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Income inequality, tax base and sovereign spreads

by

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This note investigates the impact of greater income inequality on the tax base, on the *de-facto* fiscal space, and the sovereign spreads. Using data from 50 countries in 2005 and in 2010, we find that higher income inequality is associated with a lower tax base, lower *de-facto* fiscal space, and higher sovereign spreads. The economic magnitude of these effects is rather large: a one standard deviation increase of inequality is associated with a lower tax base of 28 % GDP, and with a higher sovereign spread of 240 basis points in 2005.

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The growing public debt in OECD and developing countries put to the fore the need to rebalance fiscal deficits. This can be done either by raising taxes, or by cutting expenditure. The recent experience of the US and other countries illustrated vividly the challenges with raising taxes, suggesting the presence of structural factors accounting for resistance to tax reforms. A possible obstacle may be the polarized distribution of income. If all agents were identical, equal burden sharing would be the norm. Greater income inequality may put a drag into efforts to broaden the tax base. A possible mechanism explaining the resistance was modeled by Bénabou (2000), showing conditions under which greater inequality would result in less government spending on redistribution. As a broader tax base is a necessary condition for greater redistribution, opponents for redistribution opt to oppose it.[1] In this paper, we investigate the association between income inequalities and the tax base across countries in the 2000s, and link it to the pricing of sovereign debt. We find a strong negative association, where *higher* income inequality is associated with a *lower* tax base, with a *lower de-facto* fiscal space, and with *higher* sovereign spreads.[2]

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[1] A vivid example of resistance to broadening the tax base is the reaction to the Republican candidate Herman Cain's 9-9-9 tax reform plan in October 2011. His plan would replace the present income tax with a 9% flat income tax, slash the corporate tax rate to 9%, and introduce a new 9% national sales tax. The *Wall Street Journal* warned against the ultimate effects of the proposed reform: "European nations began adopting national sales and value-added taxes on top of their income taxes in the 1960s, and that has coincided with the rise of the entitlement state and slower economic growth. Consumption tax rates usually started at less than 10%, but in much of euroland 'the rates have nearly doubled and now are close to 20%' …. we would see regular campaigns like 'a penny to fight poverty,' or 'one-cent for universal health care' that would be politically tough to defeat." *Wall Street Journal editorial*, 10/10/11).

[2] Following Aizenman and Jinjarak (2011), we measure the *de facto* fiscal space as the public debt relative to the *de facto* tax base, where the latter measures the realized tax collection, averaged across several years to smooth for business cycle fluctuations. Hence, the *de facto* fiscal space is inversely related to the tax-years needed to repay the outstanding public debt, providing information about the relative fiscal tightness of countries.

Estimation

To study the influence of inequality on fiscal conditions, we consider a linear equation relating sovereign risk to the *de facto* fiscal space: $SovRisk_{it} = b_0 + b_1 FiscalSpace_{it} + u_{it}$; where $SovRisk_{it}$ is the market price of the sovereign risk of country i at year t, $FiscalSpace_{it}$ is the fiscal space variable(s), and u_{it} represents other factors that affect sovereign risk, such as trade openness, growth, income level, inflation, and foreign reserves. As our fiscal space variable, defined as public debt/[average 5-year tax revenue/GDP], is made of the public debt/GDP in the numerator and the average 5-year tax revenue/GDP in the denominator, the interactions between these two variables and other macroeconomic factors imply that the regressor, $FiscalSpace_{it}$, is likely to be correlated with the error term.

Income Equality and Fiscal Space

It is plausible that higher income inequality could impair tax collection and thus reduce the fiscal space. This conjecture is in line with Bénabou (2000), showing in a model of endogenous redistribution that more inequality may result in less government spending on redistribution because the consensus for ex ante efficient redistributive policies breaks down. This result was confirmed by de Mello and Tiongson (2006), finding that more unequal societies do spend less on redistribution. Our goal is to test directly the impact of greater income inequality on the tax base, and to evaluate the ultimate impact of income inequality on sovereign risk.

As long as the income inequality does not have a direct effect on the sovereign risk, the correlation between the Gini coefficient and u_{it} would be small. Thus, the Gini coefficient is a potential instrumental variable that is both relevant and exogenous: $FiscalSpace_{it} = a_0 + a_1 Gini_{it-5} + a_2 Gini^2_{it-5} + e_{it}$. Note that because sovereign risk, fiscal space, and income inequality are likely to be driven by the political economy considerations, we use the lagged (5-year) Gini coefficient so that it affects the sovereign risk only indirectly through the fiscal space variable(s). We base our econometric analysis on the 50 countries that have comprehensive records of the key variables; the Gini coefficient, tax base, fiscal space, and market pricing of sovereign risk, up to the year 2010. Using data for the 50 countries in 2005 and in 2010, Table 1 reports the quadratic regression of the *de facto* fiscal space variable and its components on the Gini coefficient.

Columns (i) and (ii) show that higher inequality is associated with a lower tax base. The quadratic term, $Gini_i^2$, suggests that a negative association between inequality and tax collection flattens out when inequality is high. The R^2 of these regressions is 47%, so the variation in inequality explains a significant variance of the tax collection across countries. On the other hand, the associations between the Gini coefficient and the public debt/GDP variable are insignificant (see columns (iii) and (iv)), as well as the Gini and the public debt/[average 5-year tax revenue/GDP] (columns (v) and (vi)). So the influence of inequality on fiscal space operates through the tax base denominator only. Figures 1.a and 1.b are scatterplots of the data for 2005 and 2010, respectively, of the tax base - income inequality relationship. Based on the regression estimates of Table 1 columns (i) and (ii), a one standard deviation increase of Gini (10.7 in 2005 and 10.5 in 2010, respectively) is associated with a lower average tax base of 28 %GDP in 2005 [10.7*(-2.94) + 114.49*(0.03) = -28.0] %GDP in 2005; and with a lower average tax base of 32.4 %GDP in 2010. This back-of-the-envelope calculation is consistent with the patterns observed in the plots of Figure 1.

Application to the Sovereign Risk Equation

We estimate the association between sovereign risk and fiscal space, applying the two-stage least square estimation of the following system:

(1) $SovRisk_{it} = b_0 + b_1 TaxBase_{it} + \mathbf{X_{it}}'\mathbf{b} + c_i + u_{it}$

(2) $TaxBase_{it} = a_0 + a_1 Gini_{it} + a_2 Gini^2_{it} + \mathbf{X}'\mathbf{a} + c_i + e_{it}$;

where $TaxBase_{it}$ is a single endogenous regressor, **a** and **b** are two sets of unknown regression coefficients, with $\mathbf{X_{it}}$ a set of exogenous variables, where c_i are the unobserved characteristics, and $Gini_{it}$ and $Gini^2_{it}$ as the two instruments in the reduced form of $TaxBase_{it}$. We can now undertake a thorough evaluation of the inequality effect on both fiscal space and sovereign risk.

To deal with the presence of c_i, we may ask first why do some countries have a higher sovereign risk than others? One reason might be variation in macroeconomic factors across countries. The factors we control are public debt/GDP, [exports+imports]/GDP, real GDP growth, GDP per capita, consumer price inflation, foreign reserves/external debt ratio, and volatility of GDP (three-year standard deviation). We add all these variables to X_{it}, so they are not part of the error term. Another reason accounting higher sovereign risk pertains to structural and historical factors. For example, fragile states may have higher sovereign risk than other states. This suggests that an omitted factor in sovereign risk, whether the country is inherently fragile, could be correlated with the Gini coefficient.

To eliminate the influence of unobserved variables that vary across countries but do not change over time, such as the state fragility and historical conditions, we make use of both the 2005 and 2010 data. Denote c_i these unobserved characteristics in the $SovRisk_{it}$ equation. Table 2 provides results from three empirical specifications. All regressions have the same regressors, and all coefficients are estimated using two-stage least squares; the only differences between the columns are (a) the functional form of the dependent variable, CDS prices, in level or in logarithmic term, and (b) the assumption on the unobserved characteristics c_i. The causal variable of interest, *TaxBase*, is instrumented by the Gini and $Gini^2$ coefficients.

Columns (i) and (ii) apply the lagged-dependent two-stage least squares estimation to the data, including the lagged CDS prices. This is akin to saying that sovereign risk persists; and thereby the CDS price today is affected by past CDS prices. The results suggest that a higher tax base and lower public debt reduce the CDS prices. To check the validity of the Gini coefficient as the instrument for TaxBase, Table 1 also reports the first-stage F-statistics (equation (2)). For the regressions in columns (i) and (ii), the p-value of the first-stage statistics is 0.005, so the Gini coefficients are not a weak instrument for TaxBase. Because both regressions are overidentified, the Sargan test for overidentifying restriction has a p-value of 0.064 for column (i) and 0.351 for column (ii), suggesting that the null hypothesis that both the Gini and $Gini^2$ instruments are exogenous cannot be rejected at a 5% significance level.

Alternatively, if $E(\mathbf{X_{it}}, c_i) \neq 0$ and $cov(TaxBase_{it}, c_i) \neq 0$, we could handle the fixed unobserved effects by constructing data on the changes in the variables between the year 2005 and 2010, and focusing on the medium term of 5-year period. Specifically, the 5-year change in sovereign risk, $SovRisk_{i,2010}$ - $SovRisk_{i,2005}$, is regressed against the 5-year change in the tax base %GDP, $TaxBase_{i,2010}$ - $TaxBase_{i,2005}$, and the 5-year change in macroeconomic factors, $x_{i,2010}$ - $x_{i,2005}$, where each $x_{i,t}$ is the variable in $\mathbf{X_{it}}$. Two instruments are used: the change in the inequality over 5 years, $Gini_{i,2010}$ - $Gini_{i,2005}$, and the change in the quadratic term of inequality over 5 years, $Gini^2_{i,2010}$ - $Gini^2_{i,2005}$. The results of this before-and-after specification are in columns (iii) and (iv). The effect of TaxBase is now larger, positive, and insignificant. It is known that if the lagged-dependent model [columns (i) and (ii)] is correct, but we use fixed effects as in columns (iii) and (iv), estimates of the TaxBase influence will tend to be too big.

Note that if $E(\mathbf{X_{it}}, c_i) = 0$ and $cov(TaxBase_{it}, c_i) = 0$, then we could directly apply a pooled two-stage least squares method to the panel data of 2005 and 2010 (2 years) based on the specification above. Columns (v) and (vi) apply the pooled two-stage least squares to the panel sample, 50 countries * 2 years = 100 observations. The results of these pooled two-stage least squares are consistent with the results of the lagged-dependent two-stage least squares estimation of columns (i) and (ii). For both specifications, the estimated effects of TaxBase and other macroeconomic controls have the expected sign and are mostly statistically significant at a 10 % level.

We summarize the economic significance of our econometric findings in Figure 2. For each variable, the corresponding bar in the figure is its coefficient estimate of column (i), multiplied by the sample standard deviation. Given that the sample standard deviation of CDS prices is 218.4 basis points, we find that our controls capture a significant variation in the sovereign risk data. Our two factors of interest, the tax base and public debt, account together for more than 150 basis points of the market measure of sovereign risk as measured by the CDS prices. This estimate indicates that sovereign risk is responsive to the tax base, and hence to the Gini coefficient, though this association is estimated using changes over a 5-year period, so it is a medium-run relationship. Other macroeconomic variables, including growth, GDP/capita, and inflation are also economically large and significant in the sovereign risk equation. Overall, the estimation suggests that increased inequality, and thus a decreased tax base and fiscal space, can make a significant worsening impact on sovereign risk, at least in the medium run. Applying our estimates, with the standard deviation of the tax base being 10.2 %GDP in 2010 (10.9% in 2005), a one standard deviation increase of the Gini coefficient is associated with a rise of 273.2 (=(32.4/10.2)*86) basis points of the sovereign spread in 2010 (242.1 basis points in 2005).

Concluding remarks

This note identified the large negative effects of income inequality on the tax base, and on the *de-facto* fiscal space. The *de-facto* fiscal space plays a key role in accounting for sovereign spreads [Aizenman, Hutchison and Jinjarak (2011)], and explains the patterns of fiscal stimuli in the aftermath of the crisis [Aizenman and Jinjark (2011)]. The results suggest that more polarized societies would find it harder to adjust to crises by raising taxes. Thereby, greater income inequality limits the ability to conduct a counter fiscal policy, and increases the downside risk of a given debt/GDP. These results also suggest that the uniform fiscal guidelines of the Maastricht treaty, recommending debt/GDP below 60%, were too lenient for peripheral countries with a low tax base.

Data Sources

Gini Coefficients are based on the World Bank database: http://siteresources.worldbank.org/INTRES/Resources/469232-1107449512766/AllTheGinis_explanation.pdf. See also Milanovic et al. (2011) for further discussion on the data and historical comparisons across countries.

Tax Base is calculated as the ratio of tax divided by GDP, averaged over the period of previous five years to account for business cycle fluctuations. The data are taken from the World Bank's WDI, IMF Article IV Consultation documents, OECD, and Eurostat.

Public Debt/GDP data are based on the IMF Fiscal Affairs Department, Article IV Consultation documents, and World Economic Outlook.

Sovereign CDS prices are 5-year tenor and based on the CDS pricing is based on London closing values collected from a consortium of over thirty swap market participants. The data are taken from the CMA Datavision. See Aizenman et al. (2011) for further discussion on the CDS prices and related studies.

Trade/GDP, Inflation (consumer price, %), Real GDP Growth and Volatility (three-year standard deviation), Real GDP/capita (in US$), and Foreign Reserves/External debt are based on the data from WDI and the Economist Intelligence Unit.

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Table 1: Income Inequality and Fiscal Space.
This table reports a cross-country OLS estimation.
The dependent variable is the fiscal space variable (*FiscalSpace*$_i$) and its component of country i.
The lagged (5 year) Gini coefficient takes a value of 0-100 (where 100 = perfect inequality).
Heteroskedasticity-robust standard errors are in parentheses, with *** (**,*) denoting statistical significance at 1 (5,10) level.

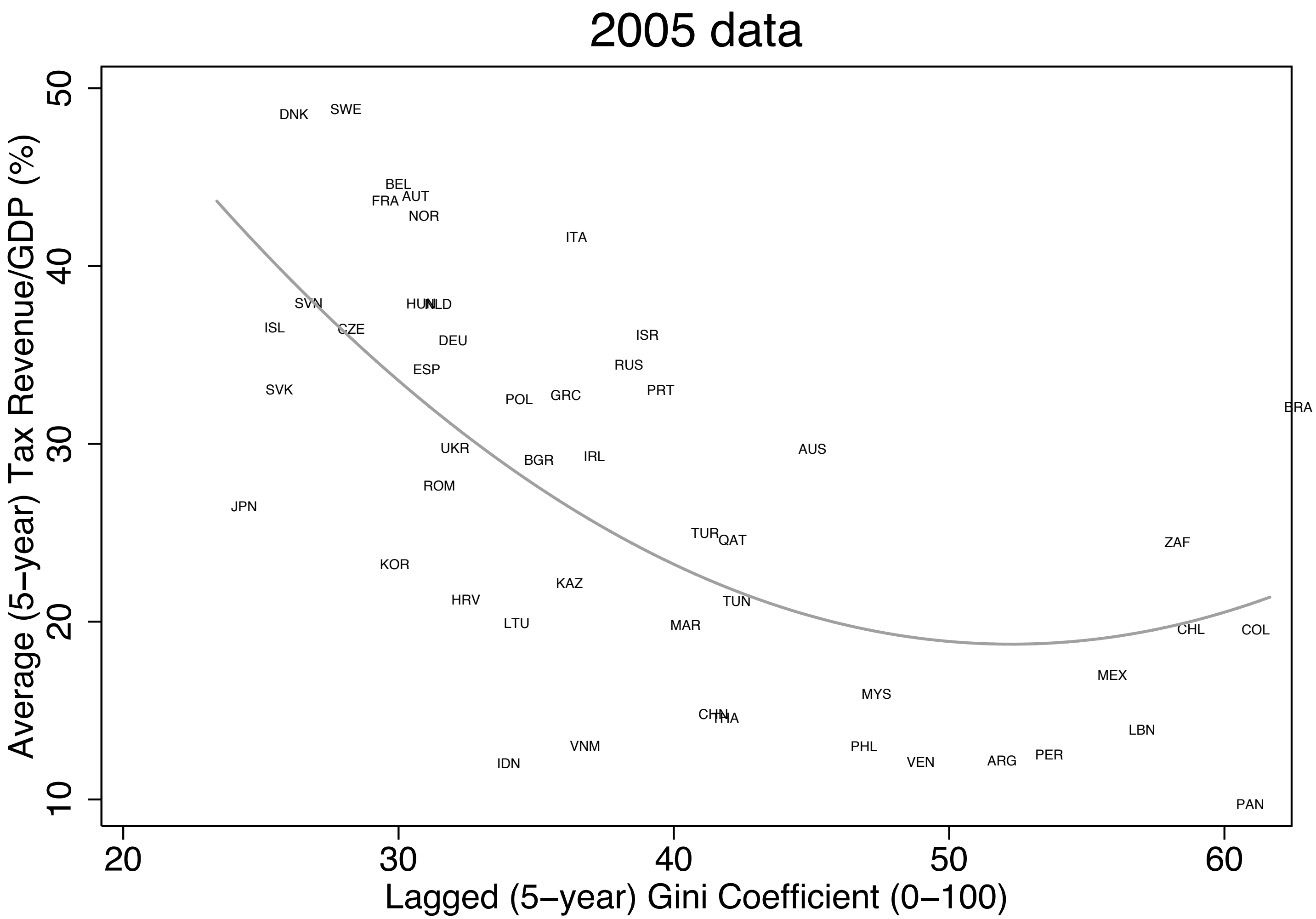
	average (5-year) tax revenue %GDP						public debt %GDP						public debt [average (5-year) tax revenue]					
	(i)			(ii)			(iii)			(iv)			(v)			(vi)		
	year = 2005			year = 2010			year = 2005			year = 2010			year = 2005			year = 2010		
	b	s.e.		b	s.e.		b	s.e.		b	s.e.		b	s.e.		b	s.e.	
$Gini_i$ (t-5)	-2.94	(1.03)	***	-3.40	(0.95)	***	-4.91	(5.36)		-6.22	(5.00)		-0.04	(0.27)		-0.07	(0.21)	
$Gini^2_i$ (t-5)	0.03	(0.01)	**	0.03	(0.01)	***	0.06	(0.06)		0.07	(0.06)		0.00	(0.00)		0.00	(0.00)	
constant	96.74	(20.62	***	105.68	(18.41)	***	145.89	(112.14)		189.39	(103.86)	*	1.71	(5.35)		2.89	(4.17)	
R^2	0.47			0.48			0.03			0.06			0.15			0.04		
countries	50			50			50			50			50			50		

Table 2: Estimates of Sovereign Risk Equation Using Panel Data for 50 Countries.
This table reports two-stage least squares estimation.
The dependent variable is the CDS prices in basis points (*SovRisk*$_{it}$ in (i), (iii), (v); ln(*SovRisk*$_{it}$) in (ii), (iv), (vi)).
The endogenous regressor is TaxBase, with the lagged and lagged spared Gini coefficient as the instruments.
Standard errors are in parentheses (s.e.[a] for unadjusted standard error; s.e.[b] for GMM-bootstrap; s.e.[c] for clustered by country heteroscedasticity robust).
*** (**,*) denote statistical significance at 1 (5,10) level.
The first-stage statistics are from the regression of *TaxBase* on Gini, Gini^2, and all other exogenous controls in the *SovRisk* equation.

	Lagged-Dependent Two-Stage Least Squares		First-Differenced Two-Stage Least Squares		Pooled Two-Stage Least Squares	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
	CDS prices	ln(CDS prices)	CDS prices	ln(CDS prices)	CDS prices	ln(CDS prices)
	b s.e.[a]	b s.e.[a]	b s.e.[b]	b s.e.[b]	b s.e.[c]	b s.e.[c]
TaxBase	-9.20 (4.73) *	-0.05 (0.02) **	32.90 (25.93)	0.17 (0.12)	-7.33 (4.24) *	-0.06 (0.03) *
Public Debt	1.23 (0.50) **	0.01 (0.00) **	2.22 (2.43)	0.00 (0.01)	1.12 (0.64) *	0.01 (0.00)
Trade Openness	17.66 (44.89)	-0.02 (0.22)	-149.37 (209.56)	-0.65 (0.80)	-14.38 (27.58)	-0.20 (0.24)
Real GDP Growth	-25.91 (7.79) ***	-0.08 (0.04) **	-17.46 (8.85) **	-0.06 (0.04)	-23.34 (7.30) ***	-0.11 (0.05) **
GDP/capita	92.69 (49.34) *	-0.12 (0.25)	-622.22 (416.59)	-1.14 (2.11)	28.08 (40.14)	-0.39 (0.28)
Inflation	30.88 (4.71) ***	0.08 (0.02) ***	22.30 (15.19)	0.04 (0.04)	24.27 (4.33) ***	0.08 (0.03) **
Reserves/Ext. Debt	0.05 (0.23)	-0.00 (0.00)	0.19 (0.72)	-0.00 (0.00)	0.04 (0.15)	-0.00 (0.00)
Volatility of Real GDP	25.81 (27.55)	0.18 (0.14)	20.41 (44.15)	0.06 (0.23)	40.69 (10.82) ***	0.69 (0.11) ***
Lagged dependent	0.40 (0.30)	-0.10 (0.09)				
constant	-623.59 (408.08)	7.36 (2.20) ***	160.04 (108.78)	4.85 (0.59) ***	-7.12 (264.78)	9.21 (1.85) ***
R^2	0.70	0.43	0.58	0.40	0.58	0.44
observations	50	50	50	50	100	100
First-stage F-stat. p-value	0.005	0.005	0.003	0.003	0.002	0.001
First-stage R^2	0.609	0.608	0.365	0.365	0.663	0.661

Figure 1: Tax Base and Inequality in 50 countries.

1a. Correlation = -0.6265



1b. Correlation = -0.6078

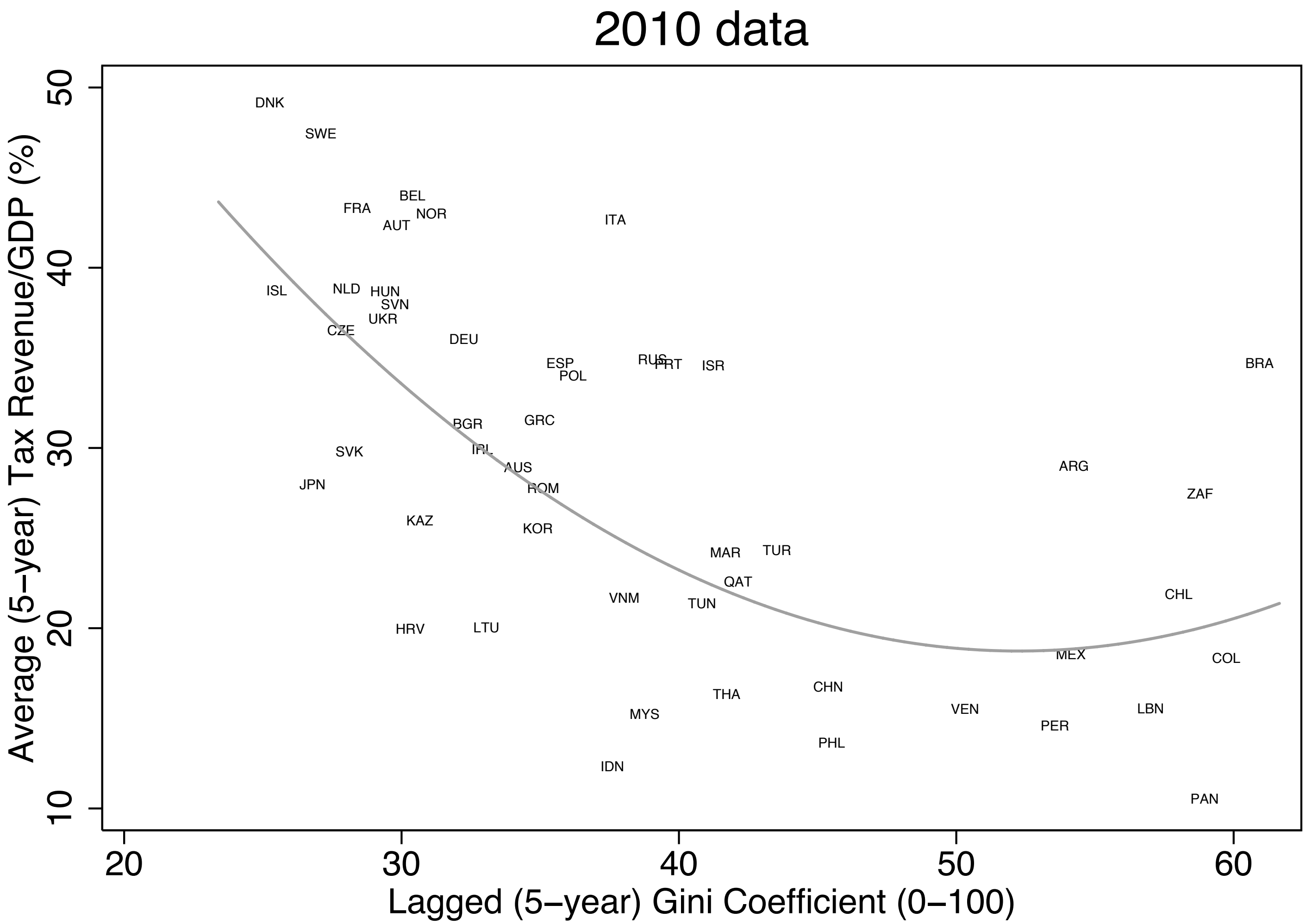


Figure 2: Economic Significance on Sovereign Risk, in basis points of CDS prices.
This figure reports the economic significance of each variable based on the estimation results of Table 2, column (i).
The height of each bar is equal to the coefficient estimate multiplied by the 2010 sample standard deviation of the variable.