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A Regional Tale of Two Income Taxes

Jerome Segura III

University of Wisconsin - Stevens Point, USA

Abstract: This study evaluates the reporting of income as taxpayers may attempt to take advantage of the difference between the tax rates on personal and corporate income. In deriving the estimable equation, this analysis models regional economic activity within a dynamic macroeconomic framework with various government revenue sources and multiple expenditure categories. In addition, the model incorporates income shifting with convex adjustment costs. The sample includes the 48 contiguous U.S. states with annual observations ranging from 1977 through 2008. The findings suggest state personal income as a share of output grows the fastest when taxing personal income at a lower top marginal rate than corporate income and as the degree of income tax integration diminishes. The findings are consistent with the hypothesis that tax rate differentials induce economic agents to shift reported income into the relatively low taxed income.

1. Introduction

Concerning the top marginal tax rate on personal income, the current 'race to the bottom' among many southern policymakers may bring about a unique set of consequences. Gordon and Slemrod (2000) explain that taxpayers shift income in an attempt to take advantage of the difference between personal and corporate income tax rates. More specifically, income-specific tax rate differentials may create the incentive to shift income into or disguise income as the relatively low taxed income. Slemrod (2004) distinguishes between tax evasion and tax avoidance and discusses the industrial organization of tax avoidance. For instance, one benefit of tax avoidance is an apparent positive relationship between corporate tax avoidances and firm value (Desai and Dharmapala, 2009). There is also likely a positive correlation between the perceived benefits of not reporting income and the marginal tax rate on income (Cebula, 1997).

From a global perspective, the methods of corporate tax avoidance are well established and documented.¹ At the state level, income shifting may occur through a number of channels. One such example occurs when double taxation alters the ownership structure of a business. Typically, treating profits solely as income of the owner and refile as a Limited Liability Company (LLC) can reduce the tax burden on corporate profits. While the time associated with dissolving one business entity and refile as an LLC is minimal, the duration to change filing status may serve as a friction associated with tax avoidance. Alternatively, a number of states offer tax credits for income earned and taxed out of state. In this sense, the income tax loophole may be influencing not only the filing status but also the location decision of the firm. This may be particularly relevant among border county firms. In addition, it is also quite possible that

¹ See Gravelle (2009) for further discussion pertaining to methods of global tax avoidance.

some agents are simply evading taxes (Gravelle, 2009).

This study evaluates the reporting of state personal income (SPI) as taxpayers may attempt to take advantage of the difference between the tax rates on personal and corporate income. However, within the regional spatial equilibrium framework (Rosen, 1974; Roback, 1982) natural amenities may alter the relative attractiveness between jurisdictions. Similarly, Gyourko and Tracy (1989) show that publicly produced goods and services affect local area economic conditions through the creation of compensating wage differentials. Therefore, this analysis attempts to estimate the growth effect of income tax loopholes on SPI as a share of gross state product (GSP) while accounting for top marginal tax rates as well as state and local government fiscal policy. Specifically, this paper considers the case when the top marginal tax rate on corporate income exceeds the top marginal tax rate on personal income.

A number of international studies evaluate the influence of a dual income tax system on the shifting of income. For example, Alstadsæter and Wangen (2010) find that business owners take advantage of the dual income tax system by altering business ownership structures. Following the Finnish Tax Reform of 1993, Pirttilä and Selin (2011) find evidence consistent with income shifting by self-employed individuals. Similarly, a Danish study finds evidence of intertemporal income shifting by the self-employed, especially those individuals within the top tax bracket (le Maire and Schjerning, 2013). Another set of literature evaluates the influence of international tax differentials on profit shifting. For example, Buettner and Wamser (2013) find evidence of profit shifting by German multinationals away from high tax countries. Klassen and Laplante (2012) find evidence that U.S. multinational corporations are increasingly shifting income out of the U.S. due to changes in domestic regulatory costs. Other international studies have argued policymakers are competing to attract firms through corporate tax avoidance allowances. For example, Fuest and Weichenrieder (2002) evaluate the impacts of tax competition between jurisdictions on profit shifting and conclude that a hike in the tax rate on personal income led to an increase in corporate savings. Zodrow (2010) surveys the literature that considers interjurisdictional tax competition arising from capital mobility and finds both intranational and international tax competition are increasing over time.

There also exists a substantial amount of literature evaluating the impact of U.S. federal tax reform on income reporting. For example, Lindsey (1987) finds an increase in reported personal income among the nation's highest income earners following the 1981-1983 U.S. personal income tax rate cuts. Similarly, Feenberg and Poterba (1993), Feldstein (1995), and Slemrod (1996) find an increase in reported personal income following the U.S. Tax Reform Act of 1986, another round of cuts in the tax rates on personal income. Furthermore, reported corporate revenues declined during the same period (Auerbach and Poterba, 1987). On the other hand, Feldstein and Feenberg (1996) find the reported incomes of high income earners fell following the 1993 U.S. tax rate hikes on personal income. Additionally, Cebula (1997) finds evidence that suggests personal income tax rate hikes not only reduce the reporting of income but also grow the size of the underground economy. Although, to my knowledge, nothing exists at the state and local level, Gnaedinger (2009) points out that Delaware, Nevada, and Wyoming have characteristics in common with known tax havens.

Previous research on tax avoidance within the U.S. has relied primarily on cross sectional data, e.g., Lindsey (1987), Auerbach and Poterba (1987), Feenberg and Poterba (1993), and Feldstein and Feenberg (1996). However, studies that focus on cross sectional data ignore time-varying behavior in the control variables (Reed, 2008). Therefore, in the absence of fixed effects, cross sectional studies potentially suffer from the common omitted variable bias. On the other hand, studies that focus on annual panel data are particularly sensitive to attenuation bias arising with measurement error (Wooldridge, 2001). Furthermore, the inclusion of jurisdiction fixed effects heightens this downward bias. Serial correlation is also a particularly relevant threat to studies focused on panel data. In contrast, multi-year interval data are less sensitive to measurement error and serial correlation. Unfortunately, multi-year interval data eliminates nearly all of the variation in the top marginal tax rates. Therefore, this study utilizes annual observations ranging from 1977 through 2008 for the 48 contiguous U.S. states. In contrast to the unrelated cross sectional approach of Feenberg and Poterba (1993) and Eissa (1995), this analysis follows a panel estimation strategy that accounts for both jurisdiction and annual fixed effects.

In deriving the estimable equation, this analysis models regional economic activity within a dynamic

macroeconomic framework with various government revenue sources and multiple expenditure categories. In addition, the model incorporates income shifting and adopts convex adjustment costs associated with the shifting of income. Convex adjustment costs are commonly used within the literature that evaluates income shifting, e.g., Devereux (2007). Adjustment costs imply agents face frictions when attempting to alter their current behavior. In the convex case, the costs of shifting income are increasing at an increasing rate. Therefore, these frictions serve to enforce stability within the framework, in the sense that shifting increases with the size of the loophole but at a diminishing rate.

A recurring theme in both the national and international literature is income shifting among self-employed individuals who are also among the top income earners. Therefore, this study focuses on top marginal income tax integration as a means of reducing tax avoidance. The empirical findings presented in this analysis are consistent with the hypothesis of income shifting when tax loopholes exist. Specifically, in jurisdictions that tax personal income at a lower top marginal rate than corporate income, personal income as a share of output grows faster as the gap increases between the top marginal tax rates on corporate and personal income. In other words, income shifting appears to occur more intensively when personal income is subject to a lower top marginal rate than corporate income and as the degree of income tax integration diminishes. The results are robust to alternate model specifications with various sets of control variables.

2. Theoretical

This paper adopts a dynamic macroeconomic approach in modeling regional economic activity. Specifically, this analysis combines the Becsi (2000) dynamic macroeconomic model that incorporates multiple government expenditure categories with the McPhail et al. (2010) model that considers various sources of tax revenue. In addition, the theoretical framework in this paper incorporates the Devereux (2007) approach for modeling income shifting with assumed convex adjustment costs.

Outside of the model, government determines the set of marginal tax rates, $\{\tau_w, \tau_\pi, \tau_k, \tau_p, \tau_s\}$. τ_w is the marginal tax rate on personal income, τ_π is the marginal tax rate on corporate income, τ_k is the marginal tax rate on capital gains, τ_p is the marginal tax rate on

property, and τ_s is the marginal tax rate on sales. These tax rates are predetermined in the sense that households respond to the imposed tax rates by adjusting consumption, labor, and savings, while firms adjust taxable profit, labor, and capital (McPhail et al., 2010).

2.1. The household problem

Households maximize lifetime utility,

$$U = \sum_{t=1}^{\infty} \beta^{t-1} [\ln(x_t) + \alpha \ln(1 - h_t)], \quad (1)$$

where $\beta = \frac{1}{\rho} \in (0,1)$. x is composite consumption of private consumption, public consumption, and public capital, i.e.,

$$x_t = c_t + \mu_c c_t^g + \mu_k k_t^g. \quad (2)$$

μ_c and μ_k are the marginal utilities derived from public consumption and public capital, respectively. h is time spent working. Household utility is constrained by the following household budget constraint:

$$c_t + k_{t+1} = (1 - \tau_w)(w_t h_t + \sigma_t) + (1 - \tau_k)r_t k_t + (1 - \delta - \tau_p)k_t + l_t^g, \quad (3)$$

where k_{t+1} is private capital stock in the following period.² w is the wage rate, and σ is the lump sum transfer to households from local firms. r is the rental rate of capital, and k_t is private capital stock. δ is the depreciation rate of capital. l^g is a lump sum transfer to households from government.

Optimality implies the marginal rate of substitution between leisure and composite consumption is equal to the after-tax wage rate, i.e.,

$$MRS_h \equiv -\frac{\frac{\partial U}{\partial h}}{\frac{\partial U}{\partial x}} = \frac{\alpha}{(1-h)}(c + \mu_c c^g + \mu_k k^g) = (1 - \tau_w)w \quad (4)$$

Similarly, optimality implies the marginal rate of substitution between contemporaneous consumption and consumption in the next period is equal to the after-tax rental rate for capital plus the retention rate of capital net depreciation and property tax, i.e.,

$$MRS_x \equiv \frac{\partial U_t}{\partial x_t} / \frac{\partial U_{t+1}}{\partial x_{t+1}} = \rho = (1 - \tau_k)r + (1 - \delta - \tau_p). \quad (5)$$

The absence of time subscripts in the first order conditions indicates steady state.

² This is similar to Equation (4) from McPhail et al. (2010).

2.2. The firm problem

Firms choose σ , h , and k in order to maximize profits, which are represented by the following functional form:

$$\Pi_t = \left[(1 - \tau_s)y_t - (w_t h_t + r_t k_t) - \tau_\pi(\varphi_t - \sigma_t) - \frac{\lambda \varphi_t}{2} \left(\frac{\sigma_t}{\varphi_t} \right)^2 - \tau_w \sigma_t \right], \quad (6)$$

where $y_t = k_t^\theta h_t^{1-\theta}$ and the price of private output, y , is normalized to one. σ is the taxable profit which has been shifted to personal income, e.g., through a dividend.³ φ is the taxable profit before income shifting, i.e.,

$$\varphi_t = (1 - \tau_s)y_t - \gamma_h w_t h_t - \gamma_k r_t k_t, \quad (7)$$

where γ_h and γ_k represent the proportion of business expenses offset against taxation. $\frac{\lambda \varphi}{2} \left(\frac{\sigma}{\varphi} \right)^2$ is the convex adjustment cost associated with shifting taxable profits to personal income and consists of two parts. The first part captures the size of the taxable profit before shifting. The second component captures the proportion of income shifted relative to φ . The first-order conditions for the firm's optimization problem follow:

$$\frac{\partial \Pi}{\partial \sigma} = \tau_\pi - \frac{\lambda \sigma}{\varphi} - \tau_w, \quad (8)$$

$$\frac{\partial \Pi}{\partial h} = (1 - \tau_s)(1 - \theta) \frac{y}{h} - w - \left[\tau_\pi - \frac{\lambda}{2} \left(\frac{\sigma}{\varphi} \right)^2 \right] x \left[(1 - \tau_s)(1 - \theta) \frac{y}{h} - \gamma_h w \right] \quad (9)$$

and

$$\frac{\partial \Pi}{\partial k} = (1 - \tau_s) \theta \frac{y}{k} - r - \left[\tau_\pi - \frac{\lambda}{2} \left(\frac{\sigma}{\varphi} \right)^2 \right] \left[(1 - \tau_s) \theta \frac{y}{k} - \gamma_k r \right]. \quad (10)$$

Solving Equation (8) for σ and substituting into Equation (9) and Equation (10) yields:

$$MP_h \equiv \frac{\partial Y}{\partial h} = (1 - \theta) \frac{y}{h} = (1 - \tau_s)^{-1} (1 + m_h) w \quad (11)$$

and

$$MP_k \equiv \frac{\partial Y}{\partial k} = \theta \frac{y}{k} = (1 - \tau_s)^{-1} (1 + m_k) r, \quad (12)$$

where $m_h = \frac{\hat{\tau}(1 - \gamma_h)}{1 - \hat{\tau}}$, $m_k = \frac{\hat{\tau}(1 - \gamma_k)}{1 - \hat{\tau}}$, and $\hat{\tau} = \tau_\pi + \frac{(\tau_\pi - \tau_w)^2}{2\lambda}$. The latter is an effective statutory rate under an optimal income shifting policy. Optimality further

implies the capital to labor ratio is equal to $\frac{\theta}{1 - \theta} \frac{1 + m_h}{1 + m_k} \frac{w}{r'}$, where the first component is the ratio of input elasticities, the second component is the ratio of effective marginal tax rates, and the third is the ratio of input prices. Again, the lack of time subscripts indicates steady state.

2.3. The government

The government's budget constraint can be written as

$$c_t^g + k_t^g + l_t^g = \tau_w(w_t h_t + \sigma_t) + \tau_\pi(\varphi_t - \sigma_t) + \tau_k r_t k_t + \tau_p k_t + \tau_s y_t. \quad (13)$$

The left side of the government budget constraint reflects how the government chooses to allocate funds between public consumption, public capital, and a lump sum transfer to or from households in order to maintain a balanced budget. The right hand side of the budget constraint reflects the following sources of government revenue: personal income tax, $\tau_w(w h + \sigma)$, corporate income tax, $\tau_\pi(\varphi - \sigma)$, capital gains tax, $\tau_k r k$, property tax, $\tau_p k$, and sales tax, $\tau_s y$.

2.4. A closed-form solution

Combining the first order conditions from the household problem and the firm problem solves the model. First substituting Equation (11) into Equation (4) yields:

$$(c/y + \mu_c \varepsilon_c + \mu_k \varepsilon_k) \alpha \frac{y}{(1-h)} = \frac{(1-\tau_w)(1-\tau_s)}{(1+m_h)} (1-\theta) \frac{y}{h}. \quad (14)$$

Next substituting Equation (12) into Equation (5) yields:

$$\rho - (1 - \delta - \tau_p) = \frac{(1-\tau_k)(1-\tau_s)}{(1+m_k)} \theta \frac{y}{k}. \quad (15)$$

The market clearing condition follows:

$$c + k + \varepsilon_c y + \varepsilon_k y = (1 + A_c \varepsilon_c + A_k \varepsilon_k) y, \quad (16)$$

where ε_c is government expenditures on public consumption as a share of private output. ε_k is government expenditures on public capital as a share of private output. A_c is the marginal product of public consumption, and A_k is the marginal product of public capital. The left side reflects aggregate demand, i.e., both private and public demand. The right side reflects aggregate supply, i.e., the sum of private output and output produced as a byproduct of government

³ This is similar to Equation (1) from Devereux (2007).

⁴ The left hand side is identical to Equation (13) from Benci (2000) while the right hand side is similar to Equation (9) from McPhail et al. (2010).

activities. Hence, aggregate demand is equal to aggregate supply. Rewriting output yields,

$$y = \left(\frac{k}{y}\right)^{\frac{\theta}{1-\theta}} h. \quad (17)$$

The closed form solution in the Appendix combines the previous four equations.

Summing the right hand side of the household budget constraint across all households yields local personal income. The reduced form equation governing aggregate personal income is

$$I = I(\tau_w, \tau_\pi, \tau_k, \tau_p, \tau_s, \varepsilon_c, \varepsilon_k; \rho, \delta, \theta, \alpha, \lambda, A_c, A_k, \mu_c, \mu_k, \gamma_h, \gamma_k) \quad (18)$$

Therefore, the theoretical model yields an income equation as a function of both marginal tax rates and fiscal policy parameterized by local characteristics.

3. Empirical model

Following a log linearization, the reduced form Equation (18) can be rewritten to reflect individual aspects of the local jurisdiction j , $j = 1, 2, \dots, J$, at time t , $t = 1, 2, \dots, T$

$$\log\left(\frac{SP_{jt}}{GSP_{jt}}\right) \times 100 = \tau'_{jt}\alpha + T'_{jt}\beta + \varphi(\tau_\pi - \tau_w)_{jt}^2 + \omega'_{jt}\gamma + error_{jt}. \quad (19)$$

τ is a column vector consisting of all jurisdiction specific top marginal tax rates, τ_m , for $m = w, \pi, p, s$. T is a column vector consisting of all jurisdiction specific squared marginal tax rates. While α captures the linear effect of the marginal tax rates on the reporting of income as a share of gross state product, β captures the nonlinear response of income reporting to the marginal tax rates.

The quadratic term, $(\tau_\pi - \tau_w)^2$, is the squared difference in income tax rates and is implied by the effective statutory rate under optimal income shifting policy, $\hat{\tau}$ from Equations (11) and (12). This measure, inversely related to the degree of income tax integration, captures the effect of a gap between the tax rate on personal and corporate income. The larger the number, the less integrated are the income tax policies within the jurisdiction. This term is equal to zero when income tax policies are fully integrated, i.e., when $\tau_\pi = \tau_w = 0$. In addition, an empirical specification with the inclusion of both income tax rates along with the linear difference between the income tax rates would be subject to multicollinearity issues.

ω is a column vector consisting of the budget constraint faced by state and local government. U.S. state and local governments, however, do not necessarily balance their budgets annually and may in fact run a

budget surplus or deficit. Consequently, Helms (1985) replaces the lump sum transfer to or from households, l^g , with deficit spending and specifies the budget constraint of the government in jurisdiction j at time t as $expenditures_{jt} - taxes_{jt} - aid_{jt} = deficit_{jt}$. Scaling both sides of the budget constraint by nominal private GSP yields measures for the relative scope of government intervention, i.e., expenditures, taxes, aid, and deficit as shares of local economic activity. This study omits miscellaneous revenues and deficit spending from ω . Estimated coefficients of γ are therefore interpreted as the growth effects resulting from incremental changes in revenue or expenditure variables against a change in the omitted fiscal category. Meanwhile, summing an estimated expenditure coefficient and a revenue coefficient yields the net effect of an incremental increase in any particular expenditure category fully financed through raised revenue.

Estimating Equation (19) in levels requires all jurisdictions be at their steady states. In the event jurisdictions are not at their steady states, consistent estimation of the levels equation requires the uniform distribution of jurisdictions around their steady states. If, however, most jurisdictions are below their steady states, then the levels analysis is likely biased. Given the dynamic macroeconomic framework of this study, the preferred estimable equation may in fact be a growth equation. In other words, while accounting for jurisdiction-specific and time-specific fixed effects in the dependent variable, this analysis regresses the growth rate of SPI as a share of GSP on the set of changes to within-jurisdiction characteristics.

Equation (19) is rewritten as a growth framework in an attempt to reflect the individual aspects of the local jurisdiction j , $j = 1, 2, \dots, J$, at time t , $t = 1, 2, \dots, T - 1$:

$$\Delta\left[\log\left(\frac{SP_{jt}}{GSP_{jt}}\right) \times 100\right] = A + \Delta\tau'_{jt}\alpha + \Delta T'_{jt}\beta + \Delta\omega'_{jt}\gamma + \varphi\Delta(\tau_\pi - \tau_w)_{jt}^2 + \lambda DUMMY_{jt} + \phi[\Delta(\tau_\pi - \tau_w)_{jt}^2 \times DUMMY_{jt}] + s_j + v_t + \varepsilon_{jt}. \quad (20)$$

s_j are jurisdiction fixed effects that capture time invariant differences in the growth rate of income as a share of output. v_t capture time fixed effects, and ε_{jt} represent random disturbances in the growth rate of income as a share of output. $\Delta\tau$ and ΔT respectively measure the linear and nonlinear changes to the vector of marginal tax rates. $\Delta\omega$ is a measure of the changes to within jurisdiction fiscal policy by the state and local governments. $\Delta(\tau_\pi - \tau_w)^2$ serves as a measure of the change in the gap between the tax

rates on personal and corporate income. However, φ alone ignores the growth effects attributed to the direction of the tax rate inequality.

In contrast to Equation (19), Equation (20) incorporates two additional controls that attempt to account for the growth effects attributed to taxing corporate income more heavily than personal income. The first is a dummy variable which equals one when $\tau_w < \tau_\pi$ and zero otherwise. The second is an interaction term between the integration measure and the dummy variable, i.e., the interaction term is equal to zero except when $\Delta(\tau_\pi - \tau_w) \neq 0$ and $\tau_\pi - \tau_w > 0$ jointly. φ captures the growth effects attributed to the non-directional degree of income tax integration. λ captures the treatment effect associated with the direction of the tax rate inequality. ϕ measures, relative to those jurisdictions that do not tax corporate profits more heavily than personal income, the growth effects attributed to changing the gap between the top marginal tax rates on corporate and personal income. Therefore, in this study the primary coefficient of interest is ϕ .

4. Data

The data are annual observations ranging from 1977 through 2008 for the 48 contiguous U.S. states. The dependent variable in this analysis is the log difference of SPI to GSP ratio. The nonfarm SPI and private industry GSP data are from Regional Economic Accounts, U.S. Bureau of Economic Analysis. This analysis does not impose additional measurement error associated with deriving real government financial data using a national gross domestic product (GDP) deflator. Rather, all variables are nominal values, merged with the McPhail and Stammer (2013) "State Marginal Tax Rates" data.

State government financial data are from *Government Finance Statistics* of the U.S. Census Bureau. The nominal explanatory variables are broken into two main categories: government expenditure variables and government revenue sources. Categorically, government expenditures fund the following locally provided government services: health and hospital, transfer payments, transportation, natural resource, park and recreation, housing and community reinvestment, sanitation, police and fire protection, primary and secondary education, higher education, and other government services. Government revenue sources include corporate income tax, personal

income tax, property tax, sales tax, charges, and net intergovernmental revenue. Other own-source revenue excludes miscellaneous revenue. All nominal variables are scaled by nominal private GSP and then multiplied by 100, e.g., the transportation expenditure variable measures the total transportation expenditure as a percentage of GSP in jurisdiction j at time t . Therefore, the estimated coefficients measure the net effect of a one percent change in any particular government financial category as a share of GSP on the growth rate of SPI as a share of GSP, i.e., the reported personal income as a share of output.

Whereas marginal tax rates are predetermined, GSP and government finances as a share of GSP by construction are simultaneously determined. Therefore, this analysis follows the existing microeconomic regional literature and lags all non-tax-rate explanatory variables by one period such that they are all at least nominally predetermined (Garcia-Milà et al., 1996, and Brown et al., 2003). The state and local government financial data are subject to missing observations in 2001 and 2003. These data gaps explode after taking first differences. Lagged values replace the missing observations. The full sample includes 1,536 observations from 48 U.S. jurisdictions over 32 years. Table 1 provides summary statistics for the full sample.⁵

5. Results

This analysis takes a pooled least squares dummy variable (LSDV) panel data approach to obtain estimates for the growth effects of state and local fiscal and tax rate policy. For the full sample, pooled OLS regression results roll out in a stepwise fashion. This analysis assumes that observations are independent across states but not necessarily within states over time. Therefore, all standard error estimates account for intra-jurisdiction correlation by way of a clustered sandwich estimator. The dependent variable is the growth rate of SPI as a share of GSP, i.e., $\Delta[\log_{10} SPI - \log_{10} GSP] \times 100$.

The regression results for five model variants are shown in Table 2. A positive sign on a marginal tax rate variable indicates a rate hike is associated with an increase in the growth rate of SPI as a share of GSP. A negative sign on the marginal tax rate squared variable indicates a diminishing pro-growth effect of the tax rate hike. A negative coefficient on a revenue variable indicates deficit reduction through growth in

⁵ Data subsequently undergo first differencing, then the within state and within year transformations prior to regression analysis.

revenue is associated with slower growth rates of SPI as a share of GSP. Alternatively, a positive coefficient on an expenditure variable indicates spending reductions in that category are growth deterrents. For example, throughout the analysis financing deficit spending with hikes in other own-source revenue is a statistically significant growth deterrent.

Model 1 fits the model to the full sample but fails to account for the income tax loophole. The model yields a positive and significant coefficient for the top marginal tax rate on corporate income. In addition,

the model estimates a negative and significant coefficient on the tax rate squared. Similar coefficients, but much larger in magnitude, are estimated for the top marginal tax rate on sales. The coefficient on productive government expenditures is positive and significant, i.e., government expenditures on transportation, education, and public safety are pro-growth. The coefficients on other government expenditures and transfer payments are negative but statistically not different from zero.

Table 1. Summary statistics and data sources (1977-2008).

Variable	Mean	SD	Min	Max
Nonfarm SPI	124,000,000,000	172,000,000,000	2,960,000,000	1,590,000,000,000
Private Industry GSP	127,000,000,000	180,000,000,000	2,900,000,000	1,680,000,000,000
Income Tax Rate Gap = $\tau_{\pi} - \tau_w$	1.28	3.14	-11.85	13.8
Tax Rate Dummy Variable = 1 if Corporate Income Tax Rate > Personal Inc. Tax Rate; 0, otherwise.	0.57	0.5	0	1
Top Marginal Tax Rates				
Corporate Income	6.54	3.04	0	13.8
Personal Income	5.26	3.3	0	19.8
Property	1.23	0.52	0.3	3.04
Sales	4.45	1.73	0	8
Revenues as a Share of GSP				
Corporate Tax	0.4	0.23	0	1.29
Personal Income Tax	1.95	1.14	0	4.83
Property Tax	3.05	1.13	0.73	6.69
Sales Tax	2.31	1.02	0	5.38
General Charges	2.6	0.79	0.93	6.2
Other Own-Source	5.78	1.86	0.42	27.85
Net Intergovernmental	3.78	1.3	1.58	12.78
Expenditures as a Share of GSP				
Other	6.2	1.41	2.8	13.31
Health and Hospital	1.5	0.64	0.35	4.32
Transfer Payment	2.5	1.02	0.42	6.08
Transportation+	1.72	0.56	0.63	4.06
Natural Resource	0.31	0.2	0.03	1.38
Parks and Recreation	0.28	0.11	0.1	0.81
Housing and Community	0.27	0.14	0	2.83
Sanitation	0.52	0.15	0.17	2.07
Police and Fire Protection+	0.83	0.19	0.41	1.54
K-12 Education+	4.58	0.78	2.73	7.49
Higher Education+	1.78	0.55	0.67	3.51

Notes: (a) The SPI and GSP data are from Regional Economic Accounts, U.S. Bureau of Economic Analysis. The marginal tax rate data are from McPhail and Stammer (2013) "State Marginal Tax Rates". The government finance data are from Government Finance Statistics, U.S. Census Bureau. (b) SPI and GSP are in \$; the remaining continuous variables are in %. (c) + indicates a productive expenditure.

(d) N = 1536.

Model 2 adds the squared deviation in top marginal tax rates on corporate income and personal income. Recall that this variable does not account for the direction of the income tax rate gap. Nonetheless, this measure captures the growth in the gap between the top marginal income tax rates. Although the non-directional control is not statistically significant, the empirical estimation is robust to the additional

control variable. Model 3 adds a dummy variable that is equal to one when the top marginal tax rate on personal income is less than the top marginal tax rate on corporate income and zero otherwise. The dummy variable is statistically not a determinant of SPI as a share of GSP, and again the empirical estimation is robust to the additional control variable.

Table 2. Growth rate determinants of SPI as a share of GSP (1979-2008).

Variable	(1)	(2)	(3)	(4)	(5)
Income Tax Rate Gap ² x Tax Rate Dummy Var.	-	-	-	0.0389**	0.0380**
Tax Rate Dummy Variable	-	-	1.65e-05	0.00147	0.00216
Income Tax Rate Gap, Squared	-	0.0108	0.0108	-0.0200	-0.0214
Top Marginal Tax Rates					
Corporate Income	0.637***	0.737***	0.737***	0.788***	0.778***
Corporate Income, Squared	-0.0341***	-0.0447***	-0.0447***	-0.0514***	-0.0500***
Personal Income	-0.0173	0.137	0.137	0.0340	-0.0115
Personal Income, Squared	0.000371	-0.00944	-0.00944	0.00225	0.00457
Property	1.882*	1.868*	1.868*	1.853*	2.017*
Property, Squared	-0.373	-0.366	-0.366	-0.358	-0.405
Sales	1.613***	1.748***	1.748***	1.895***	1.812***
Sales, Squared	-0.128**	-0.142***	-0.142***	-0.160***	-0.152***
Revenues as a Share of GSP					
Corporate Tax	0.157	0.147	0.147	0.141	0.203
Personal Income Tax	-0.310*	-0.317*	-0.317*	-0.329*	-0.330*
Property Tax	0.0843	0.0814	0.0814	0.0800	0.0538
Sales Tax	0.250	0.257	0.257	0.280	0.288
General Charges	-0.206	-0.205	-0.205	-0.224	-0.344*
Other Own-Source	-0.0346**	-0.0342**	-0.0342**	-0.0343**	-0.0384**
Net Intergovernmental	0.0226	0.0201	0.0201	0.0170	0.0619
Expenditures as a Share of GSP					
Productive	0.270***	0.268***	0.268***	0.270***	-
Transfer	-0.0878	-0.0878	-0.0878	-0.0878	-
Other	-0.0234	-0.0156	-0.0156	-0.0234	-0.0200
Health and Hospital	-	-	-	-	0.237
Transfer Payment	-	-	-	-	-0.202**
Transportation	-	-	-	-	-0.103
Natural Resource	-	-	-	-	-0.533
Parks and Recreation	-	-	-	-	-0.478
Housing and Community	-	-	-	-	0.115
Sanitation	-	-	-	-	0.0367
Police and Fire Protection	-	-	-	-	-0.203
K-12 Education	-	-	-	-	0.543***
Higher Education	-	-	-	-	0.494**
Constant	-0.00531	-0.00531	-0.00532	-0.00879	-0.00910
Observations	1,440	1,440	1,440	1,440	1,440
R-squared	0.029	0.030	0.030	0.033	0.042
F-stat	12.51***	11.52***	10.99***	11.76***	12.28***

Notes: (a) Data are first differenced and undergo within transformations, both with respect to FIPS and YEAR. (b) *** p<0.01, ** p<0.05, * p<0.1. (c) Significance of OLS estimates are based upon standard errors clustered at the state identifier.

Model 4 adds the interaction term between the tax rate dummy variable and the squared deviation in top marginal income tax rates. This is the primary variable of interest in the analysis. This set of estimates considers an increase in the income tax rate gap specifically when taxing personal income at a lower marginal rate than corporate income. The coefficient on the additional control is positive and significant. Again, the dummy variable and the non-directional measure for the degree of income tax integration remain statistically insignificant. The remainder of the empirical estimation is robust as well.

Model 5 offers an alternate set of estimates in an attempt to better account for locally provided public goods and services. It is the same as Model 4 while accounting for a much more extensive categorical list of government expenditures. The primary variable of interest continues to be positive and significant. Concerning the full set of control variables, the estimates are generally robust to the alternate formulation of the government budget constraint. Transfer payments are statistically significant growth deterrents, whereas educational expenditures are pro-growth.

6. Discussion

All of the models shown in Table 2 have F-statistic p-values ≤ 0.0001 , suggesting that the models are statistically valid. The regression with the best overall fit is Model 5. The analysis estimates a positive and significant coefficient on the primary variable of interest, i.e., the income tax rate gap squared interacted with the income tax rate dummy. The results indicate that over the period and on average states with the potential tax loophole experienced more intensive shifting of corporate income to personal income following an increase in the gap between top marginal tax rates on corporate income and personal income. In other words, as the degree of income tax integration diminished, states with the potential tax loophole were experiencing faster growth in income relative to output.

In both sets of results and indicative of sensitivities to the income tax loophole, raising the tax rate on corporate income is associated with higher growth rates in SPI as a share of GSP. Similarly, this analysis estimates a positive relationship, at a decreasing rate, between sales tax rate hikes and the growth rate of the SPI to GSP ratio. This suggests that in response to corporate income and sales income tax rate hikes, perhaps agents are disguising other income as personal income. Alternatively, these coefficients

capture the contractionary effect of the tax rate hikes on GSP.

Publicly produced goods and services alter the local economic environment (Gyourko and Tracy, 1989). Therefore, like tax rates, publicly provided goods and services provided by the state and local government are sources of regional competition for economic activity (Haughwout, 2002). The categorical view of state and local government suggests an increase in deficit spending to finance transfer payments is a growth deterrent, while the same increase in funding on education is pro-growth. In other words and with respect to maximizing the growth rate of SPI as a share of GSP, policymakers should have reduced transfer payments and increased investment in education on average over the period. Furthermore, the results suggest diminishing returns to educational expenditures, i.e., the magnitude and statistical significance of the estimated coefficient is greater for primary and secondary education expenditures relative to higher education expenditures.

The fact remains that although government policy is predetermined, it may not necessarily be exogenous. For example, state and local government is likely to increase spending on highways as the quality of the infrastructure diminishes from simple wear and tear. Similarly, there may be a connection between macroeconomic downturns, household income, and transfer payments. Endogeneity concerns also arise if marginal tax rates are determined based on observed income reporting behavior of local agents or if there is some unobserved heterogeneity in growth rates of income as a share of output (McPhail et al., 2010).

7. Conclusions

To my knowledge, this is the first study to investigate the influence of jurisdiction-specific income tax structures on the reporting of personal income at the U.S. state level. In deriving the estimable equation, the analysis models regional economic activity within a dynamic macroeconomic framework with various government revenue sources (McPhail et al., 2010) and multiple expenditure categories (Becsi, 2000). In addition, the model incorporates income shifting and adopts a convex adjustment cost associated with the shifting of income (Devereux, 2007). This analysis estimates the net effect of state top marginal income tax rates on income reporting while accounting for state and local government fiscal policy.

The findings of this analysis are consistent with the hypothesis that economic agents may exploit tax loopholes in an attempt to avoid taxation. SPI as a share of GSP grows the fastest when the top marginal tax rate on corporate income exceeds the top marginal tax rate on personal income and as the degree of income tax integration diminishes. The results are robust to alternate model specifications with various sets of control variables. If the objective of the income-shifting agent were to minimize gross tax payments, then tax avoidance would expectedly reduce tax revenue. Declining tax revenues erode the ability of the government to provide public services (Cebula and Feige, 2012); for example, facing a budget deficit some legislators may pursue budget cuts to things such as education. Alternatively, the declining tax revenues that led to a budget deficit may shift some of the contemporaneous tax burden onto future generations.

Additionally, Gordon and Slemrod (2000) point out that income shifting can distort tax efficiency studies, income distribution statistics, and the levels and changes in corporate returns, blurring the returns to capital, labor, and land. Therefore, the findings of this study are particularly problematic for existing regional studies that fail to account for shifting behavior associated with income reporting.

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Appendix

Solving Equation (15) for the capital to output ratio yields,

$$\frac{k}{y} = v_k, \quad (21)$$

$$\text{where } v_k = \frac{(1-\tau_k)(1-\tau_s)}{(1+m_k)} \frac{\theta}{\rho-(1-\delta-\tau_p)}.$$

Dividing through Equation (16) by y , solving for the consumption to output ratio, and substituting in Equation (21) yields

$$\frac{c}{y} = 1 - (1 - A_c)\varepsilon_c - (1 - A_k)\varepsilon_k - v_k. \quad (22)$$

Substituting Equation (22) into Equation (14) and solving for h yields

$$h = \frac{v_h}{1-(1-A_c-\mu_c)\varepsilon_c-(1-A_k-\mu_k)\varepsilon_k-v_k+v_h}, \quad (23)$$

$$\text{where } v_h = \frac{(1-\tau_w)(1-\tau_s)(1-\theta)}{(1+m_h)} \frac{1}{\alpha}.$$

Steady state output is obtained by substituting Equation (21) and Equation (23) into Equation (17)

$$y = \frac{v_k^{\frac{\theta}{1-\theta}} v_h}{1-(1-A_c-\mu_c)\varepsilon_c-(1-A_k-\mu_k)\varepsilon_k-v_k+v_h}. \quad (24)$$

Steady state capital is obtained by multiplying Equation (21) and Equation (24)

$$k = \frac{v_k^{\frac{1}{1-\theta}} v_h}{1-(1-A_c-\mu_c)\varepsilon_c-(1-A_k-\mu_k)\varepsilon_k-v_k+v_h}. \quad (25)$$

Multiplying Equation (22) and Equation (24) yields steady state consumption

$$c = \frac{[1-(1-A_c)\varepsilon_c-(1-A_k)\varepsilon_k-v_k]v_k^{\frac{\theta}{1-\theta}} v_h}{1-(1-A_c-\mu_c)\varepsilon_c-(1-A_k-\mu_k)\varepsilon_k-v_k+v_h}. \quad (26)$$

Substituting Equation (23) and Equation (24) into Equation (11) yields steady state wage rate

$$w = \frac{(1-\tau_s)}{(1+m_h)} (1-\theta)v_k^{\frac{\theta}{1-\theta}}. \quad (27)$$

Steady state rental rate is easily obtained from Equation (5) and is verified by substituting Equation (24) and Equation (25) into Equation (12)

$$r = \frac{(\rho-1+\delta+\tau_p)}{(1-\tau_k)}. \quad (28)$$

Lastly, the optimal shifted income is obtained from Equation (8) by solving for σ and substituting in Equations (21), (24), (25), (27), and (28)

$$\sigma = \frac{\tau_\pi - \tau_w}{\lambda} \frac{\left[(1-\tau_s) - \gamma_h \frac{(1-\tau_s)}{(1+m_h)} (1-\theta) - \gamma_k \frac{\rho-(1-\delta-\tau_p)}{(1-\tau_k)} v_k \right] v_k^{\frac{\theta}{1-\theta}} v_h}{1-(1-A_c-\mu_c)\varepsilon_c-(1-A_k-\mu_k)\varepsilon_k-v_k+v_h}. \quad (29)$$