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Stock Markets and Tax Revenue

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Abstract

Many developing countries struggle to raise taxes. The present work considers the financial sector – specifically the stock market sector – as a boon for tax revenue. Historically I find that higher stock market total value traded sectors are associated with more tax revenue. Using a panel data set of 96 countries over the period 1990-2008 I find that stock markets positively influence government's ability to raise tax revenue.

JEL Classification Codes: O11, H2, G2
Keywords: Panel data, Stock Market, Stock Market Total Value Traded, Tax, Tax Revenue

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1 Introduction

Since the early 1990's stock markets have opened in many countries across the world. Partly because theoretical and empirical literature has established a positive and significant correlation between stock market development and economic growth[2]. In the present work, rather than focusing on the link between stock markets and economic growth, I focus on the link between tax revenue and stock market total value traded.

A reference point is the recent proposal by the IMF, OECD, UN, and World Bank on the development of more effective tax systems[3], with the following call to action: "Identify key capacity constraints faced by developing countries in their tax systems and make recommendations on capacity building to (i) improve efficiency and transparency of tax administrations and (ii) strengthen tax policies to broaden the tax base and combat tax avoidance and evasion."[4] In many developing countries, a weak or opaque financial system is a serious capacity constraint for tax collection, leading to inefficiency, a narrow tax base, and routine tax avoidance.

So, what happens to tax revenue relative to GDP when the total value traded on the stock market increases? Intuitively the stock market(1) provides information ex ante about possible investments and allocates capital, (2) monitors investments and exert corporate governance after providing finance, (3) facilitates the trading, diversification, and management of risk, (4) mobilize and pool savings, and (5) eases the exchange of goods and services, Levine (2005, p. 869).

Improvements in the stock market increases the stock of funding that can be accessed for investment projects by firm's as well as increases in available liquidity. Therefore, increases in the stock market total value traded relative to GDP should in turn cause the government to raise more tax revenue as a share of GDP.

Using a panel of 96 countries over the period 1990-2008, I find that the effect

[2]Levine (2006) offers a synthesis of the vast theoretical and empirical literature.

[3]"Supporting the Development of More Effective Tax Systems: A Report to the G-20 Development Working Group" by the International Monetary Fund, Organization for Economic Co-operation and Development, United Nations, and World Bank (2011).

[4]Similarly, International Development Committee Tax in Developing Countries: Increasing Resources for Development Fourth Report of Session 201213.

of total stock market value traded to tax revenue is positive and statistically significant. In general, as the value of trades increases so does the tax revenue as a share of GDP.

The contribution of this study to the literature is that, to the best of my knowledge, it is the first empirical paper that explores the relationship between stock market value traded and tax revenue. The remainder of the paper is organized as follows. Section 2 briefly discusses the relationship between tax levels and stock market total value traded, section 3 describes the data and reports empirical results, and Section 4 concludes. Tables and figres are in Appendix A. All data and computer code used in the paper are available online at the corresponding author's website.

2 Tax and Stock Markets

Table 1 compares the sources of tax revenue among countries of different income levels. To begin with, as seen in the Table 1, the poorest countries collect two-thirds or less of the revenue collected in the richer countries, as a fraction of GDP, an observation that could reflect differences in preferences for public vs. private goods, but that could also be a symptom of problems in tax collection.

In poorer countries tax revenues tend to be smaller as a share of GDP, and the same is true of the total value traded as a share of GDP. For the years 1990-2008, Table 1 shows that in low-income countries the value traded-to-GDP ratio is about one twentieth of the tax-to-GDP ratio, and in middle-income countries the value-traded-to-GDP ratio raises to about a half of the tax-to-GDP ratio. This trend continues for high income countries where the value traded-to-GDP is twice as much as the tax-to-GDP ratio. [5]

Suppose that households spend income via three means: cash, checks, and capital investment. Cash spending is unobserved by the government and hence not taxed, while check and investment spending is taxed at a rate τ_b for each dollar spent.[6] With n households, let S_{ib} be household i's spending via banks

[5]Results are based on the authors' calculations. I divide economies according to 2010 GDP per capita, calculated using the World Bank Atlas method. For each group I compute averages using GDP as weight, for the panel data discussed in Section 3, with 96 countries observed during the years 1990-2008.

[6]Even though in practice this would be very impractical, for simplicity I assume that

("checks"), and S_{ic} be household i's ("capital") spending, in which case total tax raised T is:

$$T = \tau_b \left(\sum_{i=1}^{n} S_{ib} + \sum_{i=1}^{n} S_{ic} \right) \tag{1}$$

Let $\mathcal{T}$ be total tax divided by total income, and let $\mathcal{B}$ total check and capital spending divided by income. I can then recast the tax equation (1) as:

$$\mathcal{T} = \tau_b \mathcal{B} \tag{2}$$

If I suppose that spending via stock market equals some fixed multiple of stock market value traded then the relationship (2) is a simple interpretation of what is going on in the historical period described by Table 2. As the stock market gets bigger so does taxable income and the amount of tax. This interpretation is valid when the marginal tax rate τ_b is held fixed at some (exogenous) value, and would still be valid if τ_b rose with economic development, as then $\mathcal{T}$ would swell due to increases in $\mathcal{B}$ and also τ_b.

Missing from (2) is any sense of how or why the financial secotr $\mathcal{B}$ and tax $\mathcal{T}$ might vary from one country to the next, or one year to the next. This problem lies beyond the present scope of the paper and therefore I do not attempt to explain the relationship theoretically but rather empirically.

3 Empirics

I now examine nations' tax revenues and stock market total value traded empirically, using panel data. Using a panel of 96 countries over the period 1990-2008, I estimate models of tax-to-GDP (log-)levels, and growth rates, in various ways – all instances of the generalized method of moments. I consistently find a significant positive effect of stock on tax. In each case the effect of stock on tax is economically and statistically significant.

3.1 Data

There are different measures of stock market development in the stock market and growth literature. The three most common measures are stock market

income and capital taxes are taxed at the same rate.

capitalization to GDP ratio, stock market total value traded to GDP ratio, and turnover ratio. They all capture different characteristics of the stock market. For the purpose of this paper, I are interested in a measure of the stock market that will give us an insight about the capital gains from being listed on the stock market.

The turnover ratio captures the frequency at which the stocks are traded on the market, which only proxies for the ease with which the shares can be traded. On the other hand, the stock market capitalization ratio captures the size of the stock market which to a certain degree gives us a measure about the capital gains. However, this could be misleading because there might only be few large firms listed on the stock market making up the majority of the market. Therefore, the stock market capitalization ratio might not be representative of the whole market.

The total value traded ratio variable equals the total value of trades on the stock market exchange divided by GDP. This variable captures the cost of trading or uncertainty of trading in a particular market. Therefore, the value traded ratio provides us with a better picture of how well the stock market is functioning with regards to capital gains.

For controls I draw from the relevant tax literature, specifically Baunsgaard and Keen (2010), Auriol and Warlters (2005), Rodrik (1998), and Tanzi (1987). The control variables are GDP per capita, trade openness, inflation, freedom[7], aid per capita, population density, and lagged TAX. See Table 2 for data definitions and sources.

3.2 Basic Results

I now examine nations' tax revenues and stock market total value traded empirically, using panel data. First, I report basic results based on simple regression models of the tax-to-GDP ratio, then consider some augmented models with controls for other determinants of tax. In the basic and fixed effects model the effect of stocks on tax is economically and statistically significant.

To examine the link between tax and stock market total value traded empirically, I use a panel dataset covering 96 countries for which I have data on

[7]With freedom measured by the Civil Liberties score (Freedom House), a lower score indicates more liberty.

tax-to-GDP and value-traded-to-GDP for some or all of the years in the range 1990-2008.[8] Table 2 contains variable definitions and data sources, and Table 3 lists the countries – by region and level of economic development.

I show in the upper-left panel of Figure 1 a scatter plot of the tax and stock market total value traded variables, labeled TAX and STOCK, based on the panel data described in Table 2. It is difficult to discern a clear historical relationship from the plot, but higher STOCK seems to suggest higher TAX, on average. If so then the expectation $E[\text{TAX}|\text{STOCK}]$ should be increasing in STOCK. To explore this possibility, in Table 4 ("levels" row, "panel data" columns) I report the ordinary least squares (OLS) coefficients for the simple linear regression model of TAX on STOCK:

$$\text{TAX}_{it} = \alpha + \beta\,\text{STOCK}_{it} + u_{it} \tag{3}$$

for countries $i = 1, ..., 96$ and years $t = 1990, ..., 2008$, where u_{it} is the regression error – assumed independent of STOCK_{it}. I also report the regression R square, and the (pooled, first-order) autocorrelation between error u_{it} and it's first temporal lag $u_{i,t-1}$. As the residual autocorrelation is substantial, I explicitly model u as autoregressive:[9]

$$u_{it} = \phi u_{i,t-1} + \varepsilon_{it} \tag{4}$$

with ε_{it} serially independent and identically distributed over i and t. Given the specification (3-4), and assuming further that errors u_{it} are independent across countries i, for the TAX regression I report in Table 4 asymptotically valid standard errors.[10] The result suggests a positive and statistically significant relationship between TAX and STOCK.

Arguably, the regression errors u_{it} in the TAX model (3) are correlated across countries, which may bias the efforts at inference. To address this possibility, in the setting of (4) suppose now that the disturbance terms ε_{it} share a common component η_t, as follows:

$$\varepsilon_{it} = \eta_t + \omega_{it} \tag{5}$$

[8] Year 1990 is the earliest for which I have tax-to-GDP data.

[9] The residual autocorrelations exhibit decay at longer lags, and for simplicity I model this as first-order autoregressive.

[10] The panel dataset has missing years t for some countries i.

with ω_{it} a collection of mutually independent and identically distributed variables, each having mean zero and variance σ^2_ω. To remove the influence of η_t on inference, I subtract from each variable (TAX_{it}, STOCK_{it}) its cross-section average at date t, resulting in transformed series – each a cross-section residual or contrast. I show in Figure 1 (top right) a scatterplot of the contrast series, and report in Table 4 ("levels" row, "panel contrast" columns) linear regression results for the transformed variables, analogous to those described earlier. As earlier the results suggest a positive and statistically significant TAX-STOCK link.

The expected tax, given stock market total value traded, takes the form of a product:

$$E[\text{TAX}|\text{STOCK}] = E[\tau_b|\text{STOCK}] \times STOCK$$

so if τ_b varies with STOCK then expected tax is quite possibly non-linear in STOCK. To address this point I take logarithms of the TAX and STOCK variables, and show in Figure 1 (middle row) and Table 4 ("log-levels" row) the results for the log series, analogous to those for the level series. The scatter plots appear consistent with a linear relationship, the model fit is somewhat better in logs, and the results again suggest a positive and significant relationship between tax revenue and stock market total value traded.

The results so far are consistent with a positive effect of total value traded on tax, along the course of economic development. However, in the short-run there are other reasons that TAX and STOCK might be linked. In a recession tax revenues may fall, as may capital investments and the value traded on the stock market. If they fall in absolute terms and also relative to output then TAX and STOCK may dip together in a recession. Attempts by the government to attenuate the business cycle may further contribute to the fluctuation of TAX and STOCK short-term. Given these facts, the annual growth rates of TAX and STOCK may be influenced more by short-term influences than by any co-emergence of capital investments and tax. For growth rates defined as first-differenced log-levels of TAX and STOCK, I show in Figure 1 (bottom row) and Table 4 ("dif. log-levels" row) results analogous to those above. The results again suggest a positive and statistically significant link between tax revenue and stock market total value traded, but the R

squares are very low – consistent with the scatter plots.[11]

In terms of inference, I adjusted for the possibility of regression error correlations – across time and countries. Another approach is maximum likelihood estimation of a random effects model. For the three regressions in the "panel data" columns of Table 4, I get similar results when I estimate them via (country and time) random effects. Another possibility is fixed effects: I consider this and other extensions of the basic model in the next section.

3.3 Extended Model

I start by re-estimating the simple regression model (3) of TAX on STOCK in log-log form[12] via instrumental variables (to control for possible endogeneity of STOCK), with the lagged STOCK instrumenting for STOCK itself, and with the inclusion of time and country fixed effects. The coefficient estimate for STOCK is 0.01, with standard error now 0.004 similar to the OLS 0.005 as before. These results are consistent with the idea that STOCK may cause variation in TAX.

I next augment the simple model (3) as follows:

$$\text{TAX}_{it} = \alpha_i + \mu_t + \beta \text{STOCK}_{it} + \delta X_{it} + u_{it} \tag{6}$$

with TAX, STOCK and (per capita) GDP in log form. I also include a collection X of additional control variables, as well as fixed effects α_i and μ_t. The idiosyncratic errors u_{it} are assumed independent and identically distributed across time and countries.

I estimate the model with fixed effects via the least squares dummy variable (LSDV) estimator.[13] As the sample design has more countries than time periods, and the model includes a lagged endogenous variable, LSDV may exhibit important simultaneity bias. For robustness I follow up by instrumenting via the generalized method of moments (GMM), using difference GMM and system GMM panel methods,[14] and report the results in Table 5.

[11] All the basic results show to be positive and statistically significant.

[12] That is, I regress log-tax on log-stock.

[13] Hausman tests here favor fixed effects over random effects, so I do not report the latter.

[14] For GMM I use Stata 11 software. Difference GMM is via Stata's xtabond procedure, specified with no predetermined variables and no endogenous variables other than tax, with a maximum of 3 lags of tax used in the instrument set. Also, GMM is the two-step version,

In column one of Table 5, the STOCK coefficient is positive and statistically significant. For the control variables, coefficients are mostly insignificant except for lagged TAX and BANK.[15] Unlike in column one, in column two and three of Table 5, the STOCK variable remains positive but it becomes statistically insignificant.

Both the LSDV and GMM econometric approaches are possibly biased for estimating tax effects the model (6), with LSDV bias arising from endogeneity of lagged tax, and GMM bias occurring if some of the relevant moment conditions are violated. As a check, I compute from Table 5 Hausman tests for differences in coefficient estimates obtained from LSDV and GMM.[16] For the coefficients of interest STOCK, the Hausman tests fail to reject the null of no LSDV bias at conventional significance levels. On the other hand, Sargan tests of GMM (overidentifying) moments reject the null of correct specification in the case of the system GMM and fails to reject in the case of the difference GMM.[17] Hence the fixed effects (LSDV) and GMM-diff approach fares better.

The results are consistent with the idea that an increase in STOCK may cause an increase in TAX when governments rely more on capital taxes than on income taxes.

4 Conclusion

This paper provides some evidence that a stock market total value traded is positively correlated with tax revenue collection expressed as a share of GDP. This is true when estimated in level form, log and difference-log form, as well as controlling for other variables in a fixed effects model. This is goes to show that stock markets are an important part in tax revenue collection.

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and standard errors are robust. System GMM is via the xtabond2 procedure, with the regression equation applied in levels and differences, with a single lag of differenced tax included as instrument in the levels equation, and with the GMM specification otherwise analogous to xtabond.

[15] The GDP coefficient is both positive and negative but statistically insignificant in two out of three cases. Other studies have found similar results, and sometimes negative coefficients – see Rodrik (1998) and Baunsgaard and Keen (2010).

[16] That is, for each coefficient I compute the difference in estimates across methods, then square the difference, then divide the result by the difference in the coefficient's GMM and LSDV squared standard errors, and compare to a χ^2_1 critical value.

[17] Sargan p values are 0.698 and 0.000 for GMM-diff and GMM-sys, respectively.

Key assumption in the empirical methods is that the marginal tax rate is constant across countries, time, and different sources of income. Future research needs to be done on the theoretical and empirical frontier to confirm these results. For example, to see the exact impact of the financial sector on the various sources of tax income, one might want to disaggregate the data into capital, income, seignorage, and trade taxes.

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Appendix A: Tables and Figures

Table 1: Average values of government tax revenue, stock market total value traded and bank deposits as a share of GDP.

Economic Level	GDP per capita	Tax (% of GDP)	Stock (% of GDP)
low	1005 and less	11.93	0.53
middle	1006 - 3975	14.89	9.91
	3976 - 12275	18.72	11.81
high	12276 and higher	31.66	59.14

Table 2: Variable Description

Variables	Description
GDP	gross domestic product per capita in constant (year 2000) dollars, adjusted for PPP. Source: online version of the World Development Indicators (WDI).
STOCK	Value of listed shares on the stock market to GDP.
TAX	Tax revenue divided by GDP. This ratio downloaded from the Government Finance Statistics. For OECD countries, missing values obtained from the OECD database online.
BANK	Deposits divided by GDP, with deposits being demand, time, and saving deposits. This ratio obtained from the electronic version of International Financial Statistics (IMF), October 2008.
Aid	The amount of official development assistance (grants plus concessional loans, measured in U.S. dollars) divided by Gross National Income. Source: WDI.
Agriculture	Share of agriculture in aggregate value added. Source: WDI.
Density of Population	The midyear population divided by land area in square kilometers. Source: WDI.
Inflation	Growth rate of the consumer price index. Source: WDI.
Liberty	Civil Liberties indicator from Freedom House (2010 edition).
Openness to Trade	The sum of exports and imports of goods and services measured as a share of GDP. Source: WDI.

Table 3: List of Countries in Dataset

Region	Income Level	Countries
Africa	low	Burkina Faso, Burundi, Cameroon, Congo, Cte d'Ivoire, Ethiopia, Kenya, Madagascar, Mali, Lesotho, Senegal, Sierra Leone, Togo, Uganda, Zambia
	middle	Algeria, Benin, Botswana, Mauritius, Seychelles, South Africa, Swaziland, Tunisia
Americas	middle	Argentina, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Grenada, Guatemala, Honduras, Jamaica, Mexico, Panama, Paraguay, Peru, St. Kitts, St. Vincent, Trinidad and Tobago, Uruguay, Venezuela
	high	Bahamas, Canada, USA
Asia & Pacific	low	Bangladesh, Bhutan, India, Indonesia, Myanmar, Nepal, New Guinea
	middle	Cambodia, Fiji, Mongolia, Philippines, Sri Lanka, Thailand, Vietnam, Malaysia
	high	Australia, Japan, New Zealand, South Korea, Singapore
Middle East	low	Pakistan
	middle	Bahrain, Egypt, Iran, Jordan, Syria, Turkey, Yemen
	high	Israel, Kuwait, Quatar
Post-Soviet	middle	Albania, Armenia, Bulgaria, Croatia, Georgia, Hungary, Kazakhstan, Kyrgyz Republic, Latvia, Lithuania, Moldova, Poland, Romania, Russia
	high	Czech Republic, Estonia, Slovak Republic, Slovenia
Western Europe	high	Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxemburg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK

Table 4: Regressions of Tax Revenue on Total Value Traded

	panel data				panel random effects			
series type	intercept	slope	R^2	a.c.	intercept	slope	R^2	a.c.
levels	22.406	6.080	0.083	0.633	-0.022	0.992	0.021	0.647
	(0.465)	(0.260)			(0.048)	(0.044)		
log-levels	3.295	0.084	0.115	0.564	0.002	0.028	0.045	-0.062
	(0.022)	(0.005)			(0.003)	(0.001)		
dif. log-levels	0.007	0.012	0.006	-0.066	-0.000	0.010	0.005	-0.062
	(0.001)	(0.001)			(0.001)	(0.001)		

Table 5: Multivariate Regressions of Tax Revenue

Dependent Variable:	Tax Revenue		
	Fixed Effects	Difference GMM	System GMM
STOCK	0.01	0.01	0.001
	(0.004)**	(0.004)**	(0.002)
BANK	0.11	0.10	-0.001
	(0.021)***	(0.042)**	(0.009)
GDP	-0.000	0.17	-0.003
	(0.048)	(0.083)**	(0.020)
lag TAX	0.45	0.55	0.94
	(0.021)***	(0.089)***	(0.022)***
Agriculture	-0.01	-0.01	0.001
	(0.002)***	(0.004)**	(0.001)
Aid	0.001	-0.003	-0.001
	(0.003)	(0.004)	(0.002)
Density	-0.002	-0.001	-0.000
	(0.000)***	(0.001)	(0.000)
Inflation	-0.000	0.000	-0.000
	(0.000)*	(0.000)	(0.000)***
Liberty	0.01	0.001	-0.01
	(0.008)*	(0.011)	(0.006)**
Trade	-0.000	0.001	-0.000
	(0.000)	(0.001)	(0.000)
2-4 # of Countries	86	84	86
# of Observations	1125	1012	1125

Note: Standard errors in parentheses,
*** (**, *) indicate significance at 1 (5, 10).

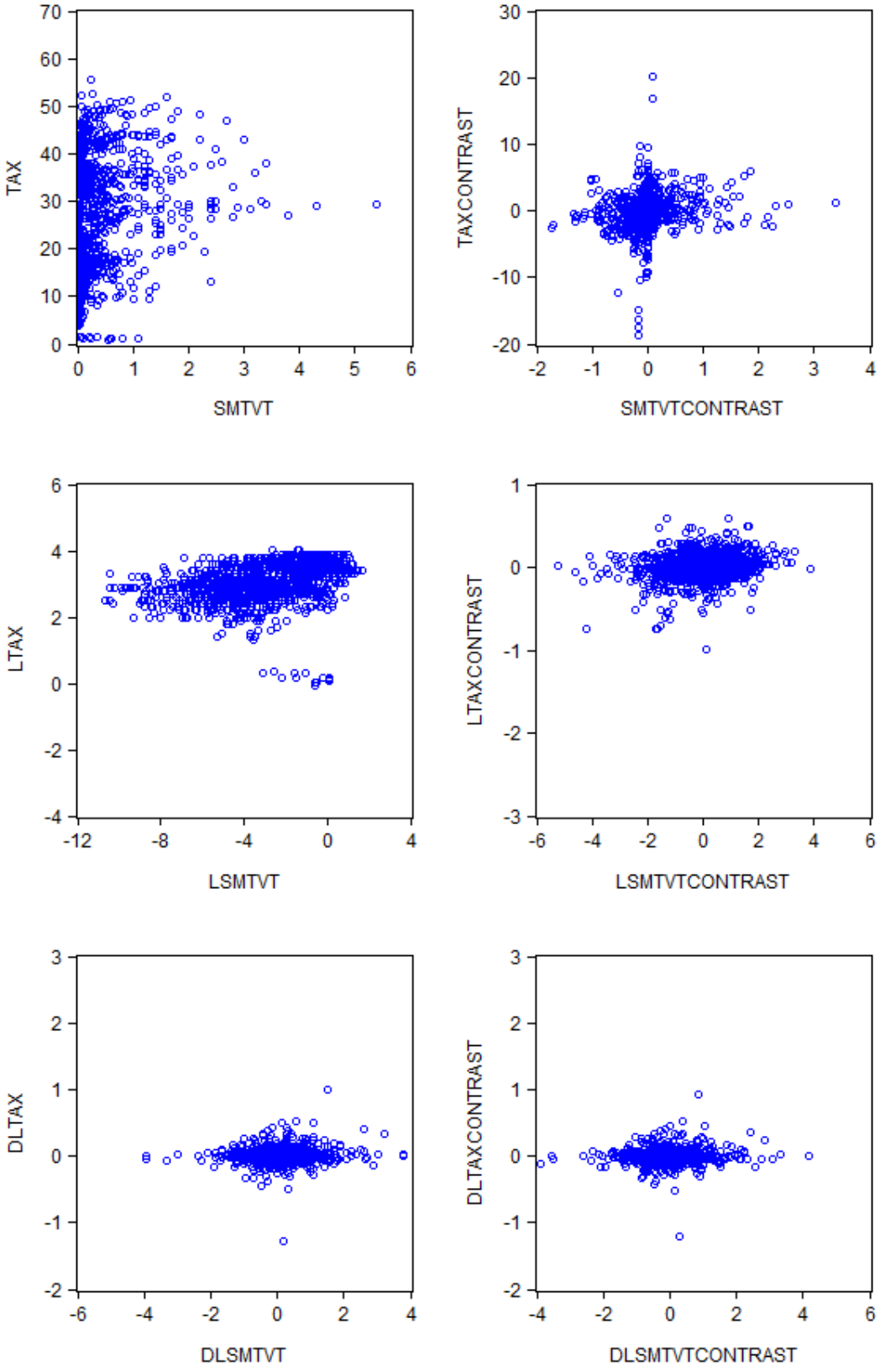

Figure 1: Tax and Stock