The "Texas Miracle" revisited: Decomposing Economic Prosperity

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ABSTRACT

How does production adjust, if taxes are changed? Can tax policy alone explain differences in economic outcomes across US states? In this paper, we use the balanced growth path of a neoclassical growth model to decompose differences in economic outcomes across states. Texas was chosen for its low tax regime and its relatively higher real per capita GDP. Ohio and Arkansas were chosen because of their weak economic performance and higher tax rates. Reducing the tax burden boosts investment and real economic output. However, we find that there exist large differences between states that cannot be overcome by tax policy alone. Factors such as Texas natural resources, reflected by the state's large positive trade balance, account for less than half of the observed differences in real per capita output. Our findings provide quantitative support for a "Texas miracle".

1. Introduction

A significant body of research finds that economic freedom is positively correlated with desirable outcomes such as high per-capita income, economic growth and greater life expectancy (see, Barro, 1996; De Haan and Strum, 2000; Farr et al, 1998; Gwartney and Lawson, 2003; Heckelman, 2000; Heckelman and Stroup 2000; and Torstensson, 1994). Government spending, property rights, labor market regulations and the overall tax burden - measured as the share of income paid in taxes – have often been used as indicators of economic freedom. Many of the linkages seem straightforward. For example, an increase in the share of income paid in taxes further constrains households and businesses, thus reducing investment and employment prospects. Dawson (2003) provides empirical evidence that economic freedom has a positive causal impact on investment.

The Fraser Institute's *Economic Freedom of North America (EFNA)* measures the extent to which the policies of individual states were supportive of economic freedom, the ability of individuals to act in the economic sphere free of undue restrictions. EFNA employs 10 variables for the 92 provincial/state governments in Canada, the United States, and Mexico in three areas: 1. Government Spending; 2. Taxes; and 3. Labor Market Freedom. EFNA ranks states according

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to specific forms of taxation such as income and payroll taxes, property taxes, sales taxes and how unfair - progressive or regressive - the tax burden is.

Table 1: Economic Freedom of North America[i]

EFNA	Average Overall Score	Average Tax Burden Score
Year	(2001-2014)	(2001-2014)
Ohio	**6.2**	**6.2**
Texas	**7.9**	**7.8**
Arkansas	6.72	6.11
New Hampshire	8.2	8.3
South Dakota	8.0	8.0
Florida	7.9	7.7
Tennessee	7.7	7.9
Virginia	7.8	7.1
Pennsylvania	6.87	6.85

To our knowledge, the EFNA index is one of only a handful that links a measure of the tax burden to economic freedom for US states. While these rankings highlight differences in the tax burden, our paper focuses on the economic outcomes implied by tax policy.

In this paper, we investigate quantitatively: How does production adjust, if taxes are changed? How much can tax rate differentials explain disparities in economic outcomes across states? To answer these questions, the balanced growth paths of a neoclassical growth model are compared as tax rates are varied. Our benchmark model calibration *(normalization)* features Ohio – a state ranked near the bottom of the EFNA index – and we ask: How could the Ohio economy be transformed if its legislature adopted Texas, New Hampshire or South Dakota's tax rates? Texas, New Hampshire and South Dakota are top ranked states on the EFNA index primarily for having the nation's lowest overall tax burden.

The present paper is closely related to Prescott (2002, 2004), who raised the issue of the incentive effects of taxes by comparing the effects of labor taxes on labor supply for the US and European countries. Prescott's work has been discussed by Ljungqvist and Sargent (2007) as well as Alesina et al. (2006). Our analysis includes incentive effects of other forms of taxation in a general equilibrium framework with endogenous transfers. Our model is the small open economy neoclassical growth model with incomplete asset markets (see, Schmitt-Grohé and Uribe, 2003) extended to include taxes that finance a government sector. Like Baxter and King (1993) or McGrattan (1994), it is assumed that government spending may be valuable only insofar as it provides utility separably from consumption and leisure.

Neoclassical growth theory is among the most widely used tools for empirical and theoretical research in macroeconomics. The neoclassical framework emphasizes economic agents' intertemporal decisions in a general equilibrium setting. The advantage of these models is that they make the economic mechanisms at work within the model transparent and account for forward looking behavior. The estimated model can serve as a baseline to provide plausible counterfactual scenarios that describe how the economy will behave conditional on the outside influences affecting it.

Not surprisingly, we find that low tax rates have a positive effect on output. Another important factor that can explain differences across states is the elasticity of substitution between production factors. Elasticity of substitution in production is a measure of how easy it is to shift between factor inputs. When comparing two states, the one with the higher elasticity of substitution will experience, ceteris paribus, a higher per-capita income. Any equilibrium values of capital-labor and income per head are an increasing function of the elasticity of substitution between labor and capital (see, Klump and de La Grandville, 2000).

Using the model, we estimate the elasticity of substitution between production factors for Texas and for Ohio. Our estimated elasticity of substitution between labor and capital is lower for Texas than for Ohio. This result implies that if it weren't for a number of other factors, Texas would be worse off than Ohio. The accounting decomposition reveals that factors such as Texas' large positive trade balance – due to its sizeable natural endowments – can account for less than half of the gap in economic prosperity when compared to its neighbor Arkansas or Ohio, two states with high tax rates. Despite large differences in the burden of taxation, labor efficiency seems most important to explain a relatively higher per capita real GDP in Texas. Why is labor so much more efficient in Texas than in Ohio? This is what we refer to as the "Texas miracle".

2. Descriptive Statistics

The tables below offer a glimpse into the general state of affairs in each of a carefully selected group of states. We chose these states because they're either at the top or the bottom of the EFNA freedom rankings. The figures provided are annual averages from 2001-2014. Table 2 shows the components that make up gross state product, as well as the labor supply, the share of income attributed to labor, and expenditures on durable goods. Of particular note is the similarity between the Ohio and Texas economies, with the exception of the trade balance that implies lower consumption as a share of output in Texas. In addition, Texas has the lowest tax burden – measured as a share of GDP – in the nation. New Hampshire has the lowest tax burden – measured as a share of personal income. Not surprisingly, Arkansas, the state with the greatest burden of taxation, also has the lowest average hours worked. When comparing the 1980-1990 and the 2001-2014 period, only Virginia outpaced Texas in real wage growth and in the growth of its working age population with 4 or more years of post-secondary education.

Table 2: Macroeconomic Aggregates

State	Consumption share of GDP	Investment share of GDP	Government share of GDP	Trade Balance	Paid Labor Hours	Capital Share of Personal Income	Durable Goods as a Share of GDP
OH	**0.66**	**0.21**	**0.12**	**0.01**	**0.28**	**0.32**	**0.08**
TX	0.56	0.21	0.12	0.11	0.29	0.35	0.08
NH	0.78	0.26	0.13	-0.17	0.31	0.42	0.09

SD	0.63	0.23	0.13	0.01	0.33	0.44	0.10
FL	0.72	0.24	0.13	-0.09	0.27	0.43	0.11
TN	0.64	0.27	0.13	-0.04	0.27	0.36	0.09
VA	0.63	0.21	0.19	-0.03	0.30	0.33	0.08
PA	0.68	0.22	0.11	-0.01	0.29	0.37	0.09
AR	0.68	0.23	0.14	-0.05	0.27	0.40	0.10

The data is taken from the Bureau of Economic Analysis (BEA). Consumption refers to expenditures on non-durable goods. Since investment is only reported at the national level, we assume that investment is equal to the US savings rate added to the share of income spent on durable goods which is reported at the state level. Government spending is directly taken from the BEA and the residual makes up the trade balance. This calculation is consistent with the reported US trade balance for every year reported by the BEA.

Table 3: Average Effective Tax rates

State	Tax rate on Consumer goods	Tax rate on Investment goods	Share of Labor Income paid to the State Government	Share of Investment Income paid to the State Government	Share of Labor Income paid to the Federal Government	Share of Investment Income paid to the Federal Government
OH	**3.5%**	**2.2%**	**2.0%**	**3.2%**	**15.0%**	**12.8%**
TX	4.8%	3.0%	0.0%	0.7%	13.1%	13.6%
NH	2.8%	1.2%	0.0%	2.9%	18.5%	15.8%
SD	2.7%	1.8%	0.0%	0.4%	16.0%	12.8%
FL	5.0%	3.5%	0.0%	0.8%	22.0%	16.2%
TN	4.4%	3.2%	0.0%	2.3%	16.9%	13.3%
VA	2.2%	1.3%	2.5%	3.5%	14.5%	15.0%
PA	3.9%	2.2%	1.8%	3.3%	17.8%	14.0%
AR	5.7%	4.2%	2.4%	3.6%	19.4%	12.5%

Calculations for the average effective tax rates are reported in the appendix. They are taken from the existing literature (see, Mendoza et al., 1994; McDaniel, 2007).

Table 4: State Taxes paid as a Share of Personal Income and GDP

State	Share of Personal Income paid in State Taxes	Share of GDP paid in State Taxes
OH	**0.060**	**0.052**
TX	0.046	0.037
NH	0.037	0.038
SD	0.043	0.038
FL	0.048	0.049
TN	0.050	0.046
VA	0.050	0.046
PA	0.059	0.056

AR	0.082	0.079

Table 5: Growth Rates

State	Real GDP	Real GDP per Capita
OH	**1.0%**	**0.9%**
TX	3.7%	1.9%

Table 6: Schooling attainment[ii]
In the prime-age population (Age 22-64)

State	1980-1990	2001-2014
OH	**9.5%**	**17.0%**
	(32141)	**(190,571)**
TX	11.0%	19.0%
	(46,563)	(357,721)
NH	14.1%	23.8%
	(2,998)	(27,297)
SD	9.6%	16.5%
	(2,011)	(26,726)
FL	11.6%	20.6%
	(33,819)	(288,902)
TN	8.8%	17.5%
	(14,078)	(99,507)
VA	14.1%	25.8%
	(16,761)	(125,976)
PA	10.1%	18.8%
	(34,865)	(204,501)
AR	7.6%	13.7%
	(6,734)	(45,013)

Table 7: Real Hourly Wage (in 1999$)

State	1980-1990	2001-2014
OH	**5.0**	**22.2**
	(13,581)	**(86,898)**
TX	4.9	24.1
	(19,711)	(158,202)
NH	5.1	23.5
	(1,418)	(14,134)
SD	3.2	15.1
	(860)	(13,308)
FL	4.9	23.6
	(13,943)	(125,222)

TN	4.4	21.2
	(5,889)	(44,283)
VA	5.3	28.1
	(7,831)	(61,425)
PA	5.0	22.9
	(14,512)	(94,075)
AR	4.0	19.3
	(2,610)	(18,998)

Number of observations is reported in parentheses

3. Description of the Model

Time is discrete and lasts forever. The representative household maximizes the discounted sum of life-time utility subject to an intertemporal budget constraint and a capital flow equation. The representative firm maximizes profits. The economy also features a government sector that collects taxes and purchases goods that yield some utility to households. Since the Bureau of Economic Analysis reports consumption data for US states in yearly intervals, a period is assumed to be a year in this framework.

Each household chooses consumption c_t, savings k_t, how much to borrow d_t and market hours l_t, to solve the following problem:

$$\max_{c_t, l_t, d_t, x_t, k_t} \sum_{t=0}^{\infty} \beta^t U_t(c_t, l_t) + \nu(g_t)$$

subject to the following constraints:

$$d_t = (1+\tau_t^C)c_t + (1+\tau_t^X)x_t + (1+i_t)d_{t-1} + \left[\frac{\phi}{2}(k_t - k_{t-1})^2\right] - (1-\tau_t^{L,s} - \tau_t^{L,f})w_t l_t - (1-\tau_t^{K,s} - \tau_t^{K,f})(r_t - \delta)k_{t-1} - \delta k_{t-1}$$

$$k_t = x_t + (1-\delta)k_{t-1}$$

$$c_t \geq 0,\ l_t \in [0,1],\ k_0 \geq 0,\ k_{T+1} = 0$$

$$U_t(c_t, l_t) = \ln(c_t) - \kappa l_t^{1+1/\varphi}$$

Individuals choose $\{c_t, x_t, l_t, k_t, d_t\}_{t=0}^{\infty}$ so as to maximize the utility function subject to the resource constraint and a no-Ponzi scheme constraint that implies that the household's debt position must be expected to grow at a rate lower than the interest rate in the long-run. δ is the depreciation rate of capital and $\beta \in [0,1]$ is a patience factor. As in Mendoza (1991), ϕ denotes a capital adjustment cost. The parameter that regulates the Frisch elasticity of labor supply is denoted φ and κ is a scaling factor that helps match hours worked observed in the data. The return on capital lent to firms is r_t. The wage paid to workers is w_t. Consumption is denoted c_t, x_t denotes gross investment, and k_t denotes physical capital lent to firms. i_t denotes the interest rate at which domestic residents can borrow from international markets in period t, and d_t is new debt. $\nu(g_t)$ represents any utility that the household enjoys from government purchases. We assume $i_t = \overline{\iota_w} + \psi(\exp(d_t - \bar{d}) - 1)$ where $\overline{\iota_w}$ is the world interest rate faced by domestic agents and is assumed to be constant, ψ and $\bar{d}$ are also constant parameters. $\psi(\exp(d_t - \bar{d}) - 1)$ is the state specific interest rate premium that increases with the amount of new debt. The assumption of an external debt elastic interest rate is taken from Senhadji (1994), Mendoza and Uribe (2000), and Schmitt-Grohé and Uribe (2001, 2003).

τ_t^C is the tax on household consumer non-durable goods. τ_t^X is the tax on investment purchases and consumer durable goods. $\tau_{e,t}^{L,s}$ is the individual labor income tax collected by the state. $\tau_{e,t}^{L,f}$ is the individual labor income tax collected by the federal government. $\tau_{e,t}^{K,s}$ is the individual capital income tax collected by the state. $\tau_{e,t}^{K,f}$ is the individual capital income tax collected by the federal government. This is a far simpler tax system than the one employed in most US states. Introducing accelerated depreciation and investment tax credits would affect the price of the investment good relative to the consumption goods, but would not alter our results very much. Similarly introducing a corporate sector with dividends taxed as ordinary income wouldn't alter any conclusion significantly. For further details on these issues, see McGrattan and Prescott (2005).

The representative firm maximizes profits:

$$\max_{k_{t-1}, l_t} \Pi_t = a_t\left(\theta k_{t-1}^{\rho} + (1-\theta)\,(z_t l_t)^{\rho}\right)^{1/\rho} - w_t l_t \; - r_t k_{t-1}$$

where a_t is total factor productivity (TFP), $\theta \in (0,1)$ is associated with the capital share of total output. z_t is a parameter that represents labor efficiency. The parameter ρ can be used to derive the elasticity of substitution σ between labor and capital ($\rho = \frac{\sigma-1}{\sigma}$). Elasticity of substitution in production is a measure of how easy it is to shift between factor inputs, typically labor and capital. This measure is defined as the percentage change in factor proportions resulting from a one-unit change in the marginal rate of technical substitution (MRTS). MRTS is the rate at which labor can be substituted for capital while holding output constant along an isoquant. Differing values of σ have different implications for the distribution of income. If $\sigma > 1$ labor and capital are substitutes, otherwise when $\sigma < 1$, labor and capital are complements.

The firm hires labor according to the following condition:

$$a_t\left(\theta k_{t-1}^{\rho} + (1-\theta)\,(z_t l_t)^{\rho}\right)^{(1/\rho)-1}(1-\theta){z_t}^{\rho}\, {l_t}^{\rho-1} = w_t,$$

where w_t is the wage rate. The demand for capital is such that:

$$a_t\left(\theta k_{t-1}^{\rho} + (1-\theta)\,(z_t l_t)^{\rho}\right)^{(1/\rho)-1}\theta k_{t-1}^{\rho-1} = r_t,$$

The paper focuses on the comparison of balanced growth paths. A key assumption is that government spending does not deviate from its balanced growth path. When tax rates are shifted, borrowing and government transfers adjust according to the government budget constraint:

$$g_t = T_t$$

The state government's tax revenues T_t are given by:

$$T_t = \tau_t^C c_t + \tau_t^X x_t + \tau_t^{L,s}\, w_t l_t + \tau_t^{K,s}\, r_t k_{t-1}$$

We can write the trade balance to GDP ratio (TB_t/y_t) as:

$$\frac{\mathrm{TB}_t}{y_t} = 1 - \frac{c_t + x_t + g_t + \frac{\phi}{2}(k_t - k_{t-1})^2}{y_t}$$

A competitive equilibrium is such that given the set of exogenous processes, households solve the household utility maximization problem, firms solve the profit maximization problem, and the capital and labor markets clear.

The characterization of the deterministic steady state is of interest for two reasons. First, the steady-state facilitates the calibration of the model. This is because, to a first approximation, the deterministic steady-state coincides with the average position of the model economy. In turn, matching average values of endogenous variables to their observed counterparts (e.g., matching predicted and observed average values of the labor share, the consumption shares, or the trade-balance-to-output ratio) can reveal information about structural parameters that can be exploited in the calibration of the model. Second, the deterministic steady-state is often used as a convenient point around which the equilibrium conditions of the stochastic economy are approximated (see Schmitt-Grohe and Uribe, 2003). For any variable, we denote its steady-state value by removing the time subscript.

Using the solution from the households and firms' choice problems, the steady-state implies that:

$$\frac{1}{\beta} = \frac{[(1 - \tau^{K,s} - \tau^{K,f})(r - \delta) + \delta + (1 + \tau^X)(1 - \delta)]}{[(1 + \tau^X)]}$$

$$y = (\theta k^\rho + (1 - \theta)\,(zl)^\rho)^{1/\rho}$$

$$r = (\theta k^\rho + (1 - \theta)\,(zl)^\rho)^{(1/\rho)-1}\theta\,k^{\rho-1}$$

$$x = \delta k$$

Combining these expressions delivers the steady-state capital-labor ratio, which we denote ω

$$k = \omega l$$

and,

$$l = \left(\frac{1}{\kappa(1 + \frac{1}{\varphi})}\frac{(1 - \tau^L)w}{(1 + \tau^C)c}\right)^\varphi$$

$$w = (\theta k^\rho + (1 - \theta)\,(zl)^\rho)^{\left(\frac{1}{\rho}\right)-1}(1 - \theta)z^\rho\,l^{\rho-1}$$

The steady-state level of consumption can be obtained by evaluating the resource constraint at the steady-state:

$$c = y - \delta k - g - TB$$

Typically, a calibration assigns values to the model parameters by matching first and second moments of the data that the model aims to explain. The depreciation rate of capital δ and the world interest rate $\overline{\iota_w}$ are based on parameter values widely used in the related business-cycle literature and on the average annual depreciation rate taken from the Bureau of Economic Analysis, $\delta = 0.1$ and $\overline{\iota_w} = 0.04$. The parameter θ is set to match the observed long-run average labor share of income. In the present model, the labor share is given by the ratio of labor income to output, which is $1 - \theta$ at all times. The parameter $\bar{d}$ is set to match the observed average trade-balance to output ratio.

Table 7a: Baseline Calibration Targets: The State of Ohio

2001-2014	Description	Restriction
$\bar{c}/\bar{y}$ =0.66	Consumption to GDP ratio	BEA
$\bar{x}/\bar{y}$ =0.21	Investment to GDP ratio	BEA
$\bar{g}/\bar{y}$ =0.12	Government spending to GDP ratio	BEA
$\overline{TB}/\bar{y}$ =0.01	Trade Balance to GDP ratio	BEA

Table 7b: Baseline Calibration Parameters: The State of Ohio

2001-2014	Description	Restriction
$\tau^{L,s}$ =0.0198	State labor income tax rate	STC
$\tau^{L,f}$ =0.1498	Federal labor income tax rate	BEA
$\tau^{K,s}$ =0.0321	State capital income tax rate	STC
$\tau^{K,f}$ =0.1282	Federal capital income tax rate	BEA
τ^{X}=0.0218	Effective investment tax rate	STC
τ^{C}=0.0349	Effective consumption tax rate	STC
$\overline{STR}/\bar{y} = 0.052$	State Tax Receipts to GDP ratio	STC
δ =0.11	Depreciation rate of capital	BEA
θ =0.32	Capital share of income	BEA
$\bar{l}$=0.28	Hours worked/available hours	IPUMS USA
κ =20.67	Disutility of work	Labor Hours
$\overline{\iota_w}$ =0.04	Avg. annual real interest rate (1950-2015)	FRED
$\varphi = 0.4$	Elasticity of labor supply to changes in the real wage	Reichling and Whalen (2012)
$\bar{d} = 0.25$	Set to match the long-run average trade balance to GDP ratio	$\frac{\overline{TB}/\bar{y}}{\overline{\iota_w}}$
$\sigma = 0.946$	Elasticity between labor and capital	Set to match Investment to GDP ratio
$\bar{z}$=1	Labor Efficiency	Normalization

4. Model Results

4.1 The Impact of Taxation

Table 8: Effects of Eliminating Taxes on Income

POLICY SIMULATION	ELIMINATING THE STATE TAX ON LABOR INCOME	ELIMINATING THE STATE TAX ON INVESTMENT INCOME
GDP	+0.69%	+0.61%
CONSUMPTION	+0.69%	+0.24%
INVESTMENT	+0.69%	+1.76%
LABOR SUPPLY	+0.68%	+0.14%
STATE TAX RECEIPTS	-26.42%	-19.17%

Table 9: Effects of Eliminating Taxes on Consumption and Investment

POLICY SIMULATION	ELIMINATING THE STATE TAX ON CONSUMER NON-DURABLE PURCHASES	ELIMINATING THE STATE TAX ON INVESTMENT AND DURABLE GOODS PURCHASES
GDP	+0.98%	+1.27%
CONSUMPTION	+0.98%	+0.52%
INVESTMENT	+0.98%	+3.64%
LABOR SUPPLY	+1.00%	+0.25%
STATE TAX RECEIPTS	-44.56%	-8.29%

What is the responsiveness of Real per capita GDP to a 1% increase in tax revenues?

Financed by the investment Tax	Financed by the consumption Tax	Financed by the investment Income Capital gains Tax	Financed by the labor income Tax
-3.00	-0.43	-0.62	-0.51

In the table above, we highlight the responsiveness of real per capita GDP to an increase in tax revenues financed in a variety of ways. Although all tax increases reduce output, a 1% increase in tax revenues financed solely by investment taxes is the most harmful because output is most responsive to changes in the capital stock. The economics literature shows that tax policies which penalize investment are more harmful to productive economic activity than taxes on consumption (see, Arnold et al., 2011; Gemmell et al, 2011; Romer and Romer, 2010; Blanchard and Perotti, 2002; Padovano and Galli, 2001; Bleaney et al., 2001; Mullen and Williams, 1994).

4.2 Which States' Tax Policy Improves Economic Outcomes?

In this section, we use the model to analyze the effects of several states' tax policy on our baseline economy. Among our comparison states, only Arkansas fares worse than Ohio on the 2014 EFNA tax burden index. While most states' taxation– with lower rates than Ohio – would deliver small economic gains for Ohio, Pennsylvania and Arkansas' higher state tax rates would hurt the Ohio economy.

Table 10: New Hampshire's Tax Policy

Simulating New Hampshire's policy	State Taxes only
GDP	+1.49%
CONSUMPTION	+1.12%
INVESTMENT	+2.65%
LABOR SUPPLY	+1.00%

Table 11: South Dakota's Tax policy

Simulating South Dakota's policy	State Taxes only
GDP	+1.65%
CONSUMPTION	+1.20%
INVESTMENT	+3.05%
LABOR SUPPLY	+1.04%

Table 12: Texas' Tax policy

Simulating Texas' policy	State Taxes only
GDP	+0.35%
CONSUMPTION	+0.33%
INVESTMENT	+0.39%
LABOR SUPPLY	+0.32%

Table 13: Florida's Tax Policy

Simulating Florida's policy	State Taxes only
GDP	+0.00%
CONSUMPTION	+0.15%
INVESTMENT	-0.48%
LABOR SUPPLY	0.21%

Table 14: Tennessee's Tax Policy

Simulating Tennessee's policy	State Taxes only
GDP	+0.03%
CONSUMPTION	+0.25%
INVESTMENT	-0.69%
LABOR SUPPLY	+0.36%

Table 15: Virginia's Tax Policy

Simulating Virginia's policy	State Taxes only
GDP	+0.64%
CONSUMPTION	+0.36%
INVESTMENT	+1.50%
LABOR SUPPLY	+0.29%

Table 16: Pennsylvania's Tax Policy

Simulating Pennsylvania's policy	State Taxes only
GDP	-0.08%
CONSUMPTION	-0.06%
INVESTMENT	-0.13%
LABOR SUPPLY	-0.04%

Table 17: Arkansas' Tax Policy

Simulating Arkansas 'policy	State Taxes only
GDP	-1.94%
CONSUMPTION	-1.25%
INVESTMENT	-4.09%
LABOR SUPPLY	-0.93%

5. Accounting Decomposition: Comparing High Tax States with Low Tax States

In this section, we repeat our calibration exercise to decompose the differences across states. For our quantitative exercise, we choose Texas since it is ranked highly by EFNA for the state's low tax burden. Given observed tax rate differentials, differences in the trade balance, we need to estimate two parameters to match two data targets. The first "free" parameter is the elasticity of substitution between production factors pinned down by the investment to GDP ratio. The second is the labor efficiency parameter which is simply a residual, set to match the average yearly gap between states in terms of real per capita GDP for the 2001-2014 period.

Our estimated elasticity of substitution between capital and labor is lower for Texas relative to Ohio (see table 18). This result suggests that all else being equal, real per capita output should be lower in Texas relative to Ohio. However, Ohio's real per capita output was on average 11.27% below Texas for 2001-2014 period. Our model suggests that if our estimates of the elasticity of substitution between capital and labor were the same for Texas and Ohio, real per capita output in Texas would be 4.3% larger than in Ohio. In addition, we learn that Texas' large positive trade balance – due to its sizeable natural endowments – can account for 42.5% of the differences between those two states. Taxation explains 7.1% while labor efficiency is responsible for 12.4% of why Texas outperforms Ohio. These results suggest that even if Ohio had the same natural resources, Ohio would still fall short of Texas in real per capita GDP by 6.5%.

Table 18: Explaining the gap between Ohio and Texas

	Taxes and Government Spending	**Adjustment for factor substitution** $\sigma = 0.839$	**Adjustment for Endowments** $\bar{d} = 2.75$	**Adjustment for the labor/capital share** $\theta = 0.35$	**Adjustment for labor efficiency** $\bar{z} = 1.014$
GDP	0.8%	-4.3%	4.8%	8.6%	1.4%
CONSUMPTION	0.9%	-2.2%	-11.1%	5.5%	1.4%
INVESTMENT	0.6%	-11.1%	4.8%	18.2%	1.4%

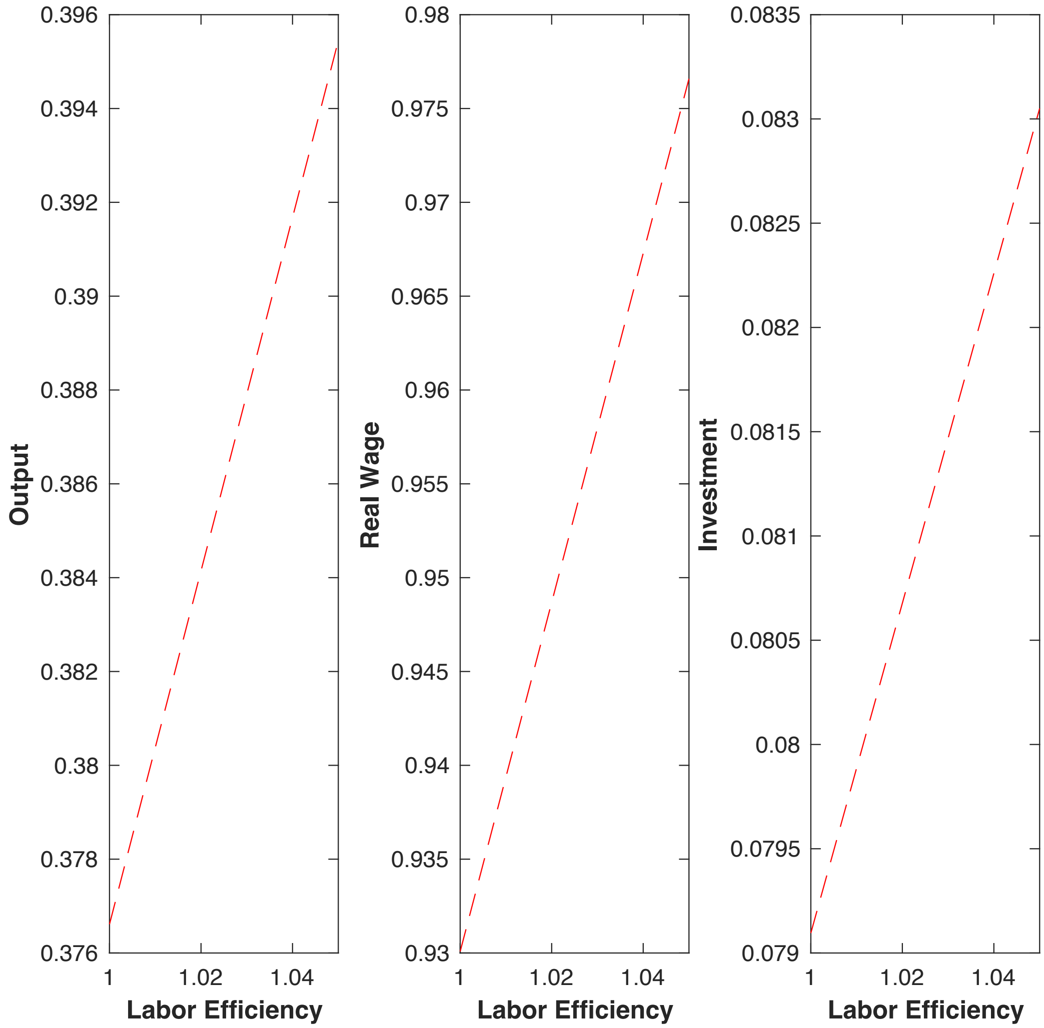

Figure 1: What does Higher Labor Efficiency Mean for an Economy?

Table 19: Explaining the gap between Arkansas and Texas

	Taxes and Government Spending	Adjustment for factor substitution $\sigma = 0.839$	Adjustment for Endowments $\bar{d} = 2.75$	Adjustment for the labor/capital share $\theta = 0.35$	Adjustment for labor efficiency $\bar{z} = 1.411$
GDP	3.6%	0.4%	8.0%	-11.7%	41.1%
CONSUMPTION	6.0%	0.2%	-17.4%	-8.6%	41.1%
INVESTMENT	5.3%	0.8%	8.0%	-21.0%	41.1%

The structure of Arkansas economy as reflected by the labor share and by the elasticity of substitution between production factors put Texas at a disadvantage, implying that all else being equal, Arkansas would be 27.4% larger than Texas in per capita terms. Accounting for the Texas trade advantage (19.3%) would still leave Arkansas ahead of Texas. However fiscal policy (8.7%) and the efficiency of Texan labor explain why real per capita GDP in Arkansas is only 58.69% that of Texas. Once again, Texas large natural resources on their own fail to account for greater economic prosperity in Texas.

6. Discussion of our findings

In our quantitative exercise, we showed that even when compared to Texas – the state with the lowest tax burden – higher taxes and government spending were only responsible for 7-8% of the difference in economic prosperity for two of the states with the highest overall tax burden (table 4). Instead it was estimated differences in labor efficiency that seemed to matter most. What are factors that can result in higher labor efficiency in Texas?

Texas scored consistently higher than Ohio on the EFNA index for labor market freedom. Could the regulatory framework be to blame for why Ohioans are less efficient than Texans? Autor, Kerr and Kugler (2007) provide empirical evidence that employment protection reduces firm-level productivity. Their findings suggest that the adoption of wrongful-discharge protection by state courts in the US from 1970 to 1999 altered short-run production choices and caused employers to retain unproductive workers, leading to a reduction in technical efficiency. Using Swedish register data, Bjuggren (2015) finds that increased labor market flexibility increases labor productivity. However, the increased productivity cannot be explained by capital intensity or by the educational level of workers.

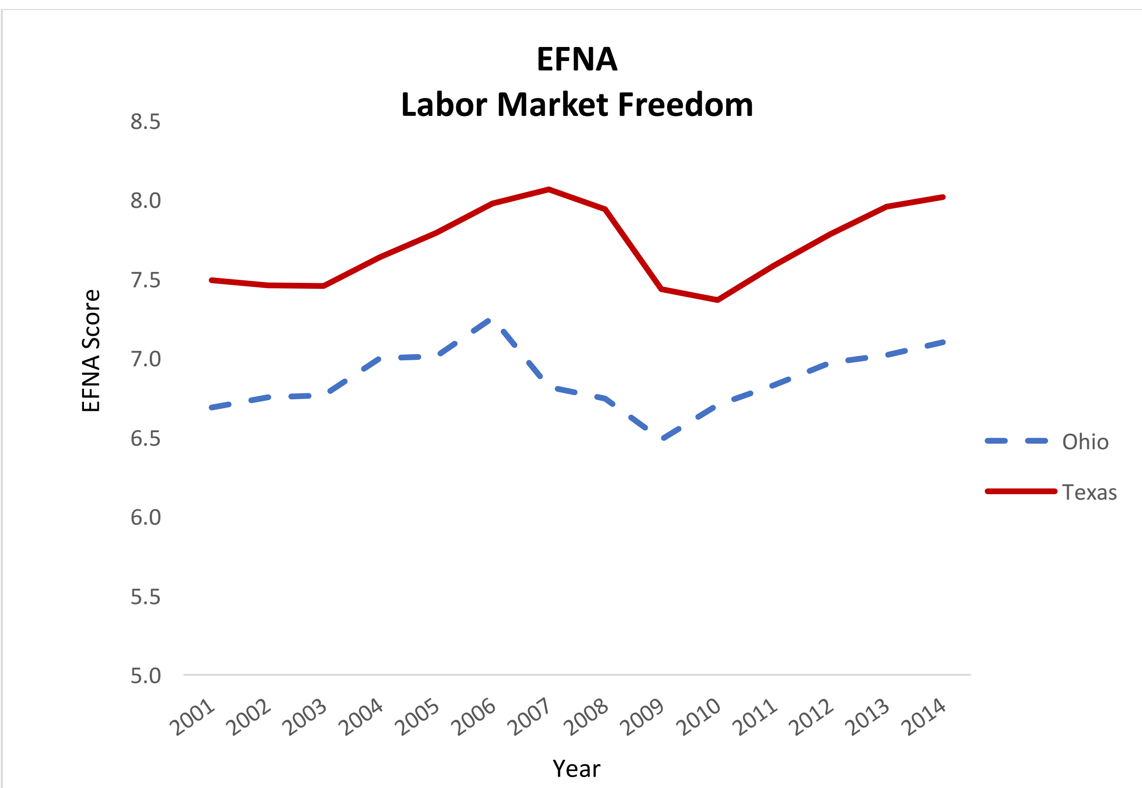

Figure 2: Labor Market Freedom scores

Beginning with the seminal work of Lazear (1990), much research has focused on assessing how dismissal costs affect employment levels and productivity. Provided that dismissal protection is not undone by Coasean bargaining, dismissal protection raises firms' adjustments costs. Consequently, firms will find it optimal not to hire workers whose short-term marginal product exceeds their market wage and will choose to retain unproductive workers whose wage exceeds their productivity (see, Blanchard and Portugal, 2001). These distortions in production choices unambiguously reduce worker flows. They are also likely to cause firms to substitute capital for labor and have the potential to reduce productivity by distorting production choices.

7. Conclusion

Using the balanced growth paths of a neoclassical growth model, we decomposed differences in macroeconomic outcomes for low and high tax US states. Our analysis focused on Ohio, Arkansas and Texas. We chose Ohio and Arkansas because of the high tax burden and poor economic performance. Texas was chosen for its low tax regime and its relatively much higher real per capita GDP. Factors such as Texas natural resources, reflected by the state's large positive trade balance, account for less than half of the observed differences in real per capita output, suggesting that if Ohio or Arkansas had the same trade balance, the average Texan would still be better off. The share of income paid in taxes and government spending can only explain 7-8% of the gap while labor efficiency makes up the largest share of the gap between these states. What makes labor so much more efficient in Texas? This is what we refer to as the "Texas miracle". The economics literature has long showed that employee protections cause firms to retain unproductive workers, while greater labor market flexibility improves worker efficiency. Could a less intrusive regulatory framework play a larger role in explaining the Texas success story? We leave this question to future research.

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APPENDIX: TAX RATES IN THE NEOCLASSICAL GROWTH MODEL

The calculation of tax rates provided in this paper follows a similar methodology to that of McDaniel (2007). The tax rates calculated in this paper are average tax rates. The general strategy employed is as follows. First, total income is categorized as labor income or capital income and private expenditures are categorized as consumption or investment. Second, tax revenues are classified as revenues generated from taxes on labor income, capital income, private consumption expenditures or private investment. To find a given tax rate, we divide each category of tax revenue by the corresponding income or expenditure. Since we compute tax rates in the same fashion each year, we drop time subscripts for the rest of this section.

Data on tax revenues come from U.S. Census Bureau Survey of State Government Tax Collections (STC) unless otherwise stated. Data on income and expenditures come from regional Bureau of Economic Analysis (BEA) data. In any given year, total tax revenues collected by the government are the sum of taxes on production and imports (TPI), social security contributions (SS), direct taxes on households (HHT), and direct taxes on corporations (CT). The following sections detail the steps we take to categorize these tax revenues and calculate average tax rates.

Share of the income tax that falls on labor

The average tax rate on labor income is found by dividing labor income tax revenues by economy-wide labor income. To compute the labor income tax rate, we need to calculate labor income tax revenues and labor income. Labor income tax revenues come from two sources: the household income tax and social security taxes. However, household income taxes represent taxes on total income. Since only a portion of this income is generated from labor, only a portion of these taxes reflect taxes on labor income. Unfortunately, the STC and BEA do not break down household income taxes according to type of income. For this reason, papers calculating average tax rates on labor and capital income based on aggregate data, such as Mendoza et al. (1994), use the household income tax to estimate the burden that falls on labor and capital income. We use the same methodology.

The federal income tax rate is found by dividing total federal taxes on income of the household, *FHHT*, by total household income in each period. Household income is defined as gross domestic product less net taxes on production and imports, or $GDP - (TPI - Sub)$. The household income tax rate is therefore measured as

$$\tau^{inc,F} = \frac{FHHT}{GDP - (TPI - Sub)}$$

It remains to divide income into payment to capital and payment to labor. Let θ be the share of income attributed to capital, with the remaining (1 − θ) share attributed to labor. Total household income taxes paid on labor income are represented by

$$FHHT_L = \tau^{inc,F}(1-\theta)(GDP - (TPI - Sub)$$

The second source of tax revenue generated from taxes on labor income are social security taxes, *SS*. This corresponds to an exact entry in the BEA data, no further adjustment is required. Social security taxes combined with *HHTL* represent total tax revenues that are classified as taxes paid on labor income, so the average tax rate on labor income is measured as

$$\tau^{l,F} = \frac{SS + FHHT_L}{(1-\theta)(GDP - (TPI - Sub)}$$

The state income tax rate is found by dividing total state taxes on income of the household, *SHHT*, by total household income in each period. Household income is defined as gross domestic product less net taxes on production and imports, or $GDP - (TPI - Sub)$. The household income tax rate is therefore measured as

$$\tau^{inc,S} = \frac{SHHT}{GDP - (TPI - Sub)}$$

It remains to divide income into payment to capital and payment to labor. Let θ be the share of income attributed to capital, with the remaining (1 − θ) share attributed to labor. Total household income taxes paid on labor income are represented by

$$SHHT_L = \tau^{inc,S}(1-\theta)(GDP - (TPI - Sub))$$

The average state tax rate on labor income is measured as

$$\tau^{l,S} = \frac{SHHT_L}{(1-\theta)(GDP - (TPI - Sub)}$$

Consumption and investment tax rates

Revenue collected from taxes levied on consumption and investment expenditures are included in taxes on production and imports, *TPI*. Consumption and investment expenditures are subsidized by the amount *Sub*. *TPI* includes general taxes on goods and services, excise taxes, import duties and property taxes. The task remains to properly allocate *TPI* to the relevant tax revenue category. This requires that we address the proper division of *TPI* across consumption and investment. *TPI* includes the following components: property taxes, general taxes on goods and services, excise taxes, taxes on specific services, and taxes on the use of goods to perform activities.

Some of the taxes included in *TPI* fall only on consumption expenditures. Others fall on both consumption and investment expenditures. We assume revenue from taxes that fall on both consumption and investment expenditures are split between consumption tax revenue and investment tax revenue according to consumption and investment share in private expenditures. Taxes that fall strictly on consumption are excise taxes and taxes on specific services, reported as select sales taxes in the STC data.

Taxes that fall on both consumption and investment are general sales and use taxes, and taxes on use of goods to perform activities, which includes motor vehicle taxes, highway taxes, license taxes, etc. These goods are used in the production of both investment goods and consumption goods, and can be calculated by subtracting select sales taxes, total income taxes, and corporation license taxes from total taxes in the STC data.

After identifying taxes that fall strictly on consumption expenditures, we calculate their share, λ, of *TPI*. Revenue collected from taxes levied on consumption expenditures is calculated as

$$TPI_C = \left(\lambda + (1-\lambda)\left(\frac{C}{C+I}\right)\right)(TPI - Sub)$$

Consumption expenditures are reported in the national accounts gross of taxes. Taxable consumption expenditures are then $C - TPIc$ and the consumption tax is measured as

$$\tau^C = \frac{TPI_C}{C - TPI_C}$$

Since *TPIc* represents revenue from consumption taxes, the remaining portion of *TPI-Sub* is attributed to taxes on investment.

$$TPI_X = TPI - Sub - \; TPI_C$$

Like consumption expenditures, investment expenditures are recorded gross of taxes. Pre-tax private investment expenditures are then $I - TPIx$. So, the investment tax ratio is

$$\tau^X = \frac{TPI_X}{I - TPI_X}$$

Share of the income tax that falls on capital

As calculated previously, income paid to capital in the economy is $\theta(GDP - (TPI - Sub))$. *OSGOV* is gross operating surplus earned by the government, and therefore is not subject to tax. Taxable capital income is therefore $\theta(GDP - (TPI - Sub)) - OSGOV$. Capital tax revenues come from the following sources: the household income tax, and taxes levied on corporate income. Federal household taxes on capital, $FHHT_K$, is then

$$FHHT_K = \tau^{inc,F}(\theta(GDP - (TPI - Sub))$$

The federal household capital income tax rate is then

$$\tau^{k,FH} = \frac{FHHT_k}{(\theta\big(GDP - (TPI - Sub)\big) - OSGOV}$$

Federal corporate tax data (FCT) is only available at the national level, therefore we assume that the average corporate tax rate is the same for each state. The federal corporate tax rate is computed using national data as

$$\tau^{CT,F} = \frac{FCT}{(\theta\big(GDP - (TPI - Sub)\big) - OSGOV}$$

As owners of corporations, households are subject to all corporate taxation. The total federal capital income tax is then

$$\tau^{K,F} = \tau^{CT,F} + \tau^{K,FH}$$

At the state level household capital income tax is

$$SHHT_K = \tau^{inc,Sc}(\theta(GDP - (TPI - Sub))$$

The state household capital income tax rate is then

$$\tau^{K,S} = \frac{(SHHT_K + SCT)}{(\theta\big(GDP - (TPI - Sub)\big) - OSGOV}$$

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