmetric between boom and recession periods? If not, that is, if it is cyclically asymmetric, in what way does cyclical asymmetry occur? These questions are motivated by the facts that tax changes can have extensive political ramifications ([Berry & Berry, 1994](#); [Geys & Vermeir, 2008](#); [Hibbs, 1977](#); [Nordhaus, 1975](#); [Sobel, 1998](#)) and that direct and indirect taxes differ in political salience ([Gamage & Shanske, 2011](#); [Oates, 1999](#); [Wagner, 1976](#)).

Intuition suggests that changes in the levels of direct taxes with higher salience are more likely to be noticed by taxpayers and, therefore, will have a greater impact on political outcomes. This has important implications for opportunistic politicians who seek to maximize votes ([Buchanan & Tullock, 1962](#); [Downs, 1957](#); [Köppel-Turyna, 2016](#)). The evident variations in political salience between direct and indirect taxes create incentives for rational, vote-maximizing politicians to make tax rate adjustments in a way that increases electoral support. For example, for tax cuts induced by cyclical surpluses during an economic boom, policymakers are likely to prefer using direct taxes with higher political salience to maximize the political benefits. Conversely, for tax increases that are forced by cyclical deficits during a recession, they are likely to prefer indirect taxes with lower political salience to minimize the political costs. As a result, cyclical asymmetry is expected to occur in the choice of tools for tax rate adjustments between boom and recession periods. Based on the theoretical discussion thus far, this study hypothesizes that cyclical increases in resource availability during an economic boom will lead to decreases in the rates of direct taxes, whereas cyclical decreases in resource availability during a recession will lead to increases in the rates of indirect taxes.

This study has theoretical significance in that it is the first attempt to integrate the theoretical foundations of two important bodies of literature on taxation—the political salience of taxation and the procyclicality of fiscal policy. This is a plausible approach, given that both literatures view fiscal behavior from a political economy perspective. This integrated approach is expected to improve our understanding of state fiscal behavior by providing a more detailed description of the factors that influence state tax rate adjustments. This study has empirical significance as well in that unlike previous studies, it considers both specific revenue actions and a whole set of tax instruments in testing the indirect tax hypothesis.

DATA AND METHODS

Data

To empirically test the indirect tax hypothesis, this study analyzed the effects of cyclical fluctuations in resource availability on the statutory rates of five major state taxes: general sales tax, personal income tax, corporate income tax, and two excise taxes (gasoline and cigarette taxes). Personal and corporate income taxes represent direct taxes, and the remainder are indirect taxes.

The study constructed a panel data set of 37 U.S. states for all five taxes for the period 1992–2014. The primary focus of this study is to examine whether states prefer a particular type of tax (direct vs. indirect tax) when increasing or decreasing the taxation level over the business cycle. Therefore, the sample should have the same composition of tax instruments. Although all states impose gasoline and cigarette taxes, not all states impose personal income tax, corporate income tax, or general sales tax.⁶ Therefore, 14 states that does not meet the above requirement, including Alaska and Hawaii that are separated from the continental United States, were excluded from the sample.

According to the NBER's Business Cycle Dating Committee, the study period includes approximately three business cycles (i.e., three sets of economic peaks and troughs): the 1991, 2001, and 2007 troughs, the 1999 and 2007 peaks, and the current expansion. Thus, the data set provides a unique opportunity to investigate the effects of business cycles on state tax rates.

Dependent Variables

⁶ The states excluded are Alaska, Delaware, Florida, Montana, Nevada, New Hampshire, Ohio, Oregon, South Dakota, Tennessee, Texas, Washington, and Wyoming.

The dependent variables are the statutory rates of each of the aforementioned five major state taxes: general sales tax, personal income tax, corporate income tax, gasoline tax, and cigarette tax (STR, PITR, CITR, GTR, and CTR, respectively). For income taxes with a progressive tax rate structure, the top marginal tax rates were used.⁷ For personal income tax, the study used both the actual rate and modified rate. For example, a number of states have adopted the so-called “millionaires’ tax,” which imposes a surtax on high-income earners. Here, a typical feature is adding a new tax bracket to the existing tax rate structure, to which a higher rate is applied ([Bishop-Henchman, 2012](#)). For example, in 2003, New York created a temporary additional bracket with a rate of 7.4 percent on income over \$500,000, and in 2004, California added a top rate of 10.3 percent on income over \$1 million.

These types of tax increases should be distinguished from those that simply raise the top marginal rates without adding a new bracket, because when the income threshold of the top bracket increases, fewer people are subject to the increased rate. Hence, the effect on revenue in the latter case should be greater than when a new tax bracket is added. To account for the revenue impacts of income cutoff levels, the study also used a modified version of the top income tax rates. Estimating the revenue impacts of tax rate increases is beyond the scope of this study. Instead, as a rule of thumb, it reflected only a certain percentage of an increment in the top tax rate: one-half of an increment if the income cutoff is \$100,000; one-third if it is \$500,000; and one-quarter if it is \$1 million.⁸

⁷ Some examples of studies using top marginal income tax rates include [Bruce, Fox and Tuttle \(2006\)](#), [Bruce, Fox and Yang \(2010\)](#), and [Saez, Slemrod and Giertz \(2012\)](#).

⁸ For example, suppose that the top tax bracket and the rate of a state is currently \$50,000 and 10 percent. Then, the state adds a new bracket with an income cutoff of \$150,000 and a rate of 11 percent. In this case, the increment in the tax rate is 1 percent, which is multiplied by 0.5. Thus, the modified top tax rate is 10.5 percent.

General sales tax, personal income tax, and corporate income tax rates were measured as a percentage, and the data were collected from the *State Tax Reporter* series, published by the Commerce Clearing House. Gasoline tax rates and cigarette tax rates were measured as cents per gallon of gasoline and cents per pack of 20 cigarettes, respectively, and the data were drawn from the *Highway Statistics* series, published by the Federal Highway Administration, and the compiled historical data ([Orzechowski & Walker, 2012](#)), respectively.

Explanatory Variables

Tax base gap: To measure cyclical fluctuations in resource availability, this study used a measure called *tax base gap* (TBG).⁹ As the cyclical component of a tax base, the measure represents a government's resource availability that fluctuates over the business cycle. Two features need to be mentioned. First, tax base, not tax revenue, is used, because the former better reflects the level of financial resources potentially available prior to any fiscal adjustments, such as spending increases/cuts and tax cuts/increases.

Second, the deviation-from-trend method (i.e., detrending) was used to extract the cyclical component from a tax base.¹⁰ This idea is borrowed from the concept of *output gap*, an economic measure of the difference between the actual output of an economy and its potential output. Output gap is expressed as $\frac{\text{actual GDP} - \text{potential GDP}}{\text{potential GDP}}$, and captures cyclical fluctuations in economic output ([Jahan & Mahmud, 2013](#)). TBG is essentially measured in the same way as

⁹ One could consider output gap using gross domestic product (GDP) as an alternative measure of cyclical fluctuations in resource availability, as government revenues come primarily from economic activity. Output gap, however, may not be appropriate for this study, because there is often a discrepancy between GDP and state tax bases. They often differ, as states provide a variety of tax exemptions and deductions. Recent empirical studies ([Bruce et al., 2006](#); [Smith, 2013](#)) have shown how special provisions in tax codes affect tax bases' elasticities to GDP.

¹⁰ Studies using this method include Dye and McGuire ([1991](#)), Hou ([2005](#)), and Kwak ([2014](#)).

output gap. In general, tax bases trend upward over time, while undergoing short-term cyclical fluctuations around the trend line. The extent to which a tax base deviates from the underlying trend line reflects its cyclical component. If TBG is a positive number, the economy and state are considered to be in an upturn phase of the business cycle. Conversely, if TBG is negative, the economy and state are considered to be in a downturn phase.

GDP may be a viable alternative to tax base, because tax revenues stem from economic activities. However, GDP is not appropriate for capturing subtle changes in resource availability, because its cyclical fluctuations could differ considerably from those of tax bases due to a variety of tax exemptions, deductions, credits, and so on ([Bruce et al., 2006](#); [Smith, 2013](#)).

What makes measuring a state's overall TBG difficult is that there are various kinds of taxes, the tax bases of which have different units. For example, the units of ad valorem taxes are monetary values, whereas those of specific taxes are amounts, such as gallons, packs, and kilograms. Thus, they cannot simply be summed to calculate an aggregate tax base. For this reason, the study obtained the TBGs of the aforementioned five state taxes individually, and then summed them after weighting each according to its proportion of the total.¹¹

As a first step, we obtained the tax bases of the selected taxes. Personal income, gross operating surplus, the net volume of motor fuel taxed, and total cigarette consumption (by adults) were used as proxies for the tax bases of personal income tax, corporate income tax, gasoline tax, and cigarette tax, respectively. The data on the first two were collected from the Bureau of Economic Analysis (BEA) database, and the latter two were drawn from the *Highway Statistics*

¹¹ On average, these taxes are the largest source of revenue for state governments, accounting for about 80 percent of their total revenue during the study period. Gasoline and cigarette taxes are the two largest (about half) in the selective sales tax category.

series published by the Federal Highway Administration (FHA) and the survey data on tobacco use collected by the Centers for Disease Control and Prevention (CDC), respectively.

For sales tax, personal consumption expenditures from the BEA database can be used as a proxy. However, these data are only available from 1997. Thus, the actual tax base was used instead, with the annual values obtained by dividing the tax collection by the tax rate. The tax collection data were collected from the *State Government Finance* series published by the U.S. Census Bureau.

As noted above, TBG was measured using the deviation-from-trend method. For each tax, TBG was obtained by (1) performing a linear regression of *tax base* on *time (year)*, (2) obtaining the residuals of the annual tax bases from the fitted regression line, and (3) dividing the residuals by the average of the tax bases for standardization.¹² Thus, TBG is the weighted sum of the deviations of the five major state tax bases from the underlying trend line.

The asymmetric relationships between macroeconomic variables over the business cycle are an important research topic in economic studies and in studies on the asymmetric effects of price on demand ([Gately & Huntington, 2002](#)). One method commonly used in these studies is to divide the independent variables into increments and decrements. To improve the measure, we consider the two fiscal years for a government's budget cycle,¹³ and TBG was measured as the mean of the one-year and two-years lagged values in TBG due to the potential endogeneity of simultaneous effects. Following this method, we consider both directions in TBG like 1) *the two-year (t-1 and t-2) mean of cumulative sum of TBG increases* and 2) *the two-year mean of*

¹² Thus, TBG is expressed as a percentage. As noted above, this procedure involves detrending, which can be performed easily using a statistical package.

¹³ We also considered the last three fiscal years to measure TBG for robustness check, and there is no systematic difference between two-years and three-years measures. Upon any request, the results can be provided.

cumulative sum of TBG decreases. These terms indicate cyclical changes in resource availability during economic expansions and contractions, respectively.¹⁴

Fiscal factors: In public finance, taxation and spending and revenue and expenditure are closely related. Tax rates are also likely to be influenced by other fiscal variables. The spend-tax hypothesis assumes that the level of taxation is determined to meet spending demand ([Ross & Payne, 1998](#)). The underlying idea is that expenditures positively affect the attitudes of economic entities toward the size of the government, thus easing constraints on tax revenue. Increases in spending are sustained by increases in tax revenue over time, eventually achieving fiscal stabilization. Like tax revenue, government spending trends upward over time. Therefore, like tax base, it needs to be detrended to capture structural changes in spending demand. The detrended expenditure was obtained using data on per capita direct general expenditure and same procedure as that for TBG. Similar to TBG, expenditure gap may have a time lag. Thus, the study again included a lag of up to two years. In contrast, subsidies from the federal government may lead to lower taxes by easing budget constraints.¹⁵ Thus, to take the effect of external revenue into account, the study included per capita federal grants. These data were collected from the *State Government Finance* series.

¹⁴ The basic idea of these measures is to decompose the variable into increments and decrements and then obtain the cumulative sum of increments and that of decrements separately. These decomposed variables capture the effects of increases and decreases in the original variable separately. This method, which is often used in studies on the asymmetric effects of price changes on demand, is also of great use to the present study aimed at determining the asymmetric effects of cyclical revenue fluctuations on tax rates.

¹⁵ As a competing view, the flypaper effect makes the opposite prediction. It suggests that if the central government subsidizes a local government, the subsidy is not used as a source of revenue for tax cuts, but is used to supply public goods. Local governments are assumed to want more financial support from the central government because they want more budgetary projects, rather than tax reductions for local residents ([Gramlich, 1987](#)).

Institutional factors: It is widely believed that institutions and rules define the way collective decisions are made and influence policy outcomes ([Buchanan & Tullock, 1962](#)). This view has been widely applied to state budget processes to create various fiscal rules ([Hou & Duncombe, 2008](#); [Knight, 2000](#)). This study focused on three fiscal rules that have been reported to play an important role in state fiscal behavior: no-deficit carry-over requirement, rainy day fund, and supermajority voting requirement. Each variable was measured as a dummy variable, taking the value one if implemented, and zero otherwise. These data were collected from the *Budget Processes in the States* series, published by the National Association of State Budget Officers (NASBO).

Political factors: Republicans and liberals have different political ideologies and, therefore, different preferences for fiscal and tax policy ([Armingeon, 2012](#); [Portney, 1980](#)). Based on the prevailing view that political circumstances may influence policy decisions, the model included three control variables for partisan control: Republican control of the legislature, Republican control of the governorship, and a divided government. In addition, to account for the political business cycle ([Drazen & Eslava, 2010](#); [Nordhaus, 1975](#)), two dummy variables indicating gubernatorial election year and its following year were included because any changes in taxation can be observed after a new gubernatorial term starts. Each variable was measured as a dummy variable, taking the value one if true, and zero otherwise. The data were obtained from the *Book of the States* series, published by the Council of State Governments (CSG).

Socio-economic factors: Finally, to account for overall socio-economic characteristics, the model included three controls: population, median income, and unemployment rate. Here, the data were

collected from the *Statistical Abstract of the United States* series, published by the U.S. Census Bureau, and the database of the Bureau of Labor Statistics. Lastly, we also include a dummy variable that indicates before and after the Great Recession of 2008 because this recession has greater effects on the process of tax policy. The summary statistics are presented in Table 1.

[Table 1 here]

Model Specification and Estimation

For the empirical analysis of the asymmetric effects of cyclical fluctuations in resource availability on state tax rates, this study employed the following panel data model:

$$tr_{it} = \beta_0 + \beta_1 tbg_inc_{it} + \beta_2 tbg_dec_{it} + \beta_3 X_{it} + \alpha_i + \delta_t + u,$$

where i and t indicate a state and year, respectively; tr_{it} indicates *str_{it}*, *pit_{it}*, *citr_{it}*, *gtr_{it}*, or *ctr_{it}*, which are the statutory rates of general sales tax, personal income tax, corporate income tax, gasoline tax, and cigarette tax, respectively; tbg_inc and tbg_dec are the two-year (t-1 and t-2) mean of cumulative sum of TBG increases and the two-year (t-1 and t-2) mean of cumulative sum of TBG decreases, respectively; X_{it} is a vector of control variables; α_i and δ_t are unobserved time invariant (state) and cross-sectionally invariant (year) effects; and u is a stochastic error term.

Two other potential problems with a panel data analysis are heteroskedasticity and serial correlation. Here, the results of a modified Wald test for groupwise heteroskedasticity and the Wooldridge test for autocorrelation indicated that both problems exist. To eliminate time-invariant unobserved heterogeneity and to correct for heteroskedasticity and serial correlation, the models were estimated using a fixed-effects estimator with clustered robust standard errors (Rogers, 1994; Wooldridge, 2010).

RESULTS AND DISCUSSION

Before running the regressions, the study graphically examined the cyclical behavior of TBG and the cumulative sums of increases and decreases in TBG. Figure 1 clearly shows cyclical fluctuations in TBG. After the 1991–1992 recession, TBG grows steadily throughout the 1990s, before dropping sharply with the 2001 recession and recovering until 2007. TBG drops again during the 2008–2009 Great Recession and is in a stage of recovery afterwards. Figure 2 shows that TBG increases and decreases gradually diverge. The increase line is a little smoother, reflecting that economic contractions are, in general, more dramatic ([Sichel, 1993](#)).

[Figures 1 and 2 here]

This study also performed visual assessments of average annual percentage changes in state tax rates, as presented in Figures 3 and 4. With all taxes included, variations in sales tax, personal/corporate income taxes, and gasoline tax are difficult to identify (Figure 4), because there are significant differences between cigarette tax and the other taxes, which distorts the scale of the y-axis. Thus, Figure 3, which excludes cigarette tax, is provided separately.

[Figures 3 and 4 here]

Overall, the lines for personal and corporate income tax (red and green, respectively) are lower than those of sales and excise taxes (blue and purple, respectively). Although the tax hikes during the Great Recession of the late 2010s stand out, most of the annual changes in personal and corporate income tax rates are below the zero percent line (i.e., negative), indicating that they have been decreasing during the study period. In contrast, the annual changes in sales and excise tax rates are mostly above the zero line (i.e., positive), indicating that they have been increasing. This interpretation is confirmed by the summary statistics. The average annual

percentage changes in sales tax, personal income tax, corporate income tax, gasoline tax, and cigarette tax are about 0.50, -0.34, -0.24, 1.07, and 14.79, respectively. These results clearly show that there have been different treatments for direct and indirect taxes.

The second, yet more important point is that the tax cuts induced by economic booms have been implemented primarily using personal and corporate income taxes, whereas the tax increases forced by economic downturns have been made mostly through sales and excise taxes. Figure 3 shows that, with the sales and gasoline tax lines hovering around and over the zero line, there were noticeable drops in personal and corporate income taxes from 1998 to 2000, when the national economy was at its height just before the 2001 recession. In contrast, from 2002 to 2004, the income tax lines are near the zero line, but there were large increases in sales and gasoline taxes, when most states were suffering from the lingering effects of the 2001 recession.

Similar patterns are observed from the mid-2000s through the early 2010s. Again, there were cuts in income taxes from 2005 to 2007 when the housing market was booming. There was also a slight decrease in sales tax rates, but this was short-lived and seems to have been intended to redress the large increases in the previous years. Furthermore, sales tax rates increased immediately the following year, and continued to rise sharply in the aftermath of the 2008 Great Recession. This time, reflecting the severity of the fiscal crisis, income taxes joined the move, although not by as much as the sales tax increases. Finally, as the economy slowly recovered in the early 2010s, there were again reductions in all three major state taxes.

Taken together, these results have two implications. First, on aggregate, the tax rate adjustments have been procyclical. Although there was some variation across taxes and anomalies within individual taxes, in general, the tax rates decreased during the expansion

periods of the late 1990s and mid-2000s and increased during the downturn periods of the early and late 2000s.

More importantly, given the main purpose of this study, direct and indirect taxes played different roles in the tax rate adjustments triggered by economic upturns and downturns. Direct taxes with higher political salience were mostly used for tax cuts, whereas indirect taxes with lower political salience, were used for tax increases. This provides initial support for the main hypothesis of cyclical asymmetry in the choice of tools for tax rate adjustments between booms and recessions to exploit the differences in political salience of various tax instruments.

[Table 2 here]

Following the graphical analysis, the results of the regression analyses are presented in Table 2. The sales tax rate model shows that increases in TBG (during a boom) do not have statistically significant effects on STR, while decreases in TBG (during a recession) have negative effects: a one-point decrease in TBG causes STR to increase by 0.004 points (at the 5 percent significance level). This means that cyclical fluctuations in resource availability have procyclical impacts on state sales tax rates only during a recession. In other words, the procyclicality of state tax policy occurs only in downturn years.

By contrast, the personal income tax model reveals that increases in TBG have negative effects on PITR, while decreases in TBG do not have statistically significant effects.¹⁶ The results indicate that a one-point increase in TBG (during a boom) causes actual and modified PITR to drop by 0.013 and 0.018 points, respectively (at the 1 percent significance level for both

¹⁶ The dependent variable (PITR) indicates the top marginal rate of personal income tax. We also considered the bottom marginal rate to follow up one anonymous reviewer's comment. However, no statistically significant effects are observed on bottom marginal rate, so we only considered the top marginal rate of personal income tax.

actual and modified PITRs). This suggests that improved resource availability during a boom leads to personal income tax cuts.¹⁷

Taken together, these results confirm our main hypothesis. The procyclicality of tax policy is found in both sales and personal income taxes, but the difference is that this occurs during an expansion in the case of personal income taxes, whereas it occurs during a recession for sales taxes. These results suggest that states tend to prefer using a personal income tax that is a direct and therefore more salient tax instrument when they enact tax cuts motivated presumably by cyclical surpluses during an expansion but prefer using a sales tax that is an indirect and therefore less salient tax instrument when they enact tax increases forced by budget shortfalls during a recession. Overall, these provide strong support for our hypothesis that politicians will exploit the difference in political salience between direct and indirect taxes in the choice of tax instruments for fiscal adjustments over the business cycle.¹⁸

Meanwhile, the corporate income tax model finds that both increases and decreases in TBG have positive effects on CITR, suggesting that states tend to make countercyclical adjustments to corporate income taxes over the course of the business cycle. The results show that a one-point increase in TBG (during a boom) causes CITR to increase by 0.01, while a one-

¹⁷ If state income tax payments constitute a quantitatively insignificant fraction of one's individual tax payments relative to those made to the federal government, then one may have doubts that the regression results in this regard provide evidence for the use of reductions in salient taxes during booms. As of FY 2014, the federal and state governments' income tax receipts were 1,394,568 and 311,529 million dollars, respectively. The fraction of one's individual tax payments made to the state government was 22.3 percent relative to those made to the federal government, which is not deemed insignificant. Besides, the personal income tax accounted for 37.3 percent of the total tax collection of the sample states, which also shows that the tax is not a source of revenue that is quantitatively insignificant in the state tax system. Due to this significance of personal income taxes at the state level, proposals for state income tax increases often spark contentious debate, with anti-tax activists and political commentators referring to the possible harms that those revenue actions would cause to the economy (Tharpe, 2019).

¹⁸ Although one may conjecture that such tax cuts are aimed at strengthening economic booms by providing more stimulus, these revenue actions are likely to be considered quite a big burden particularly for fiscally distressed governments given that personal income tax rates, once lowered, are difficult to restore.

point decrease in TBG (during a recession) induces CITR to drop by 0.012 (at the 1 percent significance level for both).

The regression reveals that state governments tend to raise the corporate income tax rate during an economic boom and lower it during a recession. The results do not support the tax salience hypothesis for both boom and recession periods. The study has assumed that politicians would prefer using a direct tax that is relatively salient for tax cuts during an economic boom and be reluctant to use it for tax increases during a recession. Overall, the results suggest that the tax salience hypothesis is not an appropriate theoretical framework for explaining changes in corporate income tax rates. Two alternative explanations are possible. First, the results can be interpreted as states undertaking countercyclical economic and fiscal policies using corporate income tax. In modern economics, governments are expected to serve as a counter to the business cycle to prevent the economy from overheating during a boom while helping it recover during a recession ([Krugman, 2000](#); [Stiglitz, 2010](#)). In a similar way, the fiscal management literature sees countercyclical fiscal capacity as an important aspect of government performance, arguing that governments should keep fiscal reserves to maintain fiscal stability and policy predictability, regardless of economic fluctuations ([Dothan & Thompson, 2009](#); [Hou, 2006](#); [Hou & Moynihan, 2008](#)).

Another explanation is based on changing public opinions on corporate income tax over the business cycle. First, during an economic boom, public opinion supporting corporate tax increases can grow under the belief that income redistribution will be improved by increasing the tax burden of corporations with higher incomes.¹⁹ Contrary to the popular belief, however, such

¹⁹ This belief depends on the assumption that corporate income and personal income are strictly separated. As a matter of fact, as a legal fiction that does not materially exist, a corporation cannot be the subject of income and tax burden ([Prebble, 1994](#)). Since corporate income tax is taxation on returns to a corporation's equity capital ([Congressional Research Service, 2019](#)), the tax burden is primarily attributed

effects have been found to be insignificant; rather, empirical research has found that corporate income tax increases further reduce (both labor and capital) incomes in low-income households than in high-income households and consequently deepen income inequality. Despite these unintended consequences, however, proposals to increase corporate income taxes for income redistribution can gain popular support, without a good understanding of the incidence of corporate income tax.

On the contrary, claims for corporate tax reduction can emerge on the business side during a recession on the grounds that there will be trickle-down effects, stimulating economic growth. The underlying assumption of the trickle-down effect is that if the economy maximizes the overall output, then the income of the lower-income group will also rise. Such a belief that reductions in corporate income tax will attract investment and create jobs is more likely to flourish in business-friendly countries like the United States and gain support particularly when the economy is in a slump. The rationales underlying corporate tax increases and cuts have in common that they are based on intuition rather than empirical evidence.²⁰

The last two columns of Table 2 report the results of regressions for gasoline and cigarette taxes, which indicate that increases in TBG have negative effects on GTR during a boom, while decreases in TBG have positive effects during a recession and that both increases and decreases in TBG exert positive impacts on CTR in both upturn and downturn years. For the

to shareholders, but it is passed on to workers and consumers through changes in relative prices of production factors and prices of goods. The former is referred to as the statutory incidence of corporate income tax, while the latter as the economical incidence. Corporations produce goods using capital, labor, land, and intermediate goods and distribute profits obtained by selling them to shareholders, employees, and land-owners according to their contribution to the production. Therefore, the corporate income tax burden is also distributed in the process of distributing business profits.

²⁰ Another thought is that the inappropriateness of the indirect tax hypothesis for corporate income tax might be simply because the tax constitutes an insignificant portion of a state's overall tax collection. As of 2014, revenue from corporate income tax accounts for 5.18 percent of the sample states' total tax collection.

proper interpretation of these results for excise taxes, one needs to take a closer look at the mechanisms by which excise tax rates are adjusted. A specific tax is imposed on the quantity of the commodity consumed, unlike an ad valorem tax, which is imposed on the value. Thus, unless adjusted for inflation, a specific tax declines in real terms. By their nature, excise taxes are generally designed as a specific tax. To keep up with inflation, states raise their excise tax rates periodically (e.g., by means of annual inflation indexing) or occasionally ([Bishop-Henchman, 2014](#); [Orzechowski & Walker, 2012](#)).²¹

This practice is illustrated in Figure 5, which shows the historical change of Arizona's cigarette tax. As seen in Figure 5a, intermittent increases to the cigarette tax result in an image similar to the side view of stairs. There is no decline in the tax rate. However, Figure 5b shows that a series of steady decreases, interspersed with abrupt increases, becomes clear, when the series are detrended. The implication is that keeping the rates of excise taxes constant carries different meanings, depending on the cyclical position of the economy. As illustrated in Figure 5b, when the economy slows down, the tax rates and TBG move in the same direction, creating a positive relationship. By contrast, when the economy improves, the two variables move in opposite directions, forming a negative relationship.

[Figures 5a and 5b here]

Going back to the results with this mechanism in mind, TBG increases are shown to lead to decreases in GTR, with TBG decreases being statistically insignificant: a one-point increase in TBG causes GTR to drop by 0.084 cents. In light of the way in which excise tax rates are adjusted over time, these results should not be interpreted as states reducing the gas tax during a boom. They suggest that states tend to keep the gas tax rate constant (in real terms) for the most

²¹ For example, some states use an annual indexing mechanism for the automatic inflation adjustment of the gas tax rate, while others adjust the tax rate manually from time to time.

part and that the intermittent inflation adjustments of the tax rate do not have systematic patterns across the states.

Meanwhile, the cigarette tax model produces a different result for the boom-period behavior of state tax policy. The result show that a one-point increase in TBG causes an increase in CTR of 1.278 cents (at the 1 percent significance level), while a one-point decrease in TBG leads to a decrease in CTR of 0.806 cents (at the 1 percent significance level). These results suggest that states tend to keep the cigarette tax rate constant during a recession, while intermittently raising it during a boom.

A possible explanation is that politicians become more concerned with the health of their electorate when economic conditions are less of a concern and more peripheral during downturns. Policymakers may find a cigarette tax increase not as politically burdensome, when the economy is in good shape. Although tax increases are generally accompanied by taxpayers' resistance, hostility toward a cigarette tax increase is limited only to smokers. Rather, this action may be welcomed by the general public, as being considered instrumental in the promotion of public health. Furthermore, policymakers may also find it fiscally attractive, as this serves not only as a corrective tax but also as a fiscal action that enhances the revenue-raising capacity.

Figure 6 provides a graphical summary of the regression results for the relationships between changes in TBG and tax rate adjustments over the business cycle. Two important findings emerge from the results thus far. First, procyclical rate adjustments are found in general sales and personal income taxes. These results confirm the findings of previous studies on procyclical fiscal policy. Interestingly, corporate income tax rates are found to exhibit countercyclical movements over the business cycle, which have been explained earlier based on

the state practice of countercyclical fiscal policy as a fiscal norm and changing public opinions toward corporate taxation.

More importantly, the indirect tax hypothesis is supported for the major state revenue sources: cyclical asymmetry exists in the procyclical rate adjustments of general sales and personal income taxes. Consistent with the indirect tax hypothesis, cyclical asymmetry in the choice of tools used for tax rate adjustments occurs in a way that raises the visibility of tax cuts and lowers that of tax increases. The regression analyses demonstrate that cyclical improvements in resource availability during a boom lead to reductions in personal income tax rates, cyclical deteriorations in financial condition during a recession result in increases in sales tax rates. That is, direct taxes with higher political salience tend to be used for tax cuts during upturn periods, while indirect taxes with their lower political salience are used for tax increases during downturn periods. Put differently, when adjusting the level of taxation, states tend to use direct and indirect taxes strategically in a way that increases the political benefits of tax cuts and reduces the political costs of tax increases.

[Figure 6 here]

Overall, the control variables show low performance in explaining tax rate changes. As expected, expenditure gap is found to have a positive effect on tax rates, but statistically significant only in the CIPR, GTR and CTR models. The size of federal grants also has significant effects on tax rates, except for CTR model; however, the effects are variously observed in positive way on sales and corporate income tax rates, while negative way on personal income and gasoline tax rates. Rainy day fund and supermajority voting requirement have partially significant effects across the models, but the results are inconsistent. In accordance with the prevailing view, Republican legislature and governor are found to lead to lower tax

rates, but the effects of the both republican affiliations are statistically significant only in the CTR model. Lastly, the greater population size has positive effects on sales, personal income and gasoline tax rates, while decreasing cigarette tax rate; however, the magnitudes are close to zero. From the two economic variables of median income and unemployment rate, the lower economic condition provides a positive effect on the tax rates, but for cigarette tax.

The weak explanatory power of the control variables may reflect that they lack the ability to create political incentives in a consistent and persistent way. Because the taxes examined here are the most important sources of revenue for states, in both a fiscal and an economic sense, even a small change draws much attention from political circles, the media, and the public, and thus requires broad political support. Therefore, to make a tax rate adjustment, any potential factor can influence the political forces necessary to make the change possible. However, the control variables appear to be lacking in this respect.

CONCLUSION

The concept of tax salience suggests that taxes vary in political salience, creating incentives for opportunistic politicians to use direct and indirect taxes strategically in a way that increases the visibility of tax cuts and reduces that of tax increases. Meanwhile, the empirical literature on state fiscal policy has found evidence of procyclical tax rate changes. Drawing on these two important literatures, the present study has addressed the question of whether states exploit the salience difference between direct and indirect taxes in tax rate adjustments over the business cycle; in other words, whether states' choices of tools for tax rate adjustments are symmetric between boom and recession periods. Using a panel data set of U.S. states from 1992 to 2014, we analyzed how cyclical fluctuations in resource availability affect the statutory rates

of general sales tax, personal income tax, corporate income tax, gasoline taxes, and cigarette taxes.

Confirming previous findings on procyclical fiscal policy, this study has found that cyclical improvements in resource availability during a boom induce reductions in personal income tax rates, while fiscal deteriorations during a recession lead to sales tax increases. Thus, the indirect tax hypothesis is supported for the major state revenue sources. These results suggest that states tend to use the personal income tax that is a direct and therefore more salient tax for tax cuts during expansion periods and use the sales tax that is an indirect and therefore less salient tax for tax increases during downturn periods.

Overall, the results suggest that states' tax mix has shifted from high-salience taxes such as personal income tax to low-salience taxes such as sales and excise taxes. These findings are of relevance to the contemporary debate over which of direct and indirect taxes is desirable. Although some studies assert the desirability of low-salience taxation on the grounds of the public's dislike of taxes (and the resulting tax aversion), chronic fiscal stress, and the difficulty of raising revenue through direct taxation ([Schenk, 2010](#)), most commentary argues for increased salience, citing the undemocratic nature of exploiting citizens' cognitive biases and the possible contributions of reliance on low-salience taxes to the growth of government ([Cabral & Hoxby, 2012](#); [Finkelstein, 2009](#)). The basic assumption of the view in favor of high-salience taxes is that low-salience taxation induces taxpayers into cognitive biases, which in turn lead to poor policymaking regarding government spending and taxation as politicians exploit these biases to maximize their own utility. The present study is important in this respect because the empirical results shed light on the behavior of politicians' exploiting the salience bias.

At least one limitation should be acknowledged. Although this study used a general model for all taxes, future studies should develop tax-specific models to account for the unique circumstances in which individual tax instruments operate. In particular, narrow-based taxes, such as excise taxes, that apply to specific consumption items require more sophisticated modeling, because they affect specific industries and a limited number of consumers and suppliers, resulting in distinct special-interest politics.

In addition to a study that overcomes this limitation, the following topics are suggested for future research. First, it would be interesting to see if the presence of right- or left leaning extremes affects tax policy changes. Political ideologies exert profound and overarching influences on various aspects of government policies. Therefore, the rise of political populism may affect what is viewed positively and negatively in terms of tax changes by the general electorate. Second, a potentially interesting alternative angle for future research is to examine how political attitudes or politicians' perceptions of public opinions are changing over time. Methodologically this question could be addressed by looking at how the coefficient on the TBG variable varies over 1992–2014 across different time periods. This question could be of particular relevance to personal income taxes. Lastly, in a similar way to the above study, one could estimate the current empirical model for different geographical regions separately. Our conjecture, for example, is that personal or corporate tax reductions would be viewed differently between conservative and liberal states.

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TABLES

Table 1. Summary statistics

Variable	Mean	S.D.	Min	Max
<i>Sales tax rate</i>	5.251	0.987	2.900	7.250
<i>Personal income tax rate (actual)</i>	6.428	1.772	2.800	10.890
<i>Personal income tax rate (modified)</i>	6.504	1.862	2.800	13.300
<i>Corporate income tax rate</i>	7.492	1.757	4.530	12.000
<i>Gasoline tax rate</i>	21.021	5.576	7.500	40.700
<i>Cigarette tax rate</i>	77.632	77.651	2.000	435.000
<i>Two-year mean of the cumulative sum of TBG increases</i>	23.820	16.893	0.000	110.179
<i>Two-year mean of the cumulative sum of TBG decreases</i>	-17.243	17.230	-83.885	0.000
<i>ln (expenditure gap)</i>	8.053	0.252	7.497	8.859
<i>ln (federal grants per capita)</i>	7.172	0.297	6.383	8.033
<i>No deficit carry-over requirement</i>	0.679	0.467	0.000	1.000
<i>Rainy day fund</i>	0.964	0.186	0.000	1.000
<i>Supermajority voting requirement</i>	0.221	0.415	0.000	1.000
<i>Republican legislature</i>	0.319	0.466	0.000	1.000
<i>Republican governor</i>	0.538	0.499	0.000	1.000
<i>Divided government</i>	0.014	0.120	0.000	1.000
<i>Election year</i>	0.263	0.441	0.000	1.000
<i>Population (in thousand)</i>	5976.951	6090.995	572.751	38680.810
<i>Median income</i>	35175.650	6507.457	21943.960	59019.700
<i>Unemployment rate</i>	5.700	1.895	2.300	13.700
<i>After Great Recession</i>	0.130	0.337	0.000	1.000

Note: All monetary values were converted to 2007 real-dollars.

Table 2. Regression results

	STR	PITR (Actual)	PITR (modified)	CITR	GTR	CTR
<i>Two-year mean of the cumulative sum of TBG increases</i>	0.000 (0.002)	-0.013*** (0.005)	-0.018*** (0.004)	0.010*** (0.004)	-0.084*** (0.017)	1.278*** (0.277)
<i>Two-year mean of the cumulative sum of TBG decreases</i>	-0.004** (0.002)	0.001 (0.004)	0.003 (0.003)	0.012*** (0.003)	-0.010 (0.013)	-0.806*** (0.211)
<i>ln (expenditure gap)</i>	0.173 (0.209)	0.336 (0.458)	0.599 (0.372)	1.069*** (0.380)	10.580*** (1.617)	-61.431** (26.481)
<i>ln (federal grants per capita)</i>	0.303** (0.120)	-0.801*** (0.263)	-0.574*** (0.214)	0.384* (0.216)	-2.360** (0.929)	16.988 (15.204)
<i>No deficit carry-over requirement</i>	-0.163 (0.182)	0.412 (0.402)	-0.255 (0.326)	0.421 (0.329)	-1.819 (1.407)	-35.151 (23.035)
<i>Rainy day fund</i>	0.232*** (0.079)	0.158 (0.172)	0.124 (0.140)	0.394*** (0.141)	-0.532 (0.610)	12.758 (9.983)
<i>Supermajority voting requirement</i>	-0.263** (0.105)	0.426* (0.229)	0.426** (0.186)	-0.585*** (0.188)	1.585* (0.812)	25.499* (13.298)
<i>Republican legislature</i>	-0.052 (0.037)	-0.145* (0.080)	-0.036 (0.065)	0.075 (0.067)	0.092 (0.283)	-22.885*** (4.641)
<i>Republican governor</i>	0.058** (0.025)	-0.020 (0.055)	0.031 (0.044)	0.017 (0.045)	-0.389** (0.193)	-15.767*** (3.165)
<i>Divided government</i>	-0.016 (0.135)	-0.008 (0.295)	-0.031 (0.240)	0.062 (0.241)	0.212 (1.045)	14.962 (17.109)
<i>Election year</i>	-0.022 (0.026)	0.027 (0.058)	-0.003 (0.047)	-0.054 (0.048)	0.043 (0.202)	-3.381 (3.305)
<i>Year after election</i>	-0.005 (0.026)	0.053 (0.058)	0.016 (0.047)	0.034 (0.048)	0.024 (0.204)	3.003 (3.334)
<i>Population (in thousand)</i>	0.000** (0.000)	0.000** (0.000)	0.000*** (0.000)	-0.000 (0.000)	0.002*** (0.000)	-0.012** (0.005)
<i>Median income</i>	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000*** (0.000)	0.000* (0.000)	0.006*** (0.001)
<i>Unemployment rate</i>	0.024** (0.010)	0.083*** (0.022)	0.054*** (0.018)	-0.029 (0.018)	0.261*** (0.078)	7.509*** (1.279)

<i>After Great Recession</i>	-0.022	-0.052	-0.028	-0.090	0.236	-9.768**
	(0.035)	(0.079)	(0.064)	(0.065)	(0.274)	(4.494)
Constant	1.127	7.009**	4.130*	0.459	-62.744***	265.924
	(1.293)	(2.839)	(2.306)	(2.351)	(10.002)	(163.770)
Observations	780	760	760	740	780	780
R-squared	0.293	0.098	0.171	0.244	0.330	0.610
Number of states	39	38	38	37	39	39

Notes: (1) Year effects are not reported. (2) Robust standard errors in parentheses. (3) statistical significance is *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

FIGURES

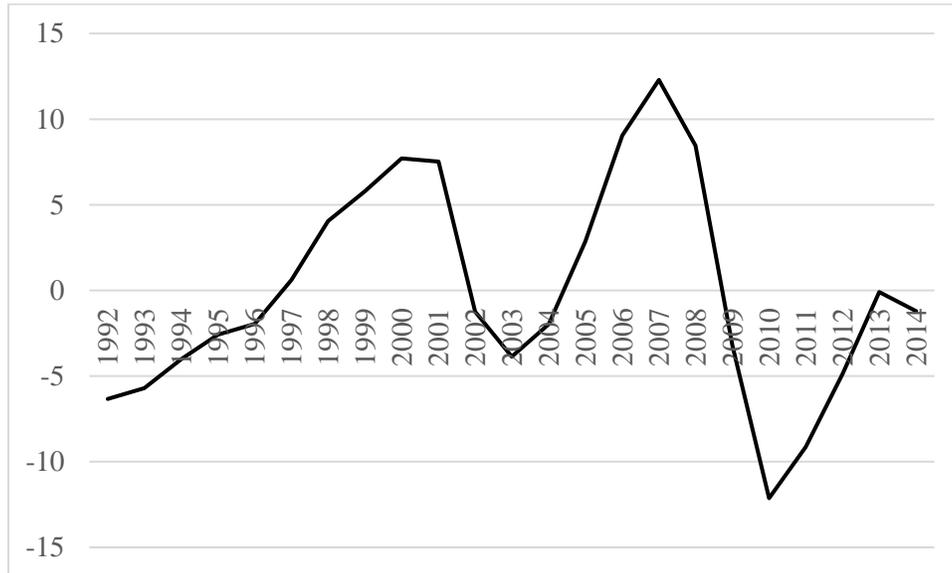


Figure 1. Historical change of average tax base gap

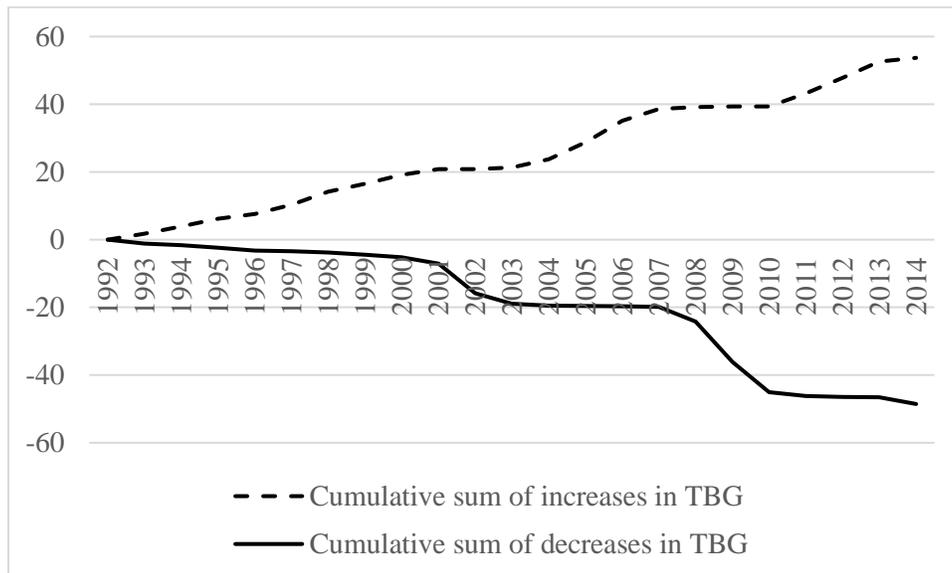


Figure 2. Historical change of the average cumulative sums of TBG increases and decreases

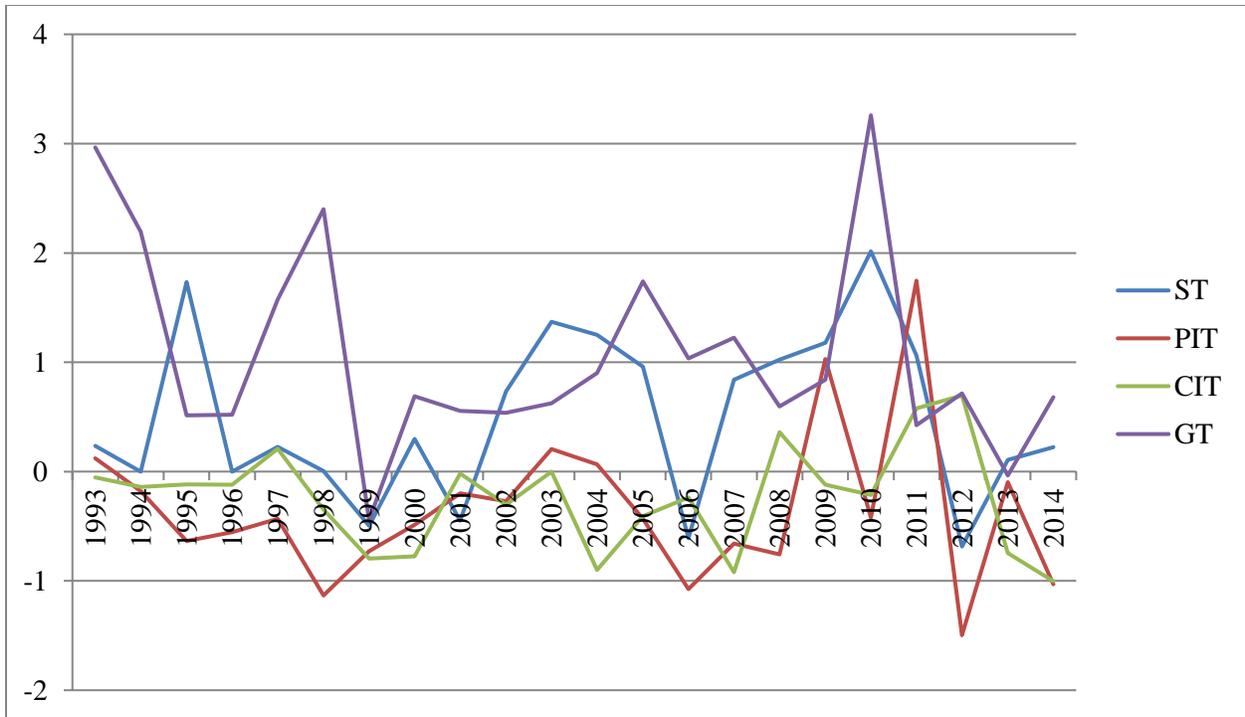


Figure 3. Average annual percentage changes of state tax rates (excluding CT)

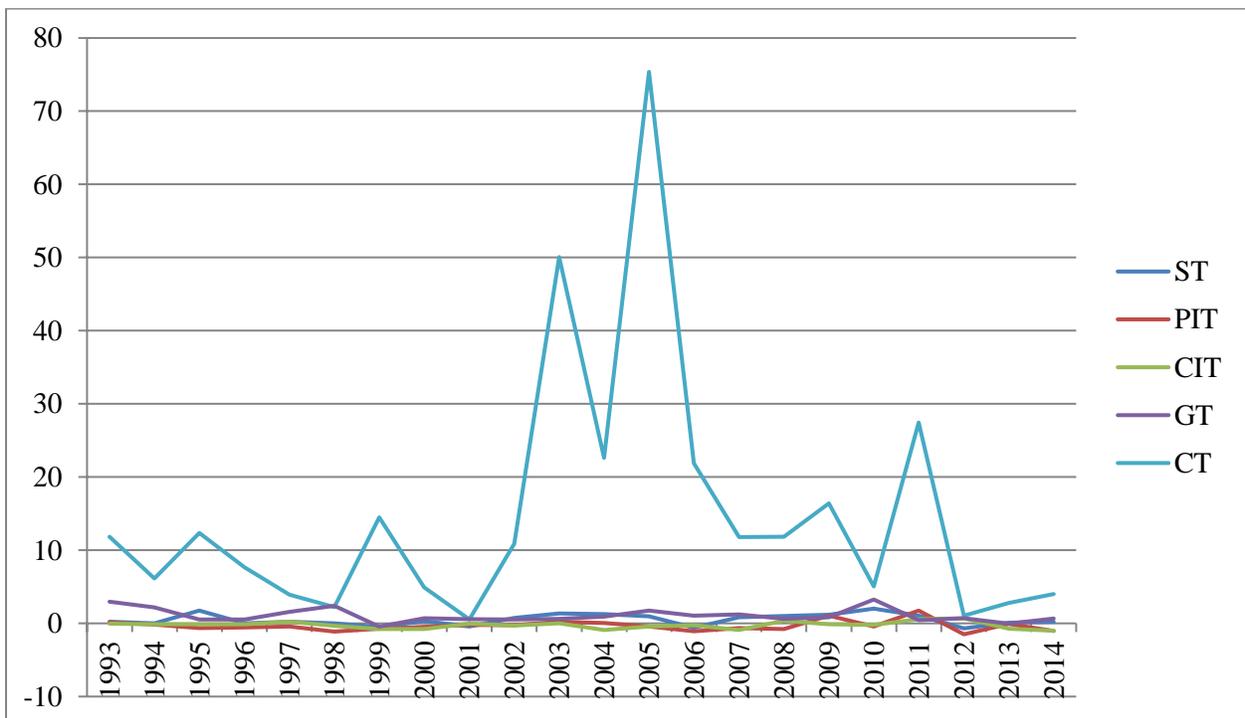


Figure 4. Average annual percentage changes of state tax rates (including all taxes)

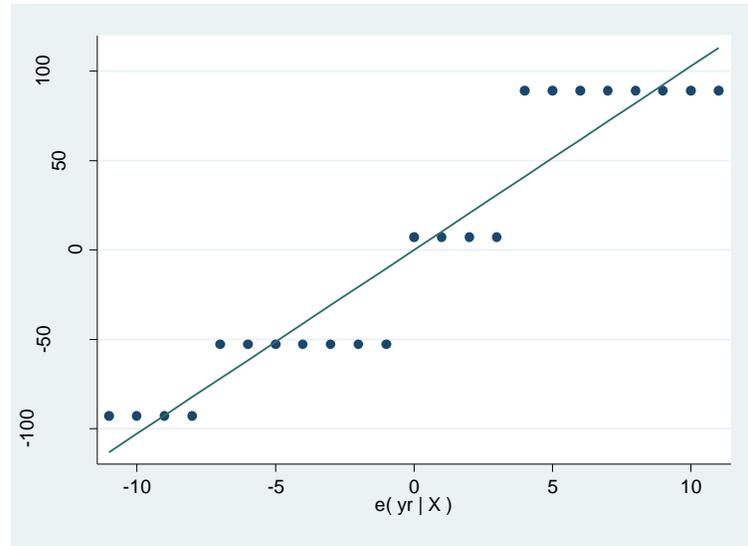


Figure 5a. Historical change of Arizona's cigarette tax rate (actual)

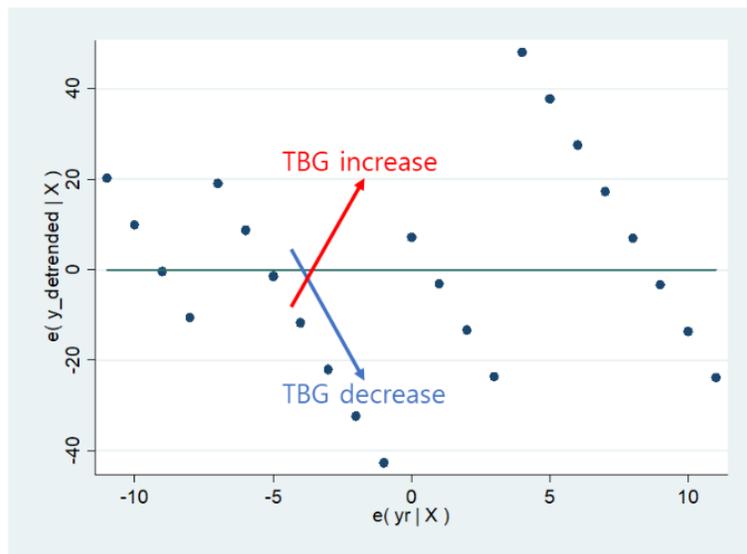
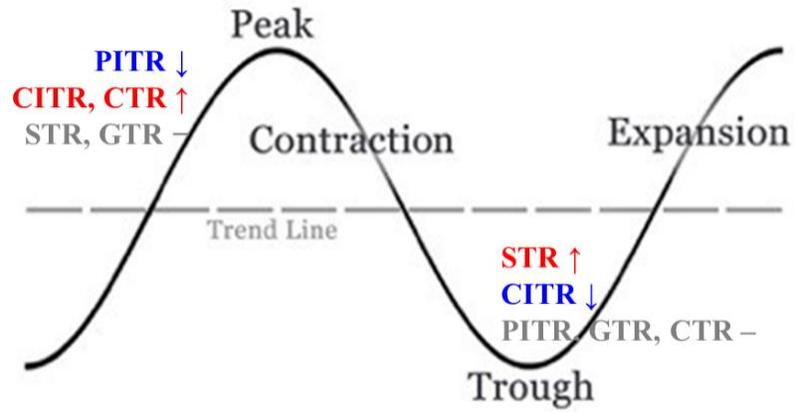


Figure 5b. Historical change of Arizona's cigarette tax rate (detrended)



Notes: ↑, ↓, and – indicate raising, lowering, and keeping the tax rate constant, respectively.

Figure 6. Graphical summary of regression results for the relationships between TBG and tax rates