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Abstract

This paper investigates whether reputation-building strategies guide U.S. governors' *responses* to changes in federal cigarette taxes (i.e. vertical tax interactions). Using 1975-2000 state cigarette tax data, we find that reputation-building strategies affect the nature of vertical tax externalities. Lame duck governors exhibit a more negative response to changes in the federal cigarette tax. Thus, by reducing the state tax base and by causing a decline in the state tax, an increase in the federal tax rate reduces state tax revenues in states headed by lame ducks.

Keywords: Vertical Tax Interactions; Fiscal Federalism; Reputation-building; Electoral Accountability; Political Institutions.
JEL Codes: H71; H77; D72; D78.

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1. Introduction

The literature studying reputation-building has documented how state tax-, expenditure-, minimum wage- and environmental policies differ when a governor is in his last term in office due to term limit legislation (e.g., Besley and Case 1995; List and Sturm 2006).[1] This suggests that politicians distort policy choices in order to get re-elected, but that when facing a binding term limit lame ducks act according to their preferred policies since re-election is no longer a consideration. This literature has not explored whether reputation-building influences "vertical tax interactions" in federal systems, where taxes set at one level of government (e.g., the federal level) affect the tax base of another level of government (e.g., the state level).[2] In this paper, we investigate a novel empirical research question: Are state governors' *responses* to federal policymaking (i.e. vertical tax interactions) guided by reputation-building strategies? In particular, we focus on vertical interactions in cigarette taxation.

Anecdotal evidence suggests that governors may behave differently when in lame duck status. For example, Gov. Otis Ray Bowen (R) of Indiana made no changes in the state cigarette tax in his first incumbency period as the federal tax was held constant at 8 cents/pack (thus, a positive response in real terms). On the other hand, in his second year as a lame duck (year 1978) he raised the state cigarette tax from 6 cents to 10.5 cents, a negative response to the declining real federal cigarette tax.[3] We seek to investigate the generality of this changed behavior.

Two strands of the literature guide our empirical work. First, the theoretical literature on vertical tax externalities identifies a multitude of (opposing) effects of a federal tax change on state

[1] 35 states had gubernatorial term limits in year 2000, and term limits may consequently have significant policy effects.

[2] A growing literature examines such "vertical tax externalities" in federal systems (see, e.g., Besley and Rosen 1998; Devereux *et al*. 2007).

[3] Gov. Thomas H. Kean (R) of New Jersey raised the nominal state cigarette tax in year 1983 as a response to the 1983 nominal increase in the federal cigarette tax (a positive response, in real terms), but in 1987 he raised this state tax again without any nominal change in the federal tax (i.e., a negative response, in real terms).

commodity taxes. Determinants of the slope of the state reaction function include the price-elasticity of demand, revenue effects, the extent of cross-border shopping, and horizontal tax competition (see, e.g., Besley and Rosen 1998; Keen 1998; Devereux *et al*. 2007).[4] The empirical literature on vertical tax externalities generally finds positive or insignificant effects on U.S. state cigarette and gasoline taxes of a change in the corresponding federal excise tax.[5] This literature has not incorporated the effect of reputation-building strategies.

Second, the seminal paper by Besley and Case (1995) provides a reputation-building model where voters with imperfect information re-elect a governor with a higher probability, the greater the incumbent's effort (which yields more "successful" policies and high voter utility) and reputation (see also Barro 1970; Banks and Sundaram 1998). In the governor's final term she finds herself a

[4] Keen (1998) and Devereux *et al*. (2007) argue that the price-elasticity of demand (the elasticity of the tax base) is an important determinant of the sign of the tax reaction function. Besley and Rosen (1998) argue that a revenue effect arises from the need of states to raise tax rates in order to keep state revenues intact, which results in a positive response to a federal tax hike. Devereux *et al*. also discuss the case of cross-border shopping and horizontal tax competition. When no cross-border shopping occurs, the state commodity tax responds negatively to the federal tax when demand is linear, but positively if demand is iso-elastic. When cross–border shopping is intense and demand is relatively price–inelastic, the state commodity tax will be unresponsive to the federal tax rate (but highly positively responsive to neighboring states' rates); when demand instead is elastic, the response is ambiguous (Devereux *et al*.). Besley and Rosen (1998) and Keen (1998) in addition argue that a federal tax hike increases the marginal value of state public goods, raising the attractiveness of the state tax. Keen points out that when the federal tax raises the consumer price and thus reduces demand for the good, the welfare loss resulting from the state tax declines, yielding a positive response. Moreover, Besley and Rosen suggest that there may be complementarity and substitutability effects among various types of taxes, in the presence of non–separabilities in demand. This suggests ambiguous responses by states. Besley and Rosen furthermore identify the possibility of endogenously determined expenditure effects, where states reduce public spending as a response to federal tax increases. This also yields an ambiguous effect on state taxes.

[5] See Besley and Rosen (1998) using 1975-89 data; Devereux *et al*. (2007) using 1977-97 data; Fredriksson and Mamun (2008) using 1975-2001 data; Fredriksson and Mamun (2008) report a negative vertical cigarette tax externality for years 1982-2001, however. The empirical literature also explores other areas of taxation. Boadway and Hayashi (2001) and Karkalakos and Kotsogiannis (2007) report negative effects on Canadian provincial corporate taxes, and Goodspeed (2000) finds a negative effect on U.S. state income taxes of federal income tax changes. Esteller–Moré and Solé–Ollé (2001) establish a positive impact on U.S. state taxes of federal personal income and general sales taxes, whereas Esteller–Moré and Solé–Ollé (2002) report a similar relationship for Canadian income taxes. Brülhart and Jametti (2006) find a positive vertical externality on Swiss personal and corporate sub–national taxes. For other theoretical and empirical contributions to the tax competition literature, see, for example, Boadway *et al*. (1998), Boadway and Hayashi (2001), Hoyt (2001), and Ravelli (2003). See Brueckner (2003) for a useful survey of the literature on horizontal tax externalities.

lame duck without re-election prospects, with no payoff from building reputation.[6] Thus, she puts in less effort and her policy choices will differ from earlier periods.[7]

The empirical literature on reputation-building includes Besley and Case (1995), who find that Democratic lame duck governors set significantly higher total state taxes per capita and higher state expenditures than other governors. Millimet *et al*. (2004) find that Republican lame ducks raise state taxes and spending per capita more than do Democratic lame ducks.[8] List and Sturm (2006) report that governors' environmental policy choices change noticeably once they obtain lame duck status, and the change is conditional on the environmental preferences of the electorate. The empirical literature on reputation-building has not yet investigated vertical tax interactions.

We merge the insights from the different literatures discussed above. The following testable prediction emerges regarding last-term governors' responses to changes in the federal tax rate: if re-electable governors are guided by reputation-building strategies, "lame duck" governors will respond *differently* to federal tax changes than do other governors. While the existing empirical literature has generally found positive responses by states to real federal tax changes, these estimates are averages

[6] This assumption is supported by empirical evidence provided by Besley and Case (1995) who report that lame duck governors do *not* appear to care for either their own or their party's reputation, as suggested by their finding that only re-electable governors respond to natural disasters by raising expenditures.

[7] Several political forces may affect the ability and willingness of lame duck governors to changes behavior in their last incumbency period (Besley and Case 1995). First, governors may be constrained in their ability to set policies freely by legislatures, constitutions, or their political parties. Second, governors may eye another political office after the stay in the governor's mansion is over. Lame duck governors may therefore continue to build reputation. Third, a potential successor from the same party may offer the incumbent compensation for keeping the party's reputation intact (Alesina and Spear 1988). Forth, the incumbent lame duck may want to raise the probability that a party colleague wins the next election, as it raises the probability that future policies are closer to the incumbent's ideology (Harrington 1992). Fifth, the lame duck may be concerned about her legacy. Finally, she may eye a future position in the private sector. These effects would all work to reduce the effect of term limits. Our empirical work below suggests that these forces are insufficient to completely neutralize the effects of term limits.

[8] Besley and Case (2003) extend the data set to 1997 and find a significant effect only for state expenditures. Millimet *et al*. (2004) extend the sample to 1999, and report stronger positive effects than the earlier literature. Lott (1987) and Lott and Bronars (1993) used voluntary retirements from the U.S. Congress as an indicator of a binding term limit in order to detect changes in voting patterns during the last term in office. Little evidence was uncovered of such behavior.

that may mask a different response by re-electable governors and lame duck governors, respectively.[9]

Utilizing state-level panel data for 1975-2000, we find that lame duck governors do exhibit a different response to federal cigarette tax changes relative to their non-lame-duck counterparts. In fact, our estimates suggest that while re-electable governors exhibit a *positive* response to real federal cigarette tax changes, lame ducks have a *negative* response. We find some evidence that our results tend to be driven particularly by Republican governors.[10]

It appears that an increase in the federal cigarette tax rate reduces state tax revenues in states headed by lame ducks, both by reducing the state tax base and by causing a decline in the state cigarette tax.[11] By merging the literature on reputation-building and vertical tax externalities, we believe our empirical results complement the existing literature.

The paper is organized as follows. Section II discusses the empirical model and data. Section III presents the results, and Section IV provides a brief conclusion.

II. Empirical Analysis

The Empirical Model

Drawing on the existing literature discussed above, we distill one testable implication. If reputation-building occurs, the response to the federal cigarette tax should differ between re-electable and lame duck governor status, i.e. it is conditional on governor lame duck status. The following basic empirical model is estimated:

$$t_{it}^{s} = \alpha_i + \gamma t_t^f + \beta l_{it} + \rho t_t^f \times l_{it} + \delta X_t + \theta Z_{it} + \varepsilon_{it}, \qquad (1)$$

[9] For example, suppose governors with an re-election motive exhibit a positive response to federal tax changes. If reputation-building occurs, lame ducks will have either a significantly greater positive response, a smaller positive response, or a negative response.

[10] Our results should not necessarily be attributed to the party affiliation of governors, but may be driven by the preferences of the state level electorate.

[11] Tobacco tax revenues are substantial in the U.S. For example, in 1997 U.S. consumers spent $52.6bn on tobacco products, out of which $5.7bn was federal taxes, and $7.8bn was state and local taxes, according to Gale *et al*. (2000).

where t_{it}^{s} is the cigarette tax rate in state *i* in year *t*, α_i is a state fixed effect, t_t^f is the federal cigarette tax in year *t*, l_{it} is a dummy variable equal to one if the governor in state i has lame duck status in year *t*, $t_t^f \times l_{it}$ is the corresponding interaction variable, X_t are the time varying controls common to all states, Z_{it} are the time and state varying controls, and ε_{it} is a random error term. The coefficients of particular interest are γ and ρ. Note that year fixed effects cannot be included due to the inclusion of the time varying variables t_t^f and X_t.

Data and Hypothesis Specification

Our data set spans 1975 to 2000 and comprises 47 contiguous U.S. states.[12] All sources and variable definitions, as well as summary statistics, are reported in Table 1. The state and federal cigarette excise tax rates (per pack of 20 cigarettes) come from Orzechowski and Walker (2003) and are deflated to 1983 constant $ prices. The state tax rates (*STATETAX*) vary substantially across states and over time. The nominal state cigarette tax rate increased for most states between 1975 and 2000, although not every state exhibited an increasing trend. In 2000, the state cigarette excise tax rate ranged from $0.025 per pack in Virginia to $1.11 in New York. The federal tax rate (*FEDTAX*) is identical for all states in any given year (of course). From 1952 to 1982 the nominal federal tax rate was 8 cents per pack, but by year 2000 it had increased to 34 cents (after several tax hikes). Figure 1 presents the pattern of real cigarette tax rates over the sample period for: (*i*) the three states with greatest real increases (CA, NY, and WA); (ii) the three states with the greatest real declines (KY, NC, and VA); and (iii) the real federal tax rate.

Data on gubernatorial term limits come from List and Sturm (2006). *LAMEDUCK* takes a value of one if the incumbent governor is currently facing a binding term limit, and zero otherwise. In many U.S. states, governors face term limits after two terms in office. However, no limit, one, and

[12] Nebraska has a non-partisan, unicameral state legislature. We therefore drop Nebraska completely from our data set, following, e.g., Reed (2006).

three term limits also existed during our sample period. Table A1 in the appendix describes the pattern of term limit legislation across states during the sample period. *FEDTAX×LAMEDUCK* is an interaction variable of main interest in this study.

In order to distinguish the policy responses by governor political party, we differentiate lame ducks by party affiliation. *DEMOLAME* represents lame duck Democrats, and *REPLAME* their Republican counterparts. *DEMOLAME* and *REPLAME* take a value of one if a lame duck governor is a Democrat and Republican, respectively. The interactions *FEDTAX×DEMOLAME* and *FEDTAX×REPLAME* are consequently of particular interest.

We utilize the same set of control variables as Besley and Rosen (1998). In order to control for political party dominance, we use (*i*) a dummy variable equal to one if the state governor is a Democrat (*DEMOGOV*), (*ii*) the proportion of Democrats in the state Senate (*DEMOSENATE*), and (*iii*) the proportion of Democrats in the state House (*DEMOHOUSE*). The state governor data comes from the National Governors Association (2005), while the proportions of Democrats in Senate and House come from various editions of the Statistical Abstracts of the United States (U.S. Census Bureau (various years)).

National real GDP (*NatlGDP*) and the national unemployment rate (*NatlUNEMPLOY*) capture fluctuations in the national economic climate. These variables represent the X_t controls in Eqn. (1). The time- and state-varying controls Z_{it} in Eqn. (1) consist of state demographic and economic variables such as the total state population (*POPULATION*), real state income per capita (*INCOME*), state unemployment rate (*UNEMPLOYstate*), the portion of population in the state between five and 17 years of age (*CHILD*), and over 65 years old (*OVER65*).[13] The national real GDP, population, and state income data are from the Bureau of Economic Analysis (U.S. Department of Commerce (various years)), and the state unemployment rates are from the Bureau of

[13] All models also include *POPULATION* and *INCOME* squared, as well as a time trend and its square.

Labor Statistics (U.S. Department of Labor (various years)). The data on the national unemployment rate and the proportion of children and the aged in the population are from various editions of the Statistical Abstracts of the United States (U.S. Census Bureau (various years)).

Next, *TOBACCO INCOME* equals tobacco production per dollar of state income, and comes from USDA (various years); it measures the relative importance of tobacco for the state. In addition, *GAS* measures gasoline production per dollar of state income. Tobacco producers may be expected to lobby for lower cigarette taxes, while gasoline producers should take the opposite stance (to reduce the need to raise gas tax revenue). *GRANTS* is federal grants/capita, which reduces the need to raise state tax revenues. *INCOME TAX* is the federal income tax divided by adjusted gross income, which seeks to capture the ability of states to engage in further taxation effort. The daily gasoline production data comes from the U.S. Department of Energy (various years) database, whereas federal grant and income tax data comes from the U.S. Census Bureau (various years).

III. Empirical Results

As shown by Moulton (1986), OLS estimations may give spurious results if the dependent variable is at the individual level and one or more of the independent variables are at the aggregate level. Thus, we utilize White (1980) robust standard errors and allow for within-year correlations.[14] All tables report the joint significance of *FEDTAX* and its interactions with *LAMEDUCK*.

Basic Model Results

Table 2 reports basic results using *LAMEDUCK* and various combinations of party power control variables (*DEMOGOV*, *DEMOSENATE*, and *DEMOHOUSE*) and their *FEDTAX* interactions. *FEDTAX* is positive in all models in Table 2, and significant in Models I-IV. *LAMEDUCK* is consistently positive and significant in all models, while the

[14] The variance of the estimators is calculated by multiplying the residuals and the regressors, then summing within year (cluster). This allows within-year correlations that affect the estimated standard errors and the variance-covariance matrix of the estimators, but not the estimated coefficients (see Rogers 1993; Williams 2000; Wooldridge 2002 for detailed discussions).

FEDTAX×*LAMEDUCK* interaction is significant and negative in all models. Moreover, *FEDTAX* and *FEDTAX*×*LAMEDUCK* are jointly significant in all models. In economic terms (performing all calculations in cents), Model I, e.g., suggests that a 10 cent increase in *FEDTAX* results in a 3.7 cent increase in *STATETAX* in states without a lame duck governor, but a 1 cent *decrease* [10×(0.37 – 0.47)= –1] in *STATETAX* in states with a lame duck in office.

The results in Table 2 thus suggest that lame duck governors have a different response to real federal tax changes than other governors. While governors eligible for re-election have a positive response to *FEDTAX*, lame ducks tend to exhibit a negative response. Thus, it appears that a federal tax hike undermines state income in states governed by lame ducks, both by reducing the tax base and by causing a decline in the state tax rate. The non-lame duck behavior is consistent with the revenue effect identified by Besley and Rosen (1998) who argue that states raise tax rates in order to keep state revenues intact as the federal tax rises (conversely, states lower the state tax as the federal tax declines). Lame ducks, on the other hand, appear to let the level of revenues (and likely public good provision) decline when the federal tax rises. However, lame ducks appear to emphasize revenues when the federal tax decreases - they raise the state tax simultaneously as the tax base expands.

Note also that our results suggest that holding *FEDTAX* constant, a lame duck governor raises *STATETAX* somewhat. This softens the effect of an increase in *FEDTAX*. For example, Model I in Table 2 suggests that a lame duck raises *STATETAX* by 0.238 cents at the mean of *FEDTAX*. Thus, a 10 cent increase in *FEDTAX* occurring when a lame duck is in office yields an overall [10×(0.37 – 0.47) + 0.238 =] 0.76 cent *decrease* in *STATETAX* (at the mean of *FEDTAX*).

Table 3 takes a closer look at the effect of lame duck governors' party affiliation. In Table 3, we separate Democratic lame duck governors (*DEMOLAME*) and Republican lame duck governors

(*REPLAME*).[15] *FEDTAX* is significant and positive in Models I-IV, while both *FEDTAX*×*DEMOLAME* and *FEDTAX*×*REPLAME* are consistently negative and significant in all five models. Table 3 suggests that Democratic and Republican lame ducks both engage in reputation-building activities. Note, however, that the *REPLAME* and *REPLAME*×*FEDTAX* coefficients are consistently greater in absolute value than *DEMOLAME* and its *FEDTAX* interaction. This suggests that Republican governors may be more heavily involved in reputation-building activities. For example, Model IV in Table 3 suggests that while Democratic lame ducks respond to a 10 cent increase in *FEDTAX* by cutting *STATETAX* by 0.5 cents ([10× (0.32– 0.37)] =-0.5), their Republican counterparts reduce *STATETAX* by 2.4 cents ([10×(0.32-0.56)] =-2.4). Thus, an increase in *FEDTAX* tends to reduce state cigarette tax revenues particularly in states governed by a Republican lame duck (via a declining tax base and *STATETAX*).

Control Variables

In Tables 2-3, the *FEDTAX* interactions with *DEMOGOV*, *DEMOSENATE*, or *DEMOHOUSE* are never significant.[16] However, *DEMOGOV* reaches significance in four of the eight models where included in Tables 2-3, *DEMOHOUSE* is significant in two out of four models, while *DEMOSENATE* is never significant. *NatlGDP* has a consistently positive (and generally significant) effect on *STATETAX*, suggesting that higher average national income growth raises the willingness to tax cigarettes in the states. On the other hand, *INCOME* is negative and significant in all models in Tables 2-3, indicating that states with (potentially) higher income tax revenues may, on the margin, have a lower need to tax cigarettes in order to meet revenue targets and provide public goods. Large *POPULATION* values appear to have a similar effect. Young states (as measured by

[15] Note that in all models included in Table 3, the excluded category is Republican governors not facing a term limit, except for Model I where it is any governor not facing the term limit. Moreover, the effect of the federal tax rate is allowed to differ between non-*DEMOLAME* and *REPLAME* in Models III and V. Incorporating this difference in other models does not change the results.

[16] R^2 varies between 0.33 and 0.35 for the models reported in Tables 2 and 3.

CHILD) have higher cigarette taxes, perhaps in order to fund schools or discourage smoking. The negative *OVER65* coefficients suggest that older populations, who may have a larger share of smokers, are associated with lower cigarette taxes. The signs of *TOBACCO INCOME* and *GAS* suggest that both tobacco and gasoline producing states have lobbies successfully influencing cigarette tax rates in their favored directions. However, apart from Model IV in Table 2, *TOBACCO INCOME* is never significant in Tables 2-3. The remaining controls do not reveal consistently significant coefficients either.

Robustness Analysis

Tables 4 and 5 offer a robustness analysis based on Model IV in Tables 2 and 3, respectively. In the following, we discuss Tables 4 and 5 simultaneously, unless otherwise noted.[17] In Model I, *FEDTAX* is instrumented by the federal deficit as a percentage of national GDP, following Besley and Rosen (1998). The state and federal cigarette tax rates may simultaneously be affected by some common factor, which may motivate state and federal governments to act simultaneously. For example, new information may become available on the adverse health consequences of smoking. Moreover, the federal government may also be influenced by state governments' tax changes. In all models using instruments (Models I, V, and VI in Tables 4-5), we report the F-test of joint significance of the instrument in each first-stage regression (see Staiger and Stock, 1997). Tables A2 and A3 in the appendix in addition report the following tests: (*i*) Shea's (1997) partial R^2: when multiple endogenous regressors are used, the F-statistics and partial R^2 measures from the first-stage regressions will not reveal weakness of the instruments. Shea's partial R^2 measure takes the inter-correlations among the instruments into account (Shea 1997; Godfrey 1999); (*ii*) Kleibergen-Paap LM under-identification test (Kleibergen and Paap 2006); (*iii*) Kleibergen-Paap Wald under-

[17] The "standard controls" included in all models in Tables 4-5 are: *DEMOGOV, DEMOSENATE,DEMOHOUSE, NatlGDP, NatlUNEMPLOY, POPULATION, INCOME, StateUNEMPLOY, CHILD, OVER65, TOBACCO INCOME, GAS, GRANTS*, and *INCOME TAX*, square terms for *POPULATION* and *INCOME*, a constant, and a time trend and its square (results available upon request).

identification test (Kleibergen and Paap 2006). Tests (*ii*) and (*iii*) test whether the equation is identified; (*iv*) the Kleibergen-Paap Wald *F* statistic (Kleibergen and Paap 2006) tests for weak identification. The *F* statistic should be compared with the critical values for the Cragg-Donald weak id test (see Stock and Yogo 2005); (*v*) the Anderson-Rubin test whether the endogenous variables are jointly statistically significant (Anderson and Rubin, 1949); (*vi*) the Stock-Wright (2000) LM test. The latter two (closely related) test statistics are robust to the presence of weak instruments. The null hypothesis tested in both tests (*v*) and (*vi*) is that the coefficients of the endogenous regressors in the structural equation are jointly equal to zero, and moreover that the over-identifying restrictions are valid. In addition to passing these tests, Tables A2 and A3 in the appendix also reveal that our instruments pass (*vii*) the Hansen's over-identification test (Hayashi 2000) of Model V in Tables 4-5, as well as Models I and VI which are exactly identified.[18]

In Model II in Tables 4 and 5, we investigate whether changes in *FEDTAX* may affect *STATETAX* with a lag of one year ($FEDTAX_{-1}$). State legislators may have a delayed reaction to federal legislation, or state legislation may not take effect until the following year.[19] Model III includes only states without any changes in the term limit legislation during the sample time period, since changes in taxes and term limits may be simultaneously determined (Besley and Case 1995). States with term limit legislation may differ from those without such limits, and therefore Model IV includes only states having term limit legislation at some point during the sample period (see List and Sturm 2006). This implies dropping 11 states (see Table A1 in the appendix). Model V adds *NEIGHBOR TAX*, which seeks to control for horizontal tax interactions (see Brueckner 2003; Devereux *et al*. 2007). Following Rork (2003), we utilize the population weighted tax set by

[18] Although Models I and VI are exactly identified, for completeness we offer additional tests that show that these models pass the instrument relevance test (i.e., Shea's partial R^2), under-identification tests, weak-identification tests, and weak instrument-robust inference tests (i.e. joint significance of the endogenous regressors).

[19] For example, California under Gov. Pete Wilson (R) raised the state cigarette tax in year 1994, after a 1993 increase in the federal tax.

neighboring states, instrumented by the population weighted state unemployment rate, the percentage of children and old in the population, and the proportion of Democrats in the state House (see also Devereux *et al.* 2007).

Model VI includes a lagged dependent variable, $STATETAX_{t-1}$. As argued by Devereux *et al*. (2007), a lagged dependent variable is likely to be appropriate if state taxes exhibit strong serial correlation. We instrument $STATETAX_{t-1}$ by the second lag of the dependent variable. *BEERTAX* is included in Model VII and comes from the World Tax Data Base (2006); it adjusts for another sin tax. In Model VIII we drop all agricultural tobacco producing states, since they may exhibit a different approach to vertical interactions in cigarette taxes. It would be of concern if these states drive our results. Model IX includes $DEFICIT_{-1}$, which is the state budget deficit as a percent of real gross state product (GSP), lagged one year. Finally, Model X adds three additional political economy related controls included by Fredriksson and Mamun (2008). Per capital sales (lagged one year), $SALES_{-1}$, controls for the voting incentive of smokers and the lobbying pressure from cigarette producers and distributers (see, e.g., Dixit *et al*. 1997). Sale of cigarettes per square mile (lagged one year) is utilized to measure smokers' and tobacco sellers' ability to organize politically and thus gain political influence (*CONCENTRATION*). Politicians may be bribed or pressured by producer and other lobby groups to change, not change, or delay changing existing policies (*CORRUPTION*).[20] See the table notes for further details.

Results of Robustness Analysis

In Table 4, *FEDTAX* (and $FEDTAX_{-1}$) and *LAMEDUCK* are positive and significant in all models, except in Model V, which includes a significantly positive *NEIGHBOR TAX*. The finding in Model V is consistent with Devereux *et al.*'s (2007) theoretical prediction that when demand is

[20] State level corruption is measured by the number of convictions of public officials on corruption charges per 1000 public employees. The conviction data is collected from the U.S. Department of Justice (various years), and is used also by, e.g., Glaeser and Saks (2006), who suggest that corruption distorts policy and economic outcomes.

relatively price-inelastic and the incentive for cross-border shopping (inter-state arbitrage) is strong (characteristics they attribute to the U.S. cigarette market), horizontal tax competition should be intense. Simultaneously, vertical tax externalities should be non-existent in this case. They present empirical evidence supporting these predictions. However, we find that *FEDTAX*×*LAMEDUCK* is negative and significant in all models in Table 4, and that this interaction and *FEDTAX* are jointly significant in Model V (as in all other models in Table 4). Thus, we find that vertical tax externalities do occur even when competition occurs between neighboring states, in particular when the governor is a lame duck. In additional robustness analysis (not reported) we dropped the national level controls (*NatlGDP* and *NatlUNEMPLOY*), which may duplicate the effects of the already included corresponding state-level variables. This allows us to add year-specific dummies. This did not affect our results. Table 5 reveals a pattern similar to Table 3 regarding the variables of interest.[21] *FEDTAX*, *REPLAME* and *FEDTAX*×*REPLAME* are significant in all models with consistent signs except in Model V, and *DEMOLAME* and *FEDTAX*×*DEMOLAME* exhibit significance in all but three models.

While adding *NEIGHBOR TAX* affects our *FEDTAX* results in Tables 4 and 5, none of our other robustness checks affect the results in material ways. Instrumenting *FEDTAX* in Model I causes both the coefficient size and significance level to rise. The $FEDTAX_{-1}$ coefficient size is greater than in the remaining models, suggesting the full effect of federal tax changes may occur with a lag. Reducing the sample to states without changes to term limit legislation in Model III in Table 5 renders the *DEMOLAME* coefficients insignificant, perhaps due to a smaller sample size.

Adding $STATETAX_{-1}$ or *BEERTAX* in Models VI-VII in Tables 4-5, respectively, do not affect the coefficients of interest in material ways. Neither does focusing on states without tobacco production, adding a measure of the state budget deficit, or adding three political economy variables

[21] In Tables 4 and 5, R^2 takes values between 0.33 and 0.35, except in Model VI where it equals 0.75 (in both tables).

in Models VIII-X. The significant $STATETAX_{-1}$ in Model VI causes a reduction of the *FEDTAX* coefficient size relative to other models.[22] However, *FEDTAX* retains its significance level, which is in contrast to Devereux *et al*. (2007) where a lagged dependent variable reduced the significance level of the federal tax variable. Using Model VI in Table 5 as an example, we find that while re-electable governors exhibit a positive response to an increase in *FEDTAX*, both Democratic and Republican lame ducks have a negative response.[23] While this result is consistent for Republican lame ducks in all ten models in Table 5, Democratic lame ducks' responses sometimes turn positive but remain small (as suggested by Model I, for example).

The significant *BEERTAX* coefficient suggests that states tend to adopt an either pro- or anti-sin stance, i.e. that beer and cigarette taxes are complements. $DEFICIT_{-1}$ in Model IX does not reach significance in either Table 4 or 5. In Model X, the negative *SALES* and *CONCENTRATION* coefficients indicate that smoking voters and special interest groups are more successful in reducing the cigarette tax, the greater the amount at stake and the easier time they have to organize collective action.[24]

IV. Conclusion

This paper provides novel evidence that reputation-building strategies by state governors affect their *responses* to federal tax policy changes. In particular, re-electable governors distort their responses to federal cigarette tax policies for electoral gains. While state governors in general exhibit a positive response in the state cigarette tax to changes in the federal cigarette tax, lame duck governors tend to have a negative response. Cigarette tax revenues consequently decline as a result

[22] According to Model VI in Table 4, a 10 cent increase in *FEDTAX* yields a 1 cent decrease in *STATETAX* [10×(0.12–0.22)= –1] in years when the governor cannot run for re-election.

[23] According to Model VI in Table 5, a 10 cent increase in *FEDTAX* yields 0.5 and 1.7 cent reductions in *STATETAX* by Democratic and Republican lame ducks, respectively. On the other hand, non-lame ducks raise *STATETAX* by 1.2 cents.

[24] We also run models with the federal-level variables *NatlGDP* and *NatlUNEMPLOY* dropped (not reported; results available upon request), as these may duplicate the effects of the already included corresponding state-level variables. We are then able to add year-specific dummies. The results remain intact.

of a federal tax increase in states governed by a lame duck, both due to a shrinking of the state tax base and a decline in the state tax rate. Moreover, we find some evidence that Republican governors tend to be more prone to engage in reputation-building activities. Republican lame duck governors exhibit a more *negative* response to federal tax policy changes.

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Appendix I

Table A1. Term Limit Legislation for Governors by State (1975-2000)

States with no term limits (13 states):
CT, ID, IL, IA, MA,[a] MN, NH, NY, ND, TX, VT, WA,[b] WI

States limiting governors to one term in office:
VA

States limiting governors to two terms in office (17 states):
AL, DE, FL, KS, LA, MD, ME, MO, NE, NJ, NV, OH, OK, OR, PA, SD, WV

State law changed from no term limit to a three-term limit:
UT (1994)

State law changed from no term limit to a two-term limit (8 states):
AZ (1992), AR (1992), CA (1990), CO (1990), MI (1992), MT (1992),
RI (1994), WY (1992)

State law changed from a one-term limit to a two-term limit (8 states):
GA (1976), IN (1972), KY (1992), NM (1991), MS (1986), NC (1977),
SC (1980), TN (1978)

Source: List and Sturm (2006).
Notes: Year of term limit change in brackets.

a. Term limits were enacted in 1994, but in 1997 the MA Supreme Court ruled them unconstitutional.
b. Two-term term limits were enacted in 1992, but in 1998 the WA Supreme Court ruled them unconstitutional.

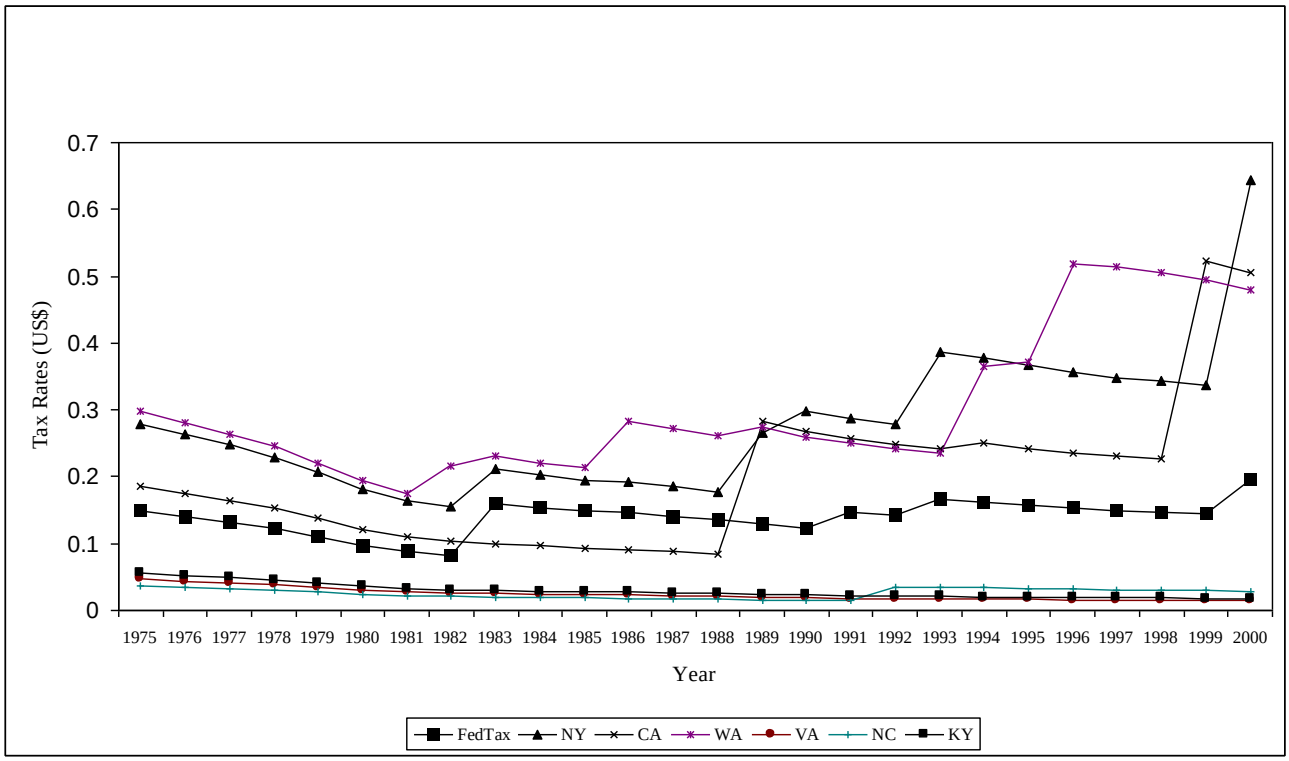
Table A2. Tests of IV Models Included in Table 4

Tests	Model I	Model V	Model VI
Shea's Partial R^2			
FEDTAX	0.31		
FEDTAX×LAMEDUCK	0.06		
NEIGHBOR TAX		0.16	
STATETAX$_{-1}$			0.61
Underidentification Tests			
Kleibergen-Paap rk LM statistic [χ^2()]	36.83 [p=0.00]	276.09 [p=0.00]	158,44 [p=0.00]
Kleibergen-Paap rk Wald statistic [χ^2()]	32.97 [p=0.00]	670.71 [p=0.00]	2046.83 [p=0.00]
Weak Identification Test			
Kleibergen-Paap Wald rk F statistic	16.20	164.03	2006.04
Weak Instrument – Robust Inference			
Anderson–Rubin Wald Test [χ^2()]	35.71 [p=0.00]	42.02 [p=0.00]	412.30 [p=0.00]
Stock-Wright LM *S* statistic [χ^2()]	33.65 [p=0.00]	37.64 [p=0.00]	98.98 [p=0.00]
Hansen's J–Statistic Overidentification Test		[p=0.18]	

Table A3. Tests of IV Models Included in Table 5

Tests	Model I	Model V	Model VI
Shea's Partial R^2			
FEDTAX	0.14		
FEDTAX×DEMOLAME	0.01		
FEDTAX×DEMOLAME	0.14	0.17	
NEIGHBOR TAX			
STATETAX$_{-1}$			0.61
Underidentification Tests			
Kleibergen-Paap rk LM statistic [χ^2()]	13.99 [p=0.00]	276.09 [p=0.00]	158,44 [p=0.00]
Kleibergen-Paap rk Wald statistic [χ^2()]	13.12 [p=0.00]	670.71 [p=0.00]	2046.83 [p=0.00]
Weak Identification Test Kleibergen-Paap Wald rk F statistic	40.29	163.74	2002.33
Weak Instrument – Robust Inference			
Anderson–Rubin Wald Test [χ^2()]	18.86 [p=0.02]	41.75 [p=0.00]	418.95 [p=0.00]
Stock-Wright LM *S* statistic [χ^2()]	18.41 [p=0.02]	37.58 [p=0.00]	99.38 [p=0.00]
Hansen's J–Statistic Overidentification Test		[p=0.13]	

Figure 1: Real Federal Cigarette Tax Rates and State Cigarette Tax Rates



Note: Fig. 1 includes the three states with the greatest increases and the three states with the largest declines.

Table 1. Summary Statistics

Variables Definition	Source	Obs	Mean	Min	Max
STATETAX State excise tax (1983 centsUS)	Orzechowski and Walker (2003)	1222	18.11	1.45	64.46
FEDTAX Federal tax (1983 centsUS)	Orzechowski and Walker (2003)	1248	13.94	8.29	19.75
LAMEDUCK	List and Sturm (2006)	1222	0.26	0	1
DEMOLAME	List and Sturm (2006)	1222	0.15	0	1
REPLAME	List and Sturm (2006)	1222	0.10	0	1
NatlGDP national real GDP (1983 bn $US)	U.S. Department of Commerce	1222	3858	2472	5700
NatlUNEMPLOY national unemployment rate	U.S. Census Bureau	1222	6.45	4	9.5
POPULATION State population	U.S. Department of Commerce	1222	5143911	376000	3.40×10^7
INCOME personal income/capita (1983 $US)	U.S. Department of Commerce	1222	12944	7628	24097
StateUNEMPLOY State unemployment rate	U.S. Department of Labor	1222	6.25	2.2	18
CHILD portion of population age 5–17	U.S. Census Bureau	1222	0.20	0.16	0.26
OVER65 Portion of population over 65	U.S. Census Bureau	1222	0.12	0.7	0.19
TOBACCO INCOME tobacco production/$US of state income	USDA	1222	0.002	0	0.10
GAS daily production/$US of state income	U.S. Department of Energy	1222	0.008	0	0.32
GRANTS federal grants/capita (1983 $US)	U.S. Census Bureau	1222	499	231	1192
INCOME TAX federal income tax divided by adjusted gross income	U.S. Census Bureau	1222	0.14	0.06	0.19
DEMOGOV dummy = 1, if the governor is a Democrat	National Governors Association	1222	0.55	0	1
DEMOSENATE proportion of Democrats in State Senate	U.S. Census Bureau	1222	0.59	0	1
DEMOHOUSE proportion of Democrats in State House	U.S. Census Bureau	1222	0.585	0	1
$SALES_{-1}$ per capita cigarette sale lagged 1 year	Orzechowski and Walker (2003)	1222	1.14	0.39	2.80
CORRUPT corruption convictions per 1000 public employees	US Department of Justice	1182	0.04	0	0.33
CONCENTRATION cigarette sales per square mile	Orzechowski and Walker (2003)	1222	0.02	0.0004	0.14
BEER TAX State excise tax per gallon (1983 $US)	World Tax Data Base (2006)	1196	0.17	0.01	1.43
$DEFICIT_{-1}$ state budget deficit (% of real GSP) lagged 1 year	U.S. Census Bureau U.S. Department of Commerce	1222	8.93	-17.05	55.93

Table 2. Fixed Effect Estimations I: Basic Models

Model	I	II	III	IV	V
FEDTAX	0.37*** (3.27)	0.36*** (3.13)	0.33** (2.22)	0.32** (2.75)	0.14 (0.77)
LAMEDUCK	6.79*** (4.89)	6.74*** (4.80)	6.77*** (4.88)	6.60*** (5.25)	6.90*** (5.74)
FEDTAX×LAMEDUCK	-0.47*** (4.22)	-0.46*** (4.12)	-0.47*** (4.17)	-0.45*** (4.56)	-0.47*** (4.89)
DEMOGOV		0.55** (2.28)	-0.11 (0.08)	0.51** (2.17)	0.19 (0.16)
FEDTAX×DEMOGOV			0.05 (0.47)		0.02 (0.26)
DEMOSENATE				-0.80 (0.72)	3.76 (0.67)
FEDTAX×DEMOSENATE					-0.31 (0.79)
DEMOHOUSE				10.15*** (3.87)	1.49 (0.22)
FEDTAX×DEMOHOUSE					0.61 (1.37)
NatlGDP	0.002** (2.08)	0.002** (1.94)	0.002** (1.96)	0.002* (1.75)	0.002* (1.73)
NatlUNEMPLOY	-0.11 (0.48)	-0.12 (0.54)	-0.12 (0.56)	-0.12 (0.59)	-0.13 (0.66)
POPULATION	-1.4E-07*** (2.79)	-1.4E-07*** (2.88)	-1.4E-07*** (2.87)	-10.5E-07* (1.93)	-10.02E-07* (1.90)
INCOME	-0.005** (5.48)	-0.005*** (5.50)	-0.005*** (5.64)	-0.005*** (5.21)	-0.005*** (5.20)
StateUNEMPLOY	-0.21 (1.43)	-0.20 (1.38)	-0.21 (1.39)	-0.19 (1.37)	-0.19 (1.37)
CHILD	127.07*** (5.48)	128.31*** (5.56)	128.06*** (5.63)	112.76*** (5.48)	115.88*** (5.72)
OVER65	-58.84*** (2.91)	-57.80*** (2.88)	-57.82*** (2.86)	-58.27*** (2.89)	-53.75** (2.49)
TOBACCO INCOME	-10.91 (0.60)	-7.57 (0.41)	-6.61 (0.35)	-27.50* (1.71)	-23.30 (-1.56)
GAS	15.34** (2.14)	12.29** (2.23)	15.08** (2.30)	12.64* (1.96)	13.23** (2.12)
GRANTS	-0.004 (1.61)	-0.003 (1.53)	-0.004 (1.54)	-0.003 (1.52)	-0.003 (1.57)
INCOME TAX	-11.51 (1.14)	-10.81 (1.05)	-10.60 (1.02)	-9.31 (0.84)	-8.47 (0.73)
Observations	1248	1248	1248	1222	1222
Joint Signif. Test	8.93 [0.00]	8.57 [0.00]	9.57 [0.00]	11.41 [0.00]	20.56 [0.00]

Notes: Fixed–effect estimations with robust standard errors for years 1975–2000 that allow for within-year correlation. The dependent variable is *STATETAX*. All models include a constant and square terms for *POPULATION* and *INCOME*, a time trend, and its square. ***(**)[*] indicates significant at the 1(5)[10]% level, respectively. Joint significant test is an F-test for all variables involving *FEDTAX*.

Table 3. Fixed Effect Estimations II: Basic Models

Model	I	II	III	IV	V
FEDTAX	0.37***	0.36***	0.36**	0.32**	0.17
	(3.18)	(3.20)	(2.34)	(2.71)	(0.95)
DEMOLAME	5.56***	5.41***	2.39***	5.31***	5.74***
	(3.16)	(3.08)	(3.27)	(3.11)	(3.56)
REPLAME	8.07***	8.47***	8.49***	8.30***	8.36***
	(4.93)	(4.88)	(4.18)	(5.47)	(4.75)
FEDTAX×DEMOLAME	-0.37**	-0.37**	-0.37**	-0.37**	-0.40***
	(2.48)	(2.53)	(2.74)	(2.60)	(3.01)
FEDTAX×REPLAME	-0.57***	-0.58***	-0.58***	-0.56***	-0.56***
	(4.92)	(4.88)	(4.06)	(5.59)	(4.74)
DEMOGOV		0.59**	0.63	0.58**	0.78
		(2.16)	(0.42)	(12.20)	(0.59)
FEDTAX×DEMOGOV			-0.003		-0.14
			(0.03)		(0.15)
DEMOSENATE				-0.81	4.17
				(0.74)	(0.74)
FEDTAX×DEMOSENATE					-0.34
					(0.85)
DEMOHOUSE				10.15***	1.40
				(3.87)	(0.21)
FEDTAX×DEMOHOUSE					0.62
					(1.37)
NatlGDP	0.002**	0.002*	0.002*	0.001*	0.001
	(2.06)	(1.87)	(1.86)	(1.67)	(1.63)
NatlUNEMPLOY	-0.11	-0.12	-0.12	-0.12	-0.13
	(0.51)	(0.55)	(0.55)	(0.58)	(0.64)
POPULATION	-1.4E-07***	-1.4E-07**	-1.4E-07***	-10.5E-07*	-10.1E-07*
	(2.79)	(2.80)	(2.78)	(1.87)	(1.83)
INCOME	-0.005***	-0.005***	-0.005***	-0.005***	-0.005***
	(3.18)	(5.52)	(5.53)	(5.21)	(5.10)
StateUNEMPLOY	-0.21	-0.20	-0.20	-0.20	-0.19
	(1.42)	(1.39)	(1.37)	(1.39)	(1.34)
CHILD	125.72***	128.82***	128.83***	113.74***	116.92***
	(5.47)	(5.61)	(5.62)	(5.56)	(5.75)
OVER65	-57.22**	-55.91**	-55.89**	-56.61**	-52.43**
	(2.74)	(2.74)	(2.71)	(2.77)	(2.39)
TOBACCO INCOME	-7.78	-4.88	-4.90	-24.88	-23.87
	(0.41)	(0.25)	(0.25)	(1.46)	(1.40)
GAS	15.06**	15.30**	15.31**	12.71**	13.44**
	(2.16)	(2.28)	(2.35)	(2.03)	(2.18)
GRANTS	-0.004	-0.003	-0.003	-0.003	-0.003
	(1.62)	(1.52)	(1.52)	(1.50)	(1.55)
INCOME TAX	-11.29	-10.45	-10.46	-8.93	-8.39
	(1.12)	(1.02)	(1.01)	(0.82)	(0.73)
Observations	1248	1248	1248	1222	1222
Joint Signif. Test	8.45	8.32	6.56	10.51	15.81
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]

Notes: See Table 2 notes.

Table 4. Fixed Effect Estimations: Robustness Analysis I

Model	I IV	II LAG FEDTAX	III NO T. LIMIT CHNGE	IV ONLY T. LIMIT STATES	V HORIZ. INTER ACTION	VI LDV	VII BEER TAX	VIII NON-TOBAC STATES	IX STATE DEFICIT	X PE VARS
FEDTAX	0.68*** (5.49)		0.29** (2.56)	0.32** (2.61)	0.14 (1.40)	0.12** (2.18)	0.32*** (2.88)	0.28** (2.30)	0.33*** (2.89)	0.31*** (2.89)
LAMEDUCK	18.22*** (3.11)	6.95*** (3.54)	4.09*** (2.97)	5.95*** (4.48)	5.18*** (2.77)	3.29*** (3.83)	6.71*** (5.23)	5.77*** (3.52)	6.72*** (5.41)	4.86*** (4.27)
FEDTAX× *LAMEDUCK*	-1.27*** (3.03)		-0.26*** (2.85)	-0.41*** (3.95)	-0.35** (2.56)	-0.22*** (3.61)	-0.46*** (4.60)	-0.47*** (4.32)	-0.46*** (4.73)	-0.32*** (3.76)
$FEDTAX_{-1}$		0.48*** (4.15)								
$FEDTAX_{-1}$× *LAMEDUCK*		-0.49*** (3.48)								
NEIGHBOR TAX					0.58*** (5.63)					
$STATETAX_{-1}$						0.83*** (28.06)				
BEERTAX							7.60*** (3.70)			
$DEFICIT_{-1}$									0.03 (1.20)	
$SALES_{-1}$										-0.17*** (6.31)
CORRUPT										0.39 (1.13)
CONCEN–TRATION										-2.20*** (6.05)
Standard Controls?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1222	1248	728	936	1170	1128	1196	780	1222	1182
F-test of Joint Sign. of Instrument Set	321.05 [0.00] 25.86 [0.00]				40.38 [0.00]	841.39 [0.00]				
Joint Signif. Test	31.35 [0.00]	8.71 [0.00]	4.43 [0.02]	7.80 [0.00]	6.51 [0.04]	13.15 [0.00]	11.36 [0.00]	9.85 [0.00]	12.00 [0.00]	8.29 [0.00]

Notes: Fixed–effect estimations with robust standard errors for years 1975–2000 that allow for within-year correlation (except for Model I, V and VI, where z-statistics is reported). The dependent variable is *STATETAX*. ***(**)[*] indicates significant at the 1(5)[10]% level, respectively. F–statistics are provided for the joint significance of the instrumented variables in Models I, V, and VI. The joint significance test is for all variables which include *FEDTAX*. Standard controls included in all models (results available upon request) are: *DEMOGOV, DEMOSENATE, DEMOHOUSE, NatlGDP, NatlUNEMPLOY, POPULATION, INCOME, StateUNEMPLOY, CHILD, OVER65, TOBACCO INCOME, GAS, GRANTS, INCOME TAX,* square terms for *POPULATION* and *INCOME*, a constant, a time trend and its square.

Table 5. Fixed Effect Estimations: Robustness Analysis II

Model	I IV	II LAG FEDTAX	III NO T. LIMIT CHNGE	IV ONLY T. LIMIT STATES	V HORIZ. INTER ACTION	VI LDV	VII BEER TAX	VIII NON-TOBAC STATES	IX STATE DEFICIT	X PE VARS
FEDTAX	0.64*** (5.43)		0.29** (2.57)	0.32** (2.57)	0.14 (1.42)	0.12** (2.17)	0.32*** (2.84)	0.28** (2.30)	0.32*** (2.85)	0.32*** (2.88)
DEMOLAME	13.22** (2.11)	5.67** (2.79)	1.84 (0.68)	4.48*** (2.67)	5.57*** (3.27)	2.54*** (2.70)	5.71*** (3.46)	4.13 (1.63)	5.36*** (3.15)	3.11* (1.72)
REPLAME	19.77** (2.38)	9.29*** (4.26)	5.69*** (3.90)	8.06*** (4.50)	5.55* (1.79)	4.25*** (4.32)	8.05*** (5.04)	9.24*** (3.58)	8.50*** (5.49)	6.82*** (4.69)
FEDTAX× *DEMOLAME*	-0.93** (2.09)		-0.10 (0.53)	-0.33** (2.31)	-0.42*** (3.47)	-0.17*** (2.76)	-0.40** (2.95)	-0.39* (1.91)	-0.37** (2.65)	-0.20 (1.40)
FEDTAX× *REPLAME*	-1.36** (2.30)		-0.38*** (4.17)	-0.54*** (4.64)	-0.33 (1.47)	-0.29*** (4.00)	-0.55*** (5.22)	-0.65*** (4.32)	-0.58*** (5.63)	-0.45*** (4.92)
$FEDTAX_{-1}$		0.47*** (4.15)								
$FEDTAX_{-1}$× *DEMOLAME*		-0.40** (2.68)								
$FEDTAX_{-1}$× *REPLAME*		-0.65*** (4.34)								
NEIGHBOR TAX					0.57*** (5.55)					
$STATETAX_{-1}$						0.83*** (28.25)				
BEERTAX							7.47*** (3.74)			
$DEFICIT_{-1}$									0.03 (1.21)	
$SALES_{-1}$										-0.17*** (6.34)
CORRUPT										0.40 (1.17)
CONCEN–TRATION										-2.20*** (6.01)
Standard Controls?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1222	1222	728	936	1170	1128	1196	780	1222	1182
F-test of Joint Sign. of Instrument Set	216.01 [0.00] 10.65 [0.00] 9.50 [0.00]				43.00 [0.00]	854.71 [0.00]				
Joint Signif. Test	32.10 [0.00]	7.09 [0.00]	6.54 [0.00]	7.97 [0.00]	12.78 [0.01]	16.32 [0.00]	9.08 [0.00]	6.48 [0.00]	10.58 [0.00]	8.43 [0.00]

Notes: See Table 4 notes.