

10-1-2011

Cross-Sectional Analysis of Corporate Income Tax, Sales Tax, Human Development Index and Real GDP Per Capita

Gonzalo Moya
San Jose State University

Follow this and additional works at: http://scholarworks.sjsu.edu/econ_grad_unpub

Recommended Citation

Moya, Gonzalo, "Cross-Sectional Analysis of Corporate Income Tax, Sales Tax, Human Development Index and Real GDP Per Capita" (2011). *Unpublished Graduate Student Papers*. Paper 1.
http://scholarworks.sjsu.edu/econ_grad_unpub/1

This Article is brought to you for free and open access by the Student Publications at SJSU ScholarWorks. It has been accepted for inclusion in Unpublished Graduate Student Papers by an authorized administrator of SJSU ScholarWorks. For more information, please contact scholarworks@sjsu.edu.

San Jose State University

Econ 232 – Seminar in Public Finance

Term Paper (Final Version)

Professor Fred Foldvary

Cross-Sectional Analysis of Corporate Income Tax, Sales Tax, Human Development Index and Real GDP per capita.

By Gonzalo Rafael Moya Villanueva

B.S. Applied Mathematics (Economics and Actuarial Science).

Fall 2011

Index

1. <u>Introduction.</u>	<u>3</u>
2. <u>On Taxes.</u>	<u>4</u>
3. <u>Cross-Sectional Analysis</u>	<u>6</u>
4. <u>Additional Regressions</u>	<u>8</u>
5. <u>Concluding Remarks</u>	<u>11</u>
6. <u>References</u>	<u>12</u>
7. <u>Appendix</u>	<u>13</u>

1. Introduction

What is the correlation between taxes and the wealth of a nation? Payroll tax encourages workers to increase their leisure and reduce their labor; corporate income taxes deter entrepreneurship and investment, which leads to fewer new jobs; and sales taxes dissuade consumption, the main component of the aggregate demand.

From this, one would expect a negative relationship between taxes and the wealth of a nation; however, we must take into account the positive impact of public expenditures as well. What the government can give back to the economy through the provision of public goods can more than make up for the drain of private resources: A fine system of police, justice and external defenses grants the security on which the market mechanisms are founded. An effective system of firemen and cleaning services can raise the value of property which also impacts positively on public welfare.

Hence, the final correlation between the amount of taxes imposed and the wealth of a nation is in theory ambiguous, and it depends on the extend the government uses the tax collected to give back in a way that the people could not have agreed alone, rather than spend it in the maintenance of the government itself.

As the title states, in this paper I will carry out a cross-sectional study among 114 countries to elucidate on the effect taxes (on corporate income and on sales, in particular) have on the wealth of a nation (measured by the Human Development Index and the Gross Domestic Product per capita at purchasing power parity). Additional regressions will be run after that to check for *omitted variable bias*. These models will include the Economic Freedom of the World (EFW) index and the Corruption Perceptions Index (CPI). Before doing all the statistical analysis though, I will describe taxes briefly.

2. On taxes.

The *corporate income tax* is one levied on the earnings of a corporation. The purpose of taxing them besides the individuals is to tax the earnings of the owners of capital that might otherwise escape taxation. The *sales tax* is the general one paid by consumers to vendors at the point of sale (compared to the excise tax which is the additional consumption tax on particular goods).

In Economics, the corporate income tax is said to be a *direct* one, as it directly taxes an individual resource (i.e. it may be adjusted to the individual characteristics of the taxpayer); while the sales tax is said to be an *indirect* one, as it taxes the *use* of the resource rather than the resource itself (i.e. they are levied on transactions irrespective of the circumstances of the buyer and seller).

Two key concepts describe the set of tax rates on income, whether individual or corporate: The first is the *marginal* tax rate, which is the percentage of the *next* dollar of income that is paid in taxes. The second concept is the *average* tax rate, which is the percentage of total income that is paid in taxes (i.e. the ratio of total tax payments to total income). Another important distinction is the tax *incidence* (i.e. who bears the true burden of a tax). *Statutory* incidence tells which party sends the check to the government (e.g. the vendor in the case of the sales tax), while *economic* or *effective* incidence concerns about which party actually “pays” the tax (e.g. the buyer in the same example).

In 2001, the *total* government of the United States (i.e. the federal, state and local governments) got most of its tax revenue from *individual income* (42.3%), followed by payroll (24.6%) and consumption (16.1%). Corporate income only meant 6.5% of its total revenue, although the top marginal bracket for the corporate-income-tax rate reaches up to 50%; while the highest sales-tax rate (state plus federal) is of only 10.3%. This is consistent with Arthur Laffer’s argument that not necessarily the tax with the highest rate will provide the highest revenue. Most governments in the world have *consumption* as their main source of tax revenue, where in developing countries revenue from individual income tax is almost non-existent.

Vertical and *horizontal equity* are the two distributional goals considered in measuring the *fairness* of a tax: the former states that groups with more resources should pay higher taxes than groups with fewer resources; whereas the latter states that similar individuals who make different economic choices should be treated similarly by the tax system.

When discussing over the vertical equality, three classifications fall upon taxes: whether they are progressive, proportional or regressive. A tax is *progressive* if its average rate rises with income; *proportional* if it stays the same; and *regressive* if the average rate actually decreases with increases in income. If we measure income not in Accounting terms but under the *Haig-Simons comprehensive definition* (where taxable resources are the change in individual's power to consume during the year, plus any increases in the person's stock of wealth), then income would be measured as an ability to pay, thus changing our classification of taxes (e.g. a proportional *sales* tax could be considered *regressive* as people with low income have a higher propensity to consume, and a proportional *income* tax could already be considered *progressive* without needing to recur to brackets).

3. Cross-Sectional Analysis.

As we can see in Table 3.1, the mean and median corporate income tax around the world is about 25%, with a corresponding value of 16% for sales tax¹. The distribution of income tax is almost symmetric while the sales tax is skewed to the left. The coefficient of variability is less than 40% in both cases.

Table 3.1: Summary statistics, using the observations 1 - 114 (missing values were skipped)

	Mean	Median	Minimum	Maximum
Corporate_Income	0.25289	0.25000	0.00000	0.50000
Sales_Tax	0.15974	0.17500	0.00000	0.25500
HDI	0.70913	0.73200	0.28200	0.93800
Real_GDP_per_cap	17686.	12775.	412.00	81466.

	Std. Dev.	C.V.	Skewness	Ex. kurtosis
Corporate_Income	0.087559	0.34624	-0.0041105	0.26199
Sales_Tax	0.058089	0.36364	-0.75708	0.18598
HDI	0.15348	0.21643	-0.88462	0.19868
Real_GDP_per_cap	15283.	0.86415	1.2022	1.4968

As we can see in Table 3.2, there is a low correlation between corporate income tax and sales tax, and both have a low correlation with Real GDP per capita. By low I mean below the 5% critical value necessary to state that they are significantly different from zero at this confidence level. Compared to the HDI they fared better but still around this critical value. Only the correlation between HDI and Real GDP per capita was strong, but that is not in the scope of this paper.²

Table 3.2: Correlation Coefficients, using the observations 1 - 114 (missing values were skipped)

5% critical value (two-tailed) = 0.1937 for n = 103

Corporate_Income	Sales_Tax	HDI	Real_GDP_per_cap	
1.0000	0.0150	-0.2067	-0.0267	Corporate_Income
	1.0000	0.1863	0.0417	Sales_Tax
		1.0000	0.7772	HDI
			1.0000	Real_GDP_per_cap

¹ Corporate_Income is measured as its marginal tax bracket. Both variables, Sales_Tax and Corporate_Income, take the maximum values of each country, which includes federal, state and local taxes. So -for example- for the case of the United States, we get 10.3% and 50%, respectively.

² HDI stands for Human Development Index, and its calculation includes life expectancy, education, and income. Real_GDP_per_cap stands for Gross Domestic Product per capita at purchasing power parity.

As we can see in Table 3.3, the ordinary least squares regression of Real GDP per capita on both corporate income tax and sales tax threw that neither of these two independent variables had a significantly explanatory effect on Real GDP per capita (this from looking at the low t-ratios) and that even combined they fail to explain the dependent variable sufficiently (this from looking at the low F-value).

Table 3.3: Model 1: OLS, using observations 1-114 (n = 103)
 Missing or incomplete observations dropped: 11
 Dependent variable: Real_GDP_per_cap
 Heteroskedasticity-robust standard errors, variant HC1

	coefficient	std. error	t-ratio	p-value	
const	15507.7	6508.59	2.383	0.0191	**
Corporate_Income	1600.17	17746.6	0.09017	0.9283	
Sales_Tax	12396.2	27441.3	0.4517	0.6524	
Mean dependent var	17934.10	S.D. dependent var	14780.78		
Sum squared resid	2.22e+10	S.E. of regression	14910.68		
R-squared	0.002300	Adjusted R-squared	-0.017654		
F(2, 100)	0.104794	P-value(F)	0.900609		

As we can see in Table 3.4, the ordinary least squares regression of Human Development Index on both corporate income tax and sales tax threw that only the latter independent variable explained the HDI with statistical sufficiency, but barely. The finding is similar for their combined amount of explanation.

Table 3.4: Model 2: OLS, using observations 1-114 (n = 99)
 Missing or incomplete observations dropped: 15
 Dependent variable: HDI
 Heteroskedasticity-robust standard errors, variant HC1

	coefficient	std. error	t-ratio	p-value	
const	0.710886	0.0586129	12.13	4.44e-021	***
Corporate_Income	-0.300960	0.183212	-1.643	0.1037	
Sales_Tax	0.524412	0.260912	2.010	0.0472	**
Mean dependent var	0.720657	S.D. dependent var	0.145072		
Sum squared resid	1.911409	S.E. of regression	0.141105		
R-squared	0.073252	Adjusted R-squared	0.053945		
F(2, 96)	3.109813	P-value(F)	0.049133		

4. Additional Regressions.

Fearing that the two models from the previous section may suffer from “Omitted Variable Bias”, I decided to run them again but including Economic Freedom of the World (EFW) index and the Corruption Perceptions Index (CPI) as additional regressors.

Omitted variable bias occurs when two conditions are true: (1) the omitted variables are correlated with the included regressors –Corporate_Income and Sales_Tax-; and (2) the omitted variables are determinants of the dependent variables –Real_GDP_per_cap and HDI-.

The EFW is obtained annually by the Fraser Institute, which compiles the information provided by its Economic Freedom Network Members in 141 nations. Its computation comprehends five areas or components: (1) Size of Government: Expenditures, Taxes and Enterprises; (2) Legal Structure and Security of Property Rights; (3) Access to Sound Money; (4) Freedom to Trade Internationally; and (5) Regulation of Credit, Labor and Business.

The CPI (do not confuse with Consumer Price Index) is obtained annually by the Transparency International (TI) organization which defines “corruption” as the abuse of entrusted power for political gain. The CPI measures the degree to which public sector corruption is perceived to exist in 178 countries around the world. Its results are drawn from 13 surveys and assessments published by several independent institutions.

These two indices go in theory from 0 to 10, 0 being “very restricted” and 10 being “very free” for the EFW, and 0 being “highly corrupt” and 10 being “very clean” for the CPI. However, as we can see in Table 4.1, these ranges are in practice narrower: from 3.89 (Angola) to 9.05 (Hong Kong) for the EFW and from 1.4 (Afghanistan) to 9.3 (New Zealand) for the CPI. The distribution of EFW is skewed left and very concentrated, while CPI is skewed right and more spread.

Table 4.1: Summary statistics, using the observations 1 - 114
(missing values were skipped)

	EFW	CPI
Mean	6.8348	4.6312
Median	7.0050	3.7000
Minimum	3.8900	1.4000
Maximum	9.0500	9.3000
Standard deviation	0.88138	2.2613
C.V.	0.12895	0.48827
Skewness	-0.66390	0.70361
Ex. kurtosis	0.96868	-0.76829

As we can see in Table 4.2, both of the additional regressors are highly correlated with both dependent variables (~70%), and somewhat correlated to at least one of the included regressors (~|20%|), suggesting indeed omitted variable bias in the models of the previous section.

Table 4.2: Correlation Coefficients, using the observations 1 - 114
(missing values were skipped)

	EFW	CPI
	-0.2796	-0.0309 Corporate_Income
	0.0003	0.1475 Sales_Tax
	0.7074	0.7384 HDI
	0.6475	0.8371 Real_GDP_per_cap
	1.0000	0.7345 EFW
		1.0000 CPI

As we can see in Table 4.3, the joint explanation of the new OLS regression on Real_GDP_per_cap increased significantly (from 0.1 to 39.3 in F), but it is mostly attributed to CPI, who has the highest t-ratio (8.46). The p-values of Corporate_Income and Sales_Tax decreased considerably (from 93% and 65%, to 47% and 51%, respectively), but they are still too high to be considered statistically significant at any relevant confidence level.

Table 4.3: Model 3: OLS, using observations 1-114 (n = 93)

Missing or incomplete observations dropped: 21
 Dependent variable: Real_GDP_per_cap
 Heteroskedasticity-robust standard errors, variant HC1

	coefficient	std. error	t-ratio	p-value
const	-11110.0	9564.52	-1.162	0.2485
Corporate_Income	6661.14	9238.78	0.7210	0.4728
Sales_Tax	-11234.8	17105.0	-0.6568	0.5130
EFW	432.465	1357.76	0.3185	0.7509
CPI	5579.59	659.297	8.463	5.22e-013 ***
Mean dependent var	18685.37	S.D. dependent var	15077.82	
Sum squared resid	5.84e+09	S.E. of regression	8149.497	
R-squared	0.720566	Adjusted R-squared	0.707865	
F(4, 88)	39.31380	P-value(F)	7.58e-19	

Finally, as we can see in Table 4.4, the joint explanation of the new OLS regression on HDI increased significantly (from 3.1 to 47.7 in F). Here it is also mostly attributed to CPI, who has the highest t-ratio (5.72); however, it is interesting to notice how the significance of the previously included explanatory variables has shifted from one to the other: Corporate_Income is now the one that is barely significant at a 5% confidence level, while Sales_Tax used to be so when the variables EFW and CPI were not present.

Table 4.4: Model 4: OLS, using observations 1-114 (n = 92)

Missing or incomplete observations dropped: 22
 Dependent variable: HDI
 Heteroskedasticity-robust standard errors, variant HC1

	coefficient	std. error	t-ratio	p-value
const	0.284787	0.160767	1.771	0.0800 *
Corporate_Income	-0.254724	0.126763	-2.009	0.0476 **
Sales_Tax	0.212814	0.196950	1.081	0.2829
EFW	0.0448527	0.0226930	1.977	0.0513 *
CPI	0.0338533	0.00592185	5.717	1.50e-07 ***
Mean dependent var	0.725533	S.D. dependent var	0.144141	
Sum squared resid	0.731569	S.E. of regression	0.091700	
R-squared	0.613065	Adjusted R-squared	0.595275	
F(4, 87)	47.74349	P-value(F)	3.50e-21	

5. Concluding Remarks.

As stated in the introduction, and “proved” statistically throughout this paper, the final relationship between taxes and the welfare of the nation is ambiguous: In the case of *Real GDP per capita*, no significant explanation could be made just by the combination of *corporate income tax* and *sales tax*, and in the case of the *Human Development Index*, the explanation achieved by these two variables combined was barely significant according to statistical measures, and insignificant according to economic, stricter standards.

When the *Economic Freedom of the World* (EFW) index and the *Corruption Perceptions Index* (CPI) were added as explanatory variables, the ordinary least squares regressions showed significant improvement in the overall explanation, mainly due to CPI. However, the independent variables previously included in the models remained basically insignificant, implying that their lack of explanatory power was not because of *omitted variable bias*. Therefore, tax rates are not determinant in the wealth of a nation.

A government that spends most of its tax revenue on current expenditures (payrolls) and does not contribute sufficiently to the welfare of the economy by providing quality public goods and services that the private sector cannot convene to manage, will have a negative effect on the wealth of its nation, as the negative incentives of high taxation will not be compensated by the positive effects the tax collected can produce.

On the contrary, a government that uses most of its tax revenue to supply quality public goods and services that the private sector cannot arrange to administer (rather than spending most of it on current expenditures), will have a net positive effect on the wealth of its nation, as the positive impacts the tax gathered can generate will more than make up for the negative incentives of high taxation. Thus, only then, the presence of the government would be beneficial on the net to the welfare of the economy.

6. References.

[1] Stock, James H. and Mark W. Watson. Introduction to Econometrics. 2nd Edition. Pearson-Addison Weasley. Boston, 2007.

[2] Gruber, Jonathan. Public Finance and Public Policy. Worth Publishers. New York, 2005.

[3] Anderson, John E. Public Finance. Principles and Policy. Houghton Mifflin Company. Boston-New York, 2003.

[4] Wikipedia. The Free Encyclopedia. Tax rates around the world. Accessible online at http://en.wikipedia.org/wiki/Tax_rates_around_the_world

[5] Wikipedia. The Free Encyclopedia. Human Development Index. Accessible online at <http://en.wikipedia.org/wiki/Hdi>

[6] Wikipedia. The Free Encyclopedia. List of countries by GDP (PPP) per capita. Accessible online at [http://en.wikipedia.org/wiki/List_of_countries_by_GDP_\(PPP\)_per_capita](http://en.wikipedia.org/wiki/List_of_countries_by_GDP_(PPP)_per_capita)

[7] Gwartney, James D.; Joshua C. Hall; and Robert Lawson. Economic Freedom of the World: 2010 Annual Report. Vancouver, BC: The Fraser Institute. Data retrieved from www.freetheworld.com.

[8] Transparency International. The Global Coalition Against Corruption. Policy and Research. Surveys and Indices. CPI 2010 data. Accessible online at http://www.transparency.org/policy_research/surveys_indices/cpi/2010/in_detail