Globalization and Developing Countries - a Shrinking Tax Base ?

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Abstract[*]

This paper evaluates the impact of globalization on tax bases of countries at varying stages of development. We see globalization as a process that induces countries to embrace greater trade and financial integration. This in turn should shift their tax revenue from "*easy to collect*" taxes (tariffs and seigniorage) towards "*hard to collect*" taxes (value added and income taxes). We find that trade and financial openness have a positive association with the "*hard to collect*" taxes, and a negative association with the "*easy to collect*" taxes.

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1. Introduction

A salient feature of the last twenty years has been the phenomenal increase in trade and financial integration of developing countries alongside dropping inflation rates. The greater openness has been reflected both in de-facto and de-jure measures of trade and financial integration. These trends are consistent with developing countries recognizing that, in the era of globalization, the opportunity costs of inward orientation have increased to a level justifying outward oriented reforms. These reforms include trade liberalization (reducing tariffs, quotas, and other non-tariff trade barriers); financial liberalization (reducing capital controls, and financial repression); and macroeconomic stabilizations (reducing inflation, reducing thereby the financial spread and the cost of borrowing). All of these reforms have a common fiscal denominator – they erode the tax rates from what we call *"easy to collect"* taxes. These are the traditional sources of revenue used by developing countries including tariffs, inflation tax, and financial repression.[1] Some of these effects may be compensated by the higher tariff tax base induced by higher imports volume propagated by trade liberalizations. Yet, for countries that start with very high tariff rates, reducing drastically tariff rates, the *tax cut effect* may dominate the *tax base expansion effect*.[2] In these circumstances, globalization may entail a negative fiscal shock to developing countries, shrinking the tax revenue from traditional taxes. Short of matching the drop in these taxes by a corresponding cut in fiscal expenditure, affected countries need to increase revenue. To do this, they must rely on alternative *"hard to collect"* sources such as Value Added Taxes (VAT), income taxes, sales taxes, etc. These *"hard to collect"* taxes, unlike tariff administered at centralized locations (seaports, airports, etc.) and implicit taxation by means of seigniorage and financial repression, need significant investment in tax collection infrastructure, and spending resources on monitoring and enforcement.

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[1] Developing countries' reliance on *"easy to collect"* taxes has been explained by their limited institutional capacities, political instability, and polarization. Studies explaining the reliance on *"easy to collect"* taxes in developing countries include Phelps (1973), Vegh (1989), Cukierman et al. (1992), Giovannini and De-Melo (1993), Aizenman and Guidotti (1994), Emran and Stiglitz (2005), and Gordon and Li (2007). The impact of globalization on the pattern of taxation in the OECD countries has been the focus of Rodrik (1998). See also Tanzi and Zee (2000); and Ebrill et al. (2002).

[2] This would be the case in countries where, due to political economy considerations, the initial tariff rate was set in order to maximize the tariff revenue. One purpose of our analysis is to quantify the ultimate revenue impact of tariff cuts, allowing us to test which of the two effects dominate. Similarly, macroeconomic stabilization may increase economic growth, with ambiguous effects on seigniorage. Yet, if most countries operate on the "proper" part of Laffer's tax curve, one expects that globalization would reduce the tariff and the seigniorage revenue/GDP ratios.

The purpose of this paper is to evaluate empirically the impact of globalization throughout the 1980s – 1990s on the vector of taxes collected by countries at varying stages of development. We view the greater trade and financial integration as the outcome of deeper processes often dubbed "globalization." Taking the globalization process first as exogenous for the purpose of the present investigation, we trace its impact on the tax base, and the ultimate collection of taxes. The factors explaining globalization include faster, more reliable, and cheaper delivery of goods and services across borders, and advances in information technology that allow cheaper fragmentation of production via FDI and outsourcing, etc. Specifically, we quantify and explain the degree to which globalization has contributed to the diminishing fiscal base of developing countries, and the degree to which these countries managed to switch from the traditional *"easy to collect"* taxes to new, *"hard to collect"* taxes. We trace factors explaining the heterogeneity of the negative fiscal shock induced by globalization and thus explaining the depth of the fiscal adjustment accomplished already by countries at varying levels of development.

Figures 1.a and 1.b compare trade openness and financial integration between the 1980s and the 1990s for developing countries segregated into five regions.[3] The comparison confirms that the globalization trend is indeed global – openness increased remarkably in all regions. Figures 1.c and 1.d report the decline in the tariff and inflation rates during that period. On balance, the average tariff and inflation rates declined more in regions where the rates were above the average during the 1980s, indicating convergence of rates to a lower common denominator. Further insight about these developments is gained by comparing the revenue/GDP during the first 5 years of 1980s to that during the last 5 years of 1990s. Figure 1.e indicates, as percentages of GDP, a major drop in the revenue from "*easy to collect*" taxes [seigniorage + tariff], and a sizable increase - though at a smaller rate - in the revenue from

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[3] Developing countries are <u>Africa</u>: Cameroon*, Gabon***, Guinea*, Lesotho*, Mauritius***, Namibia**, South Africa***, Zambia*, Zimbabwe*; <u>East Asia</u>: Indonesia**, Korea***, Malaysia***, Myanmar*, Thailand**; <u>Eastern Europe</u>: Azerbaijan**, Belarus**, Bulgaria**, Croatia***, Czech Republic***, Estonia***, Hungary***, Latvia***, Lithuania***, Poland***, Romania**, Russian Federation***, Turkey***; <u>Latin America</u>: Argentina***, Bolivia**, Brazil**, Chile***, Colombia**, Costa Rica***, Mexico***, Nicaragua*, Paraguay**, Peru**, Trinidad and Tobago***, Uruguay***, Venezuela***; <u>Middle East and North Africa</u>: Iran**, Morocco**, Tunisia**, <u>South Asia</u>: India*, Nepal*, Pakistan*, Sri Lanka**. High-Income Countries are: Australia, Canada, Cyprus, Denmark, Iceland, Israel, Japan, Malta, Norway, Slovenia, Sweden, Switzerland, United Kingdom. Low*, middle**, and upper income*** developing countries classification is based on income and regional classification of the World Bank (http://www.worldbank.org/data/countryclass).

"*hard to collect*" taxes [VAT + income]. While the drop in "*easy to collect*" effective tax rates is more pronounced for high income countries, the greater initial base of "*hard to collect*" taxes in these countries relative to developing countries implies a net increase in total taxes of 6 percent in the first group, and a drop of 2 percent in the second. The position of four South Asian countries[4] is in between the high income and the developing countries: the large increase in the revenue from "*hard to collect*" taxes more than offset the drop in the revenue from the "*easy to collect*" taxes, increasing total tax revenue by 4 percent. These figures mask significant heterogeneity of the adjustment across countries, an issue that will be investigated in this paper using regression analyses.

Before turning to the empirical work, we note the sizable theoretical literature and growing empirical research on tax effort, tax evasion and avoidance, and administration [see Slemrod and Yitzhaki (2002) and Slemrod (2007) for a comprehensive survey and discussion]. Applying cost benefit analysis, models inspired by Allingham and Sandmo (1972) [see also Sandmo (2005)] explained the interplay between tax underpayment and the tax authority's effort to identify and limit tax frauds. This occurs in circumstances where agents gamble by underpaying taxes, and where the probability of detection and the resultant penalties are determined by the resources committed by the regulator, and the efficacy of institutions. These models identify several factors explaining tax underpayment, including the tax burden, the stringiness and efficacy of enforcement, the penalties associated with tax underpayment, and the degree of risk aversion. Using Chilean tax revenues to estimate the impact of changes in enforcement spending, Engel et al. (2001) find that 1 USD of additional enforcement spending increases VAT revenues by 31 USD, and a 10 percent increase in spending could reduce evasion from its current rate of 23 to 20 percent. Reliable evasion estimates are difficult to obtain because the availability of data. The empirical assessment of tax effort and avoidance frequently rely on macro estimates of the "black economy," quantifying the revenue lost due to underpayment of taxes.[5] Some studies moved beyond inferring tax underpayment by means of

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[4] India, Nepal, Pakistan, and Sri Lanka.

[5] A review of these methods can be found in Schneider (2004) and Alm et al. (2006). The methods include evaluations of the discrepancy between national expenditure and income statistics and the discrepancy between the official and actual labor forces [see Thomas (1992) for further discussion]; currency demand approach, exploiting the fact that black market transactions are intermediated mostly using cash [see Tanzi (1983)]; and the electric-power consumption, using it as an indicator of "overall" economic activity [Kaufmann and Kaliberda (1996)]. Unavoidable limitations of these methods are the inability to control properly for idiosyncratic differences across tax

macro methods, using information from tax audits evaluating compliance. Not surprisingly, the estimates of VAT non-compliance vary across countries, from about 2.5 percent in the Netherlands to over 34 percent in Italy on average during 1994-96 [Nam et al. (2003)]. While informative, the above methods provide us with little guidance for dealing with the impact of a common macro shock, like globalization, on the tax revenue in a panel of countries. Our approach is to implement an extended version of the methodology used by Cukierman et al. (1992) for the assessment of international use of inflation tax, adding controls associated with the impact of globalization on "*easy to collect*" taxes.

We outline the conceptual framework in the following section. Data and descriptive statistics are presented in Section 3. Section 4 reports the benchmark panel regressions. We provide robustness check together with quantification of economic significance in Section 5. Section 6 closes the paper with concluding remarks.

2.   Conceptual Framework

Our empirical specification controls for variables suggested by a model outlined in Appendix A. Our benchmark model is adopted from Cukierman et al. (1992), explaining the obstacles to tax reforms in polarized countries, characterized by political instability. They focused on the case where fiscal revenue can be raised by taxes associated with collection costs [income taxes], and implicit taxes where the collection cost is zero [inflation tax]. They assumed implementation lags – the present policy maker determines the efficiency of the tax system next period. This implies strategic choice of tax system's efficiency – the current policy maker may choose an inefficient future tax system in order to constrain the fiscal revenue available to future policy makers. This prevents future policy makers from spending in ways that are viewed as inferior from the vantage point of the present policy maker. We add endogenous tax evasion, and model the optimal enforcement of the "*hard to collect*" taxes. Similarly to Cukierman et al. (1992), the model suggests the following types of controls:

i. Macro variables dealing with the tax base, and with the level of economic development.

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codes due to differential exemptions and relevant provisions of the tax code, and the measurement errors and omissions in national accounts.

ii. Controls dealing with the sectoral composition of the economy, reflecting differential costs of tax evasion and collection across economic activities.[6]

iii. Variables dealing with political instability, polarization and quality of institutions, reflecting the model's prediction that the present tax infrastructure reflects past public investment, which in turn is affected by the incentives facing the previous administrations.[7]

Specifically, the variables we use are

(a) Globalization Factors: Our conjecture is that, if globalization cut the fiscal revenue from traditional taxes, it would set in motion forces that will increase the collection from alternative, less traditional taxes, including the VAT. Consequently, we expect the globalization factors, measured by Trade Openness and Financial Openness, to increase VAT collection, and reduce seigniorage and cut tariff revenue (the last result would hold if the adverse revenue effect of lower tariffs dominates the increase in tariff revenue due to the growth of imports, a conjecture that is verified as part of the empirical study).[8] Slemrod (2004) finds that up to the early 1990s measures of openness are negatively associated with statutory corporate rates, although not with revenues collected as a fraction of GDP. One problem with using statutory rates in the developing countries context has to do with tax incentives [Zee et al. (2002)]. At any rate, our study is closely related to that of Slemrod (2004), but we emphasize on effective tax collection.

 (b) Agriculture Share: "*easy to collect*" taxes should be applied more heavily in a country with larger agricultural share in GDP, where the collection of income and VAT is challenged by the widespread distribution of production among geographically diffused farmers. Another possibility is that in countries where manufacturing sector is relatively small, it is optimal for

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[6] See also Crocker and Slemrod (2005) for an examination on corporate tax evasion in the context of the contractual relationship between the shareholders of a firm and a tax manager; Hines (2004) for a study on endogenous private adoption of tax avoidance technology in response to tax reforms.

[7] Other political considerations include Anesi (2006) who argues that the electoral pressure may favor the existence of tax-earmarking equilibria, but that it sometimes creates a tendency against earmarked taxation even when incumbent governments have strong incentives to use earmarking rules to constrain future policymakers. Bizer and Durlauf (1990) find that there is a cyclical component to tax changes corresponding to changes in political party administration. See also Roine (2006) for an analysis on redistributive as well as political consequences of tax avoidance, and Kenny and Winer (2006) for empirical evidence on democracies and reliance on income taxation.

[8] See Fisman and Wei (2004) and Aizenman (2004) for fiscal implications of trade mis-invoicing. In addition cross-border shopping tends to make taxation even more challenging [see for example Christiansen (1994), Asplund et al. (2007), and Goolsbee (2000)].

firms either to have small size to evade official detection and taxes, or to have a very large size to overwhelm the system and extract more than proportionate benefits.[9]

(c) Urbanization: We expect that it is more difficult to administer and collect "*hard to collect*" taxes in less urbanized and more rural countries. However, it is also possible that urbanization is associated with underground economy, inducing the use of seigniorage to tax such informal sector. Equally important in industrial countries is the issue of income shifting through incorporation by high-income individuals, though it is still an open question to what degree this practice applies to developing countries.[10]

(d) Institutional Quality and Political Durability: We expect countries with better institutional quality and more stable politics tend to invest more in the tax collation infrastructure, collecting more from "*hard to collect*" taxes, and less from "*easy to collect*" taxes.[11]

3. Data and Descriptive Statistics

Our sample spans from 1980 to 1999 over 60 countries. Data Appendix provides sources and details of the sample. A third of these countries have observations across the 1980s and the 1990s sufficient for panel regressions. Figure 2.a reports total tax/GDP in the early 1980s

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[9] Though interesting, there has yet any formal test on the relationship between firm size distribution and tax evasion across countries. For specific country studies, see for example Gauthier and Reinikka (2006) for a study on firms in Uganda and Sleuwaegen and Goedhuys (2002) on firms in Cote d'Ivoire.

[10] Koreshkova (2006) finds some evidence on the relationships between the size of an underground economy, inflation rate, income tax rate and the share of seigniorage in the government revenue in the U.S. and cross-country data. Across 107 countries over 1960-2001, Catao and Terrones (2005) find a positive association between deficits and inflation among high-inflation and developing country groups, but not among low-inflation advanced economies. On the analysis of taxes and informal sector, see also Dessy and Pallage (2003) and Fortin et al. (1997). Urbanization may also facilitate income shifting in response to tax changes. Using a panel of high-frequency VAT data from Israel, Romanov (2006) traces income shifting through incorporation by high-income individuals who convert their labor income into less-taxed dividends. He finds that a rise in the personal income tax rates resulted in more than 4500 companies-a 5 percent addition to the corporate sector-being registered in the 12 months following the tax change, mainly by self-employed professionals in the industries of business activities and health services; behavioral response to taxation was found only in the top percentile of the income distribution. Firms may also self-select into a black market and various organization forms as an optimal response to taxation [Davidson et al. (2005), Goolsbee (2004), Kopczuk and Slemrod (2006), and Mackie-Mason and Gordon (1997)]. Another important consideration is the distribution of the VAT and sales tax burden between consumers and producers [see for example Carbonnier (2007) for a study on VAT reforms in France].

[11] Admittedly, Institutional Quality covers a wide range of aspects. Torgler (2005) finds in a survey data that tax burden, lacking honesty, and corruption are seen as the main factors of tax evasion in Latin America. Political Durability can also be viewed as the strength of an incumbent government. In the case of Spain, Esteller-More (2005) finds that the system of unconditional grants from the central layer of government provokes an "income effect" which disincentivises the efforts of the regional tax administration, but the importance of these disincentives decreases according to the parliamentary strength of the incumbent.

(measured horizontally) and in the late 1990s (measured vertically). The further away is a country from the 45-degree ray, the greater is the change over time in that country. Figures 2.b and 2.c report the GDP share of revenue colleted by "*easy to collect*" taxes and by "*hard to collect*" taxes. For most developing countries, the share of "*easy to collect*" declined, whereas the share of "*hard to collect*" taxes increased. The average total tax revenue/GDP declined from 0.182 to 0.176. The average revenue/GDP of "*easy to collect*" taxes declined during the period from 0.060 to 0.046 [see Figure 2.b]; whereas average tax revenue/GDP of "*hard to collect*" taxes increased slightly from 0.086 to 0.093 [see Figure 2.c]. Interestingly, the overall cross country patterns are non-linear, characterized by an inverted U-shape curve [see the quadratic regression lines in Figures 2.b and 2.c]. In both figures, the left arch of the fitted U curve is close to the 45-degree ray for countries below the sample mean, with increasing divergence from the 45-degree ray for countries above the sample mean. The concavity of the cross-country patterns is more pronounced in figure 2.b suggesting that countries that had previously relied heavily on the "*easy to collect*" taxes confronted greater losses. Figure 2.c suggests that countries below the mean of revenue from "*hard to collect*" taxes in the early 1980s ended up increasing the revenue in the late 1990s. Both figures are consistent with the notion that globalization entails fiscal convergence. Figure 2.d compares the total government expenditure/GDP between the early 1980s and the late 1990 and shows that the average drops from 0.264 to 0.234.

To gain perspectives about the net adjustment, Figure 3.a reports tax revenues as percentages of GDP in the early 1980s across income groups. Most of the variation across the four income groups was in the revenue from "*hard to collect*" taxes, which was about 8 percent of GDP for the low income, progressing upward and reaching 17 percent of GDP in the high income countries. In contrast, there was little variation in the revenue from "*easy to collect*" taxes across the income groups: it was 6 percent of GDP for the low income and 5 percent of GDP for the high income countries. The total official tax collection to GDP in these four income groups mimics the patterns of the "*hard to collect*" taxes: it was about 16 percent of GDP for the low income group, progressing upward with GDP per capita and reaching 28 percent of GDP for the high income group. Figure 3.b reports the changes in total taxes/GDP, and in "*easy to collect*" and "*hard to collect*" taxes/GDP between the early 1980s with the late 1990s across the four income groups. Overall, the record is mixed. The drop in the revenue from "*easy to collect*" taxes was larger for the higher income groups [in fact the revenue from "*easy to collect*" taxes

went up for the middle income group by 8.4 percent]. Both the high income and the middle income managed to increase the revenue from the "*hard to collect*" taxes significantly [11 percent and 40 percent, respectively] and increasing the total tax/GDP by 6 percent and 10 percent, respectively. The increase in revenue from the "*hard to collect*" taxes was rather timid for the upper and the low income countries [13 percent and 12 percent, respectively], less than what was needed to compensate for the drop in the revenue from "*easy to collect*" taxes. This induced a drop in the total tax revenue of 3 percent for the upper income countries and 17 percent for the low income developing countries. Seemingly countries exhibit complex non-linear patterns of adjustment, where the middle-income developing countries adjust more easily than the upper and the lower income developing countries.

Figures 3c-3d summarize the changes in the tax revenues in the 1990s. Figure 3c reports the patterns of tax revenues in the early 1990s, and Figure 3d traces the tax revenue changes between the 1990-1994 and 1995-1999. The middle income countries experienced a sizable contraction in the easy to collect tax revenue (by about 35 percent), reducing the overall tax revenue by about 1 percent. The low income countries experienced similar drop of the tax revenue, accounted by smaller drop in the easy to collect tax revenue (by about 10 percent), and a drop in total official tax collection to GDP by about 1 percent.

Globalization, being a common shock, may induce fiscal convergence across countries. Figure 4 confirms this conjecture. It shows a gradual decline in the coefficient of variation of tax revenues/GDP during 1980s – 1990s. This effect differs across taxes: the coefficients of variation of seigniorage and tariff revenue/GDP during 1980s - 1990s declined by about 40 percent, as opposed to only about 4 percent for the "*hard to collect*" taxes. At any rate, the reductions in the coefficients from 1980-84 to 1995-99 are statistically significant at 0.1 percent level. Apparently, improving the performance of the "*hard to collect*" taxes seems more challenging than reducing the use of "*easy to collect*" sources of revenue. [12]

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[12] We should also note that there is another, hard to measure, "*easy to collect*" tax – government revenue from financial repression. Government can impose controls on international capital flows and domestic financial intermediaries as a form of taxation. The resultant wedge between effective external and domestic interest rates of public debt is the financial repression tax, which is essentially a subsidy on interest payments on government liabilities. As discussed in Giovannini and De-Melo (1993), there are also potential complementarities between financial repression revenue and seigniorage because (i) inflation implies low real interest rates facing savers, and thus interest savings on government liabilities, and (ii) negative real interest rates on savings increase money demand, that is, the inflation tax base. Financial repression revenue is calculated by multiplying the stock of outstanding domestic debt by the financial repression tax rate, which is the interest rate differential in local currency between the effective external and domestic interest rates. Financial repression revenue may be negative (i.e. the

4. Benchmark Panel Estimation

For our regression analysis, an important issue is how to measure globalization factors. While we take the globalization process, measured by trade and financial openness, as exogenous factors inducing fiscal adjustment in the next periods, we use instrumental method to control for endogeneity of trade openness to geographic and structural factors advanced in the gravity equation literature.[13] Elsewhere, applying instrumental variables for trade openness has been used by Frankel and Romer (1999) to study the impact of trade openness on income per capita, Hall and Jones (1999) to study the impact of social infrastructure on income per capita, and Persson and Tabellini (2003) to study the impact of political institutions on productivity and growth. Following Frankel and Romer (1999), we use the gravity instrument for trade openness, which is constructed from geographical determinants of bilateral trade, including log of distance, log of partner country population, log of land area, dummy variables for common language, common land border, and landlocked status. After estimating the gravity model, we aggregate the exponent of the fitted values across bilateral trading partners to arrive at an estimate of total trade share for a given country, dubbing it as the "gravity trade share." Our gravity trade share estimation explains around 35 percent of variation in the actual trade shares from 1975 to 1999. The correlation between the actual and gravity trade shares is 44 percent across countries. There is also an increasing trend of the gravity trade share across countries over the sample period.[14] In what follows throughout, we shall use this gravity trade share as a measure of trade openness to estimate its impact on tax base adjustments. Definition of other variables in the regressions can be found in the Data Appendix.

Table 1 reports the benchmark panel regressions. For each of the tax equations, we use fixed effects estimation controlling for first-order autoregressive in the disturbances. We take

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effective foreign interest rate is smaller than the effective domestic interest rate), reflecting a lower cost of foreign borrowing relative to domestic borrowing facing a government. We focus on seigniorage because there is a high positive correlation between seigniorage and government revenue from financial repression (about 0.50). See Giovannini and De-Melo (1993) for reports of the financial repression revenue in the 1970s and early 1980s, Jinjarak (2006) for the 1990s, and Roubini and Sala-i-Martin (1995) for a growth model of tax evasion and financial repression. Limited data availability on a panel of tax revenue from financial repression prevents us from adding this implicit tax to the figures dealing with "*easy to collect*" taxes. Hence, these figures tend to understate the shrinking of "*easy to collect*" taxes in our sample.

[13] See for example Anderson and van Wincoop (2003) and Helpman et al. (2007).

[14] A simple fixed effect regression of gravity trade share on time trend shows a statistically significant increase of 0.3 percent per year from 1980 to 1999.

into account reverse causality from fiscal adjustment by lagging one year the globalization factors and explanatory variables in the regression analysis.[15] Because our estimation is quite information demanding, twenty of sixty countries have enough data.[16] At any rate, the benchmark panel estimation yields encouraging results. We find that trade and financial openness have a positive relationship with "*hard to collect*" taxes, and negative relationship with the "*easy to collect*" taxes. As a group, "*hard to collect*" tax revenue responds positively to trade and financial openness. VAT and Income Taxes are also associated with the globalization factors with the expected positive sign. Though the coefficient of Trade Openness on Income Taxes and the coefficient of Financial Openness on VAT are found to be insignificant, these findings are not entirely surprising given the ongoing debates on how to effectively tax corporations and financial services [see, for example, taxation on financial services in Auerbach and Gordon (2002), Caminal (1997), and Whalley and Zhang (2005), and taxation on transfer pricing and multinationals in Bartelsman and Beetsma (2003) Desai et al. (2004), and Desai et al. (2006)].[17]

Of the "*easy to collect*" taxes expected to be hard hit by globalization factors, only Seigniorage is found to respond significantly in statistical term to Trade Openness. Except the coefficient of Financial Openness on Tariffs, the components of "*easy to collect*" taxes respond to globalization with a correct negative sign. A negative association between Trade Openness and Tariffs is consistent with previous studies on trade liberalization and tariff revenue [see, for example, Baunsgaard and Keen (2005)]. Financial Openness is negatively associated Seigniorage but positively with Tariffs; the latter, though insignificant, may be justified by a possibility that openness and development of the financial system help improving trade mis-invoicing problems. As a group, "*easy to collect*" tax revenue responds strongly negative to Trade Openness, but insignificantly positive to Financial Openness.

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[15] A future step would be an investigation on the two-way causality between tax base adjustment and global macroeconomy. Some leads in this direction can be found in Frenkel and Razin (1989), Mendoza and Tesar (1998), and Mendoza and Tesar (2005).

[16] Argentina, Cameroon, Chile, Colombia, Costa Rica, Hungary, India, Indonesia, Mexico, Morocco, Pakistan, South Africa, Thailand, Trinidad and Tobago, Tunisia, Turkey, Uruguay, Venezuela, Zambia, and Zimbabwe.

[17] Notwithstanding the reliability issue of corporate tax data available; see Desai (2005) and Desai and Dharmapala (2006) on how firms could simultaneously be inflating profits reported to the capital markets and understating profits reported to tax authorities.

Turning to other control variables, we find that better Institutional Quality is associated with a lower use of "*easy to collect*" taxes. VAT and Tariffs respond negatively to Political Durability. Although the negative relationships of VAT with Political Durability and Institutional Quality seem counterintuitive, it is not impossible given the difficulty in implementing and adjusting VAT collection technicality for industrial countries facing even more organized and sophisticated tax frauds.[18] As expected, Urbanization increases VAT collection, and we have yet to find supportive evidence that Urbanization facilitates the use of Seigniorage to tax informal sector. Tariff revenue is found to be increasing with the Agriculture Share in GDP, in line with the theoretical prediction.

Overall the benchmark regressions are supporting our conjecture that above and beyond institutional, political, and structural factors, the globalization forces influence the size and composition of tax base and tax revenue. One issue with this set of estimation is that we have only twenty countries each with six or seven years of observations. The Jarque-Bera and Shapiro-Wilk residuals tests reject the null of normality in all except for residuals from the VAT equation. With such the data availability, our hope lies on a more robust estimation technique on this sample, the empirical task that we take in the following section.

5. Robustness and Economic Significance

One way to improve upon the benchmark regressions is to take into account a joint determination among "*easy to collect*" and "*hard to collect*" taxes, and that different taxes have different evasion characteristics, so that optimal tax mix and its transitions emerge naturally [Boadway et al. (1994), Caselli (1997), Kaplow (2006), Levinsohn and Slemrod (1993), and Naito (2006)].[19] Zellner (1962)'s Seemingly Unrelated Regression (SUR) is appropriate in this context because it captures the efficiency due to the correlation of the disturbances across equations [Baltagi (2005)]. Since we do not model tax equations as having structural

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[18] The pan-European VAT system and tax base harmonization debated in the European communities is a good example. See for example FT (2006) and FT (2007).

[19] For example Gordon and Bo Nielsen (1997) note that ignoring tax evasion possibilities, a VAT and a cash-flow income tax have similar behavioral and distributional consequences, yet the available means of tax evasion under each can be very different: under a VAT, avoidance occurs through cross-border shopping, whereas under an income tax it can occur through shifting taxable income abroad – a country would make use of both taxes in order to minimize the efficiency costs of evasion activity, relying relatively more on whichever tax is harder to evade. They provide some supportive evidence that VAT is more effective in the case of Denmark.

relationship in the sense that one type of taxes appears as an explanatory variable in the others, each revenue equation is, by itself, a classical regression, and therefore the parameters could be estimated consistently, if not efficiently, by the OLS [Ruud (2000)] as we do in the previous section. In a cross-section context, the OLS and generalized least squares (GLS) on the whole system are identical when the equations have identical explanatory variables [Greene (2002)]. In a panel data framework, Baltagi (2005) shows that a block-diagonal covariance matrix between the disturbances of different equations makes GLS on the whole system equivalent to GLS on each equation separately, but not when the same explanatory variables appear in each equation. To directly apply SUR with a set of our benchmark regressions of the previous section, we use the same explanatory variables. In order to gain estimation efficiency from SUR, we develop a two-step approach. In the first step, we generate a new set of interaction variables between globalization factors and other control variables based on their statistical significance in the benchmark regressions of Table 1. In the second step, we apply SUR to the set of benchmark regressions adding the interaction variables, the inclusion of which varies across regressions. Not only does this two-step procedure allow us to capture estimation efficiency from SUR, but we also get a further insight from interacting globalization factors with institutional, political, and structural variables. Essentially, we can then understand, for example, whether economic integration affects differently to countries with a high level of institution compared to countries with a low level.

Table 2 reports SUR estimates with interactions. Besides the control variables outlined above, we also include a one-year lag of the dependent variables to improve the fit and control for possible dynamics of tax collection. Coefficients of the main explanatory variables are similar to those found in the benchmark regressions. The coefficient of Political Durability on Income Taxes and the coefficient of Urbanization on Seigniorage are now statistically significant. The latter thus supports the conjecture that urbanization is associated with underground economy, inducing the use of seigniorage to tax such informal sector. SUR with interaction variables explain well around 40-90 percent of variation in the data. We also find that the normality of residuals cannot be rejected for VAT equation based on the Jarque-Bera and Shapiro-Wilk tests, and that the variance of the residuals are independent of the explanatory variables for the "*hard to collect*" and "*easy to collect*" SUR regressions based on the Breusch-Pagan test. Although the improvement of these SUR estimates upon the benchmark estimation is

rather small across the board in term of residuals normality, we believe that the inclusion of control variables suggested in the literature is comprehensive and thus a future expansion of country-year observations beyond the current sample will help increase the overall efficiency of the estimation.

Fortunately we gain several further insights from the interaction variables. Seigniorage responds more negatively to higher Trade Openness and Institutional Quality. That is, countries with low level of Institutional Quality have found the fiscal adjustment more challenging, frequently ending with a diminishing tax revenue. When Political Durability is longer, Trade Openness has a larger positive impact on VAT and "*hard to collect*" tax revenues, and a larger negative impact on Tariffs. Furthermore VAT also responds favorably to Trade Openness when countries have a high level of Urbanization. Countries with a higher Agriculture Share in GDP scale down Tariff revenue in response to Trade Openness, and Income Taxes in response to greater Financial Openness. Income Taxes of countries with higher level of Urbanization tend to respond positively to Financial Openness. We are intrigued to find that "*hard to collect*" tax revenue tends to fall when Political Durability and Financial Openness are both at a high level. The rapid financial liberalizations of the 1990s seem to pose a greater fiscal challenge on a relatively durable government to reform.

We conclude our empirical analysis with quantifying economic significance of the globalization factors. Table 3 summarizes the impact of a one standard deviation change of the globalization factors on taxes/GDP. The calculation is based on the SUR estimates reported in Table 2.[20] Summing up its individual and interaction effects, Trade Openness increases "*hard to collect*" tax revenue by 4.5 percent, of which two-third of the impact comes from its interactions with Political Durability. The individual effect of Trade Openness is responsible for a reduction of 8 percent in "*easy to collect*" tax revenue. In response to Trade Openness, VAT increases 3.1 percent, Tariffs and Seigniorage drop by 2.4 percent and 4.1 percent, respectively. About two-third of the impact on VAT is a result of the interactions, further highlighting the role of administration costs in its collection facing the developing country governments. Financial Openness has a small negative effect on "*hard to collect*" tax revenue, mainly from its

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[20] For example, a standard deviation of the Trade Openness for developing countries is 2.2 percent. Using the coefficient estimate of Trade Openness on "*hard to collect*" taxes from Table 2, which is 0.8 and statistically significant, the effect of a one standard deviation change of Trade Openness is to increase "*hard to collect*" taxes by $2.2 \times 0.8 = 1.7$ percent of GDP.

interactions with Political Durability and Agriculture Share, partially an intriguing result discussed earlier. In total, the globalization factors increase, as percentages of GDP, "*hard to collect*" revenue by 3 percent and decrease "*easy to collect*" revenue by 8 percent. Following a one standard deviation increase of globalization factors, VAT increases by 3.1 percent, Income Taxes increase by 0.7 percent, Tariffs drop by 2.4 percent, and Seigniorage drops by 4.6 percent. Taken together with our earlier discussion on the overall tax revenue adjustment, these numbers imply that the globalization factors are responsible for about a fifth of the 16 percent increase of "*hard to collect*" base/GDP and two-third of the 12 percent drop of "*easy to collect*" base/GDP in developing countries.

6. Concluding Remarks

Our study found that globalization has imposed new fiscal challenges on developing countries, forcing them to scale down traditional "*easy to collect*" revenue sources. A good share of developing countries managed the adjustment by shifting the tax revenue to the "*hard to collect*" taxes. Yet, countries with low level of institutional quality have found the adjustment more challenging, frequently ending with a drop in the net tax revenue/GDP. Trade and financial openness exert economically significant impact on tax revenue/GDP over the period of our investigation. A fifth of the increase in "*hard to collect*" taxes/GDP and two-third of the drop in "*easy to collect*" taxes/GDP can be traced back to the individual and interaction effects of globalization factors.

This paper is another step in understanding the evolution of tax revenue, tax base, and tax effort across countries. Among fiscal issues in the global context, we have yet to touch on the consequences of competition over tax revenue among fiscal institutions.[21] Our study has also focused only on half of the adjustment, as we do not include government expenditure as a potential determinant of the tax policy. It is possible that part of the adjustment of "*hard to collect*" and "*easy to collect*" tax to globalization is accomplished by opening a larger fiscal gap, or by scaling down government spending.[22] At this point, we do not have sufficient data that will

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[21] This issue is particularly important in fiscal federalism. See for example Berkowitz and Li (2000), Boadway et al. (2002), Brulhart and Jametti (2006), Cremer and Gahvari (2000), and Devereux et al. (2007).

[22] See Rodrik (1998) and Shelton (forthcoming) for some discussion on globalization and the size of government expenditures. In addition, the ramification of fiscal adjustment on macroeconomy in general is less well understood in the case of developing countries. Talvi and Vegh (2005) study the association between tax base volatility and

allow us to do more rigorous analysis beyond a simple period comparison reported in Figure 2.d. Another possible empirical extension is to directly quantity tax effort across countries.[23] We should also note that the presence of informal economy may overstate the effective tax rates used throughout the paper. The association between tax revenue and the informal sector in developing countries warrants future investigations.[24]

Data Appendix

Tax Revenues: The effective rate of actual revenue collection as a percentage of GDP. VAT (value added taxes), Income Taxes (corporate and personal taxes), and Tariffs (imports and exports trade taxes) are from Office of Tax Policy Research at University of Michigan; http://www.bus.umich.edu/OTPR/. Following Cukierman et al. (1992), Seigniorage is constructed from changes in high-powered (reserve) money from line 14…ZF… of International Financial Statistics (IFS). By tax effort, Tariffs and Seigniorage are "*easy to collect*" taxes, whereas VAT and Income Taxes are "*hard to collect*" taxes. All of the taxes are divided by GDP.

Globalization variables: Trade Openness is constructed from gravity regression methodology, using data from NBER-UN World Trade Flows (http://www.nber.org/data/; values of exports and imports), Frankel and Rose (2002) (distance, common official language, common borders, land-area product), World Development Indicators (WDI; population of trading partners, real GDP). Financial Openness is imputed Quinn index from Edwards (forthcoming).

Control variables: Institutional Quality is the composite index of good governance from International Country Risk Guide (http://www.prsgroup.com/). Political Durability is the number of years in power of incumbent government, from Political IV Project (http://www.cidcm.umd.edu/polity/). Urbanization and Agricultural Share are from WDI. Government expenditure is from IFS. Weighted tariff rates are derived from reports of the World Bank-Operations Evaluation Department.

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macroeconomic policies in developing countries. For OECD, Alesina et al. (2002) find that various types of taxes also have negative effects on profits, but, interestingly, the effects of government spending on investment are larger than those of taxes.

[23] See Leuthold (1991) for an application on some African countries.

[24] See Schneider and Enste (2000), Friedman et al. (2000), Dabla-Norris et al. (forthcoming) for attempts to measure of informal economy in the early 1990s. Garcia-Penalosa and Turnovsky (2005) consider optimal capital-labor income tax structure in the presence of informal economy.

Appendix A

Our benchmark model is adopted from Cukierman, et al. (1992), which explains the obstacles to tax reforms in polarized countries, characterized by political instability. They focused on the case where fiscal revenue can be raised by taxes associated with collection costs [income taxes], and implicit taxes where the collection cost is zero [inflation tax]. They assumed implementation lags – the present policy maker determines the efficiency of the tax system next period. This implies that the choice of the tax system efficiency may be strategic – the current policy maker may choose an inefficient future tax system in order to constrain the fiscal revenue available to future policy makers. This prevents future policy makers from spending in ways that are viewed as inferior from the vantage point of the present policy maker.

We extend Cukierman et. al. model by adding endogenous tax evasion, and modeling the optimal enforcement of the "hard to collect" taxes. The economy at time t is described by two representative budget constraints: the government, (A1) and the private sector, (A2):

$$g_t + f_t + \theta_t \le \tau_t^a + s_t \qquad (A1)$$

$$c_t = 1 - \tau_t^a - s_t - \delta(\tilde{\tau}_t) - \gamma(s_t). \qquad (A2)$$

Each individual is endowed with one unit of output in each period. The variables g_t; f_t represent two different public goods [say guns and butter] in per capita terms, and c_t is per-capita private consumption. The term θ_t is the fiscal investment in tax capacity, the impact of which is discussed below. The government collects from each individual an amount s_t, in the form of easy to collect taxes [seigniorage, tariff, etc.] and an amount τ_t^a of actual hard to collect taxes [like, income, VAT, etc]. The statutory tax rate is $\tilde{\tau}_t$. Easy to collect taxes carries no administrative costs, whereas the hard to collect taxes are associated with costly enforcement, described below. Both types of taxes impose convex deadweight losses on the private sector, equal to $\delta(\tilde{\tau}_t)$; $\gamma(s_t)$, satisfying $\delta' > 0$, $\delta'' > 0$, $\gamma' > 0$, $\gamma'' > 0$. Underpaying taxes is costly: with probability p_t, the agent is audited. If she is found paying τ_t below the statutory rate, she would be penalized, paying $\tilde{\tau}_t + 0.5\phi_t[\tilde{\tau}_t - \tau_t]^2$. Hence, underpaying is associated with a quadratic penalty of $0.5\phi_t[\tilde{\tau}_t - \tau_t]^2$, paid with probability p_t. The period t utility from the private consumption is $U(c_t)$. The representative agent would submit tax payment τ_t^s, maximizing her expected utility:

$$MAX_{\tau_t} \left[p_t U \begin{pmatrix} 1 - \{\tilde{\tau}_t + 0.5\phi_t[\tilde{\tau}_t - \tau_t]^2\} - \\ s_t - \delta(\tilde{\tau}_t) - \gamma(s_t) \end{pmatrix} + (1 - p_t)U\left(1 - \tau_t - s_t - \delta(\tilde{\tau}_t) - \gamma(s_t)\right) \right] \qquad (A3)$$

Optimizing (A3), the optimal submitted tax, denoted by τ_t^s, is: $\tau_t^s = \widetilde{\tau}_t - \dfrac{1 - p_t}{p_t \phi_t}(1 - \lambda)$ where λ is the risk

premium adjustment, $\lambda = \dfrac{U'(c_{t,a}) - U'(c_{t,n})}{U'(c_{t,a})} \geq 0$, and $U'(c_t)$ is the marginal utility associated with

consumption c_t. The risk term, λ, is the percentage gap of the marginal utilities between the audit and no-audit

cases. The resultant expected tax payment is $E[\tau_t] = \widetilde{\tau}_t - 0.5\dfrac{(1 - p_t)^2}{p_t \phi_t}(1 - \lambda^2)$. In practice, the risk

adjustment term, λ, is of second order magnitude in circumstances where the tax gap between the increases in tax

payment associated with audit, is small relative to total consumption. Thus, for simplicity, we henceforth ignore this

risk adjustment term, assuming $\lambda \cong 0$ [It is easy to verify that $\lambda \cong \dfrac{c_{t,n} - c_{t,a}}{c_{t,a}} \dfrac{-U''(c_{t,a})}{U'(c_{t,a})}$, hence, λ is negligible

when $\dfrac{c_{t,n} - c_{t,a}}{c_{t,a}}$ is small]. The economy is populated with a large number of atomistic agents. Hence, from the

point of view of the authorities, the idiosyncratic risk associated with tax evasion is diversified away – in the macro

budget constraints (A1) - (A2), the actual tax revenue τ_t^a is the expected tax payment of the atomistic agent,

$$\tau_t^a = \widetilde{\tau}_t - 0.5\frac{(1 - p_t)^2}{p_t \phi_t}(1 - \lambda^2) \cong \widetilde{\tau}_t - 0.5\frac{(1 - p_t)^2}{p_t \phi_t}. \tag{A4}$$

The policy maker problem

There are two possible policymaker types, L and R, who randomly alternate in office. The policy maker of
type i, i = L, R maximizes welfare:

$$w_i^t = E_t \left\{ \sum_{k=0}^{\infty} \beta^k \left[\begin{matrix} U(c_{t+k}) + \\ H^i(g_{t+k}, f_{t+k}) \end{matrix} \right] \right\}; \quad H^i(g, f) = \begin{cases} \dfrac{\min[\alpha g, \, (1-\alpha)f]}{\alpha(1-\alpha)} & i = L \\[4mm] \dfrac{\min[\alpha g, \, (1-\alpha)f]}{\alpha(1-\alpha)} & i = R \end{cases} \tag{A5}$$

where E_t denotes the expectation operator, U is a concave utility function, $H^i(g, f)$ corresponds to the utility

associated with the public good, as evaluated by policy maker type i, $1 > \beta > 0$, $1 > \alpha > 0$. The political system

is described as a Markov process with transition probabilities π and $1 - \pi$: the government in office at time t has a

fixed probability $1 - \pi$ of being reappointed next period. With probability π, it is thrown out of office and the other

policymaker type is appointed.

Let $x \equiv g + f$ denote the total amount of government spending. For concreteness, we assume $\alpha > 0.5$. While the private agent views the probability of an audit, and the penalty rate at time t, as exogenous, these variables are pre-determined by the policy maker at time t -1. The efficiency of the tax system is determined by the probability of an audit, and by the penalty associated with tax evasion, p and ϕ, respectively. We assume that both p and ϕ are determined by the investment in tax capacity, θ. To capture the greater inertia in reforming the tax system than in changing fiscal policy, assume that the investment in tax efficiency, θ, along with p and ϕ, but not the other policy variables ($\tilde{\tau}_t$; s_t; g_t; f_t), must be chosen one period in advance. Thus, θ_{t-1} was chosen at time t-1, but exerts an influence on the efficiency of the tax system only at time t:

$$p_t = p_t(\theta_{t-1}; ST); \quad p' > 0; \quad p'' < 0;$$
$$\phi_t = \phi_t(\theta_{t-1}; ST); \quad \phi' > 0; \quad \phi'' < 0; \qquad (A6)$$

where ST is the vector of structural factors impacting the cost of tax collection. Specifically, high urbanization rate, lower share of agriculture and higher trade openness may reduce the effective cost of monitoring and collecting information, implying greater efficiency of the collection system. As these structural factors are changing slowly, we view them beyond the control of the policy maker, and focus on the determination of optimal investment in tax capacity, θ_t. As in proposition 1 in Cukierman, et al. (1992), optimal choices of consumption, aggregate public good, easy and hard taxes are a function of the efficiency of the tax system:

$$c^* = C(\theta); x^* = X(\theta); s^* = S(\theta); (\tau^a)^* = T(\theta); \qquad (A7)$$

satisfying $C'(\theta) < 0; X'(\theta) > 0; S'(\theta) < 0; T'(\theta) > 0$, where z^* denotes the optimal value of z. The equilibrium value of the tax rate chosen, θ, satisfies the first order condition:

$$\beta U'(C(\theta))C'(\theta) + \left[1 - \pi + \pi\frac{1-\alpha}{\alpha}\right]X'(\theta) = 1 \qquad (A8)$$

The main results of the model are summarized by the following proposition:

    I.   If the current government is certain of being reappointed, or if there is no polarization ($\pi = 0$ or $\alpha = 0.5$), then it brings about the most efficient tax system.

    II.   The lower the probability that the current government will remain in office and the greater the polarization, the more inefficient is the tax system left as a legacy to the future administration. This inefficiency is manifested by lower investment in tax capacity, inducing a lower probability of auditing, and a lower penalty on tax evasion, reducing thereby the tax collection associated with a given statutory tax rate. Structural factors that increase the ease of tax evasion reduce the equilibrium tax collection, and increase the share of the "easy to collect" taxes.

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Table 1: Benchmark Panel Regressions [a]

Dependent Variables	Tax Revenue by Tax Effort		Hard to Collect		Easy to Collect	
	Hard to Collect	*Easy to Collect*	VAT	Income Taxes	Tariffs	Seigniorage
Explanatory Variables	β (s.e.)	β (s.e.)	β (s.e.)	β (s.e.)	β (s.e.)	β (s.e.)
Trade Openness	0.7 (0.3)**	-2.8 (1.4)*	0.3 (0.2)*	0.4 (0.2)	-0.2 (0.1)	-0.6 (0.3)*
Financial Openness	2.9 (1.4)**	2.7 (7.5)	0.8 (0.8)	2.2 (1.0)**	0.4 (0.6)	-2.2 (1.7)
Institutional Quality	-1.1 (2.9)	-24.1 (12.3)*	-0.1 (1.6)	-1.1 (2.1)	0.7 (1.4)	-1.2 (2.6)
Political Durability	-1.2 (3.2)	20.1 (14.3)	-3.0 (1.8)*	1.8 (2.3)	-3.9 (1.5)**	0.9 (3.1)
Urbanization	13.2 (10.2)	17.3 (39.9)	10.5 (5.8)*	2.9 (7.3)	0.2 (5.2)	11.2 (9.1)
Agriculture Share	-5.9 (6.2)	13.0 (25.7)	-3.8 (3.5)	-2.2 (4.5)	7.5 (3.0)**	-1.0 (5.6)
Countries/Obs.	20/127	20/127	20/127	20/127	20/127	20/127
Jarque-Bera chi-sq(2)[prob.]	40.83[0.00000]	39.81[0.00000]	5.38[0.06800]	70.70[0.00000]	70.7[0.00000]	13.83[0.00100]
Shapiro-Wilk z-stat[prob.]	4.86[0.00000]	5.11[0.00000]	2.79[0.00260]	6.54[0.00000]	6.78[0.00000]	2.95[0.00150]

[a] The dependent variables, all divided by GDP, are the effective rates of collection of "*hard to collect*" taxes (VAT and Income Taxes revenues/GDP) and "*easy to collect*" taxes (Tariffs and Seigniorage revenues/GDP). Each of the explanatory variables are lagged by one year. The estimation procedure is fixed effects controlling for first-order autoregressive in the disturbances. Standard errors are in parentheses, with *[**,***] denoting statistical significance at 10[5,1] percent. Jargue-Bera and Shapiro-Wilk are residuals tests under the null of normality. The sample period is 1980-1999.

Table 2: Seemingly Unrelated Regressions with Interaction Variables [b]

Dependent Variables	Tax Revenue by Tax Effort		Hard to Collect		Easy to Collect	
	Hard to Collect	*Easy to Collect*	VAT	Income Taxes	Tariffs	Seigniorage
Explanatory Variables	β (s.e.)	β (s.e.)	β (s.e.)	β (s.e.)	β (s.e.)	β (s.e.)
Trade Openness	0.8 (0.3)***	-3.7 (1.2)***	0.5 (0.2)***	0.1 (0.2)	-0.6 (0.2)***	-1.0 (0.3)***
Financial Openness	2.2 (1.3)*	-2.2 (5.6)	0.5 (0.7)	1.4 (1.0)	-0.6 (0.8)	-2.4 (1.2)*
Institutional Quality	-2.7 (2.1)	-0.1 (9.8)	-2.4 (1.2)*	0.8 (1.6)	-1.5 (1.2)	3.4 (2.1)
Political Durability	3.6 (2.8)	10.4 (13.0)	0.0 (1.6)	4.3 (2.0)**	-4.4 (1.7)**	1.0 (2.8)
Urbanization	17.1 (8.7)*	36.3 (34.3)	20.3 (5.1)***	3.0 (6.5)	-3.5 (4.5)	12.2 (7.1)*
Agriculture Share	4.6 (4.6)	12.7 (21.6)	-0.6 (2.7)	3.1 (3.7)	9.3 (2.8)***	6.0 (4.7)
Trade Openness Interactions:						
✗ *Institutional Quality*	-5.9 (6.2)	-13.6 (20.6)	-1.1 (2.4)			-13.0 (4.2)***
× *Political Durability*	34.6 (7.8)***	-29.9 (26.9)	9.7 (4.3)**		-7.9 (3.8)**	0.4 (5.7)
× *Urbanization*	8.8 (8.0)	-32.0 (31.7)	8.2 (3.9)**			2.1 (6.5)
× *Agriculture Share*	10.6 (12.0)	15.8 (42.1)	0.7 (5.5)		-10.4 (6.0)*	9.0 (9.2)
Financial Openness Interactions:						
✗ *Institutional Quality*	3.5 (4.6)	-10.0 (7.6)		-0.2 (2.4)		
× *Political Durability*	-9.2 (3.9)**		0.3 (1.9)	-0.0 (2.3)	0.5 (1.7)	
× *Urbanization*	0.6 (0.4)		-0.2 (0.2)	0.5 (0.3)*		
× *Agriculture Share*	-1.7 (0.9)*			-1.2 (0.5)**	0.7 (0.5)	
Countries/Obs.;R-sq	20/147;0.95	20/147;0.41	20/147;0.92	20/147;0.93	20/147;0.90	20/147;0.49
Breusch-Pagan test	chi-sq(1) = 0.126, Pr = 0.7227		chi-sq(6) = 15.075, Pr = 0.0197			
Jarque-Bera chi-sq(2)[prob.]	11.97[0.00250]	51.90[0.00000]	2.97[0.22610]	24.85[0.00000]	13.77[0.00100]	22.77[0.00100]
Shapiro-Wilk z-stat[prob.]	3.25[0.00057]	5.83[0.00000]	0.87[0.19072]	4.78[0.00000]	3.04[0.00117]	3.87[0.00005]

[b] The dependent variables, all divided by GDP, are the effective rates of collection of "*hard to collect*" taxes (VAT and Income Taxes revenues/GDP) and "*easy to collect*" taxes (Tariffs and Seigniorage revenues/GDP). Each of the explanatory variables are lagged by one year. The estimation procedure is Seemingly Unrelated Regressions (SUR) including one-year lagged dependent and country dummies. Standard errors are in parentheses, with *[**,***] denoting statistical significance at 10[5,1] percent. Jargue-Bera and Shapiro-Wilk are residuals tests under the null of normality. The sample period is 1980-1999.

**Table 3: Quantifying Economic Significance of Globalization on Tax Revenue/GDP** [c]

Globalization Factors	Tax Revenue by Tax Effort		Hard to Collect		Easy to Collect	
	Hard to Collect	*Easy to Collect*	VAT	Income Taxes	Tariffs	Seigniorage
Trade Openness	4.5	-8.0	3.1	0.0	-2.4	-4.1
Individual effects:	1.7	-8.0	1.1	0.0	-1.3	-2.2
Interaction effects, of which:	2.8	0.0	2.0	0.0	-1.1	-1.9
× *Institutional Quality*	0.0	0.0	0.0	0.0	0.0	-1.9
× *Political Durability*	2.8	0.0	0.8	0.0	-0.6	0.0
× *Urbanization*	0.0	0.0	1.2	0.0	0.0	0.0
× *Agriculture Share*	0.0	0.0	0.0	0.0	-0.5	0.0
Financial Openness	-1.5	0.0	0.0	0.7	0.0	-0.5
Individual effects:	0.4	0.0	0.0	0.0	0.0	-0.5
Interaction effects, of which:	-2.0	0.0	0.0	0.7	0.0	0.0
× *Institutional Quality*	0.0	0.0	0.0	0.0	0.0	0.0
× *Political Durability*	-1.4	0.0	0.0	0.0	0.0	0.0
× *Urbanization*	0.0	0.0	0.0	1.1	0.0	0.0
× *Agriculture Share*	-0.6	0.0	0.0	-0.4	0.0	0.0
Total Globalization Impact (%)	**3.0**	**-8.0**	**3.1**	**0.7**	**-2.4**	**-4.6**

[c] Calculation based on the estimates reported in Table 2. For example, a standard deviation of the Trade Openness for developing countries is 2.2 percent. Using the coefficient estimate of Trade Openness on "*hard to collect*" taxes from Table 2, which is 0.8 and statistically significant, the effect of a one standard deviation change of Trade Openness is to increase "*hard to collect*" taxes by 2.2×0.8 = 1.7 percent of GDP.

Figure 1.a: (Exports + Imports)/GDP
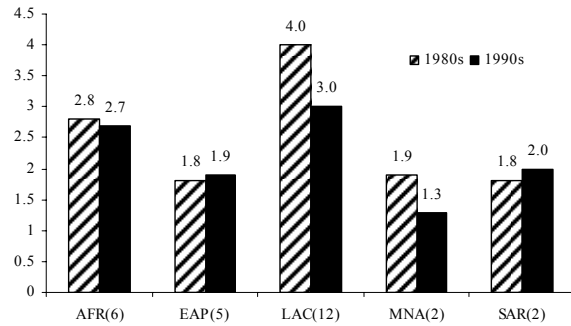The actual trade share ranges from 0 to 1.
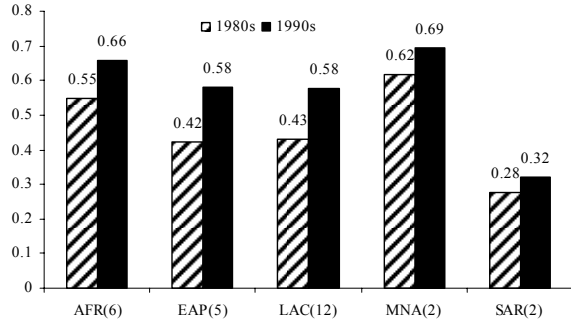
Figure 1.b: Index of Capital Mobility
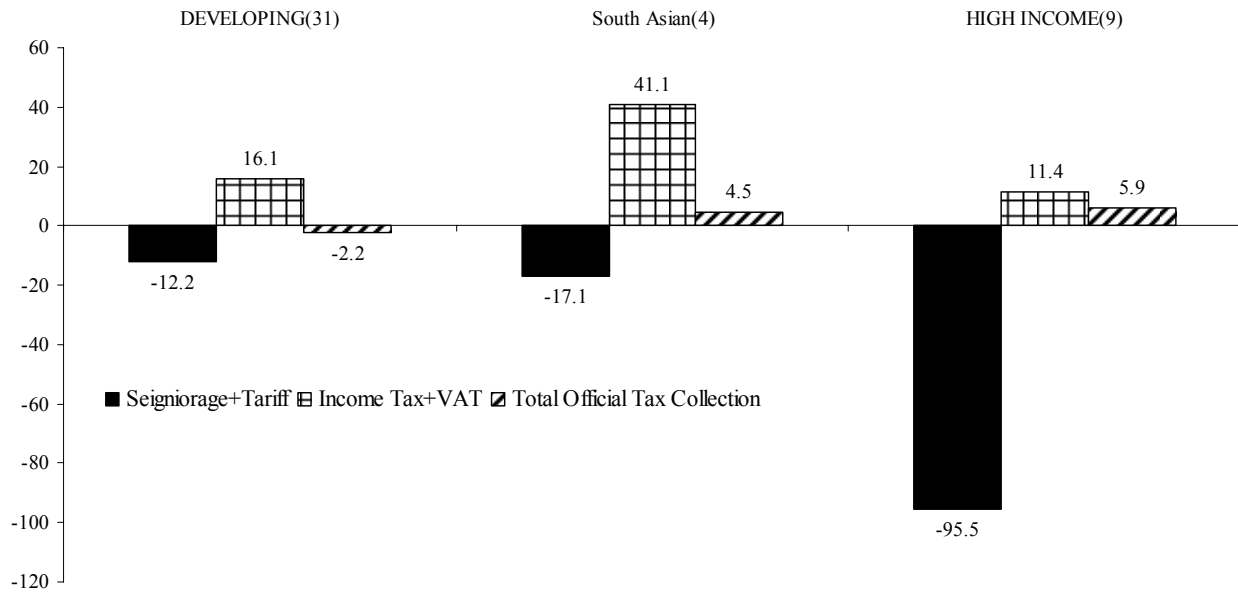The index ranges from 0 to 100.
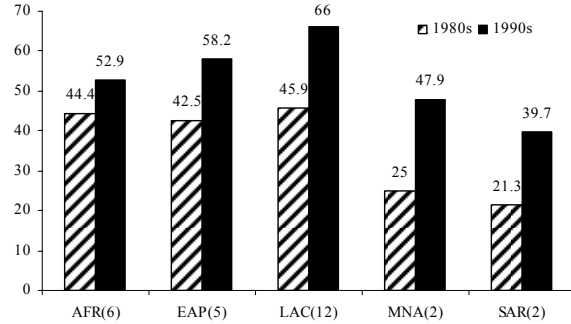
Figure 1.c: Tariff Rates
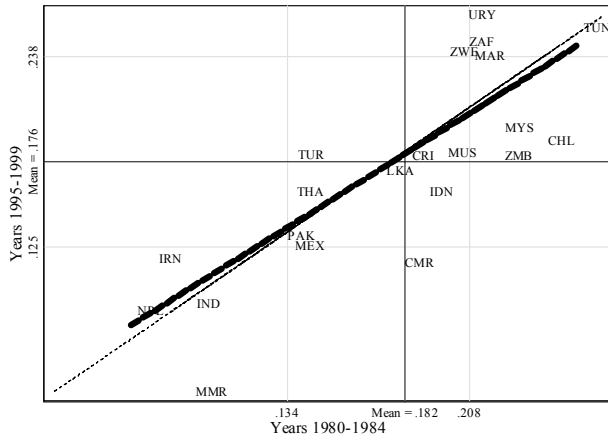Weighted average rates.
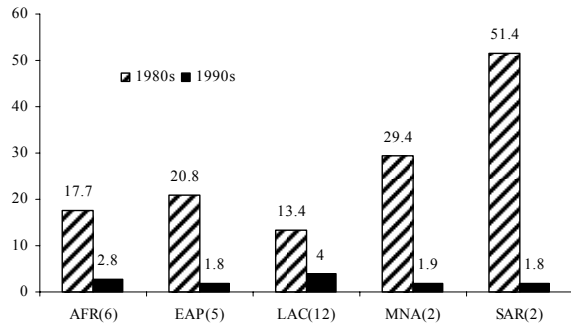
Figure 1.d: Inflation
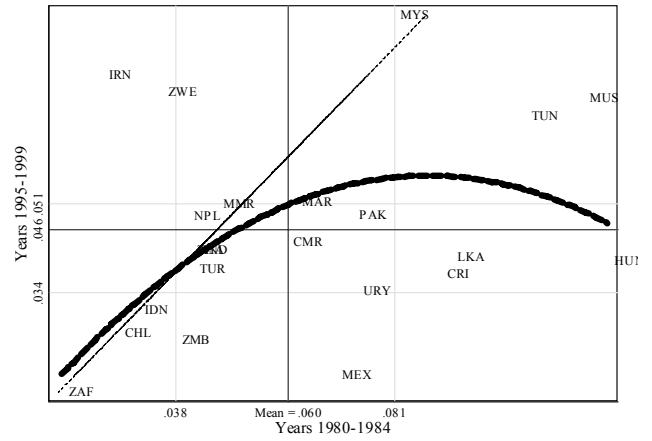Logarithms of the CPI inflation rates.

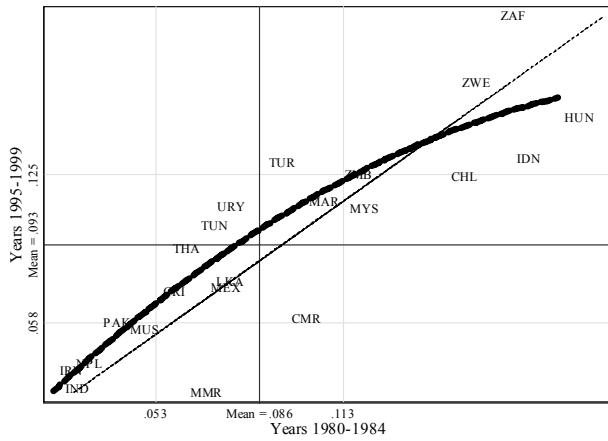**Figure 1.e: Tax/GDP Adjustment (%) from 1980-1984 to 1995-1999**

Figure 2.a: (Total Official Tax Collection)/GDP
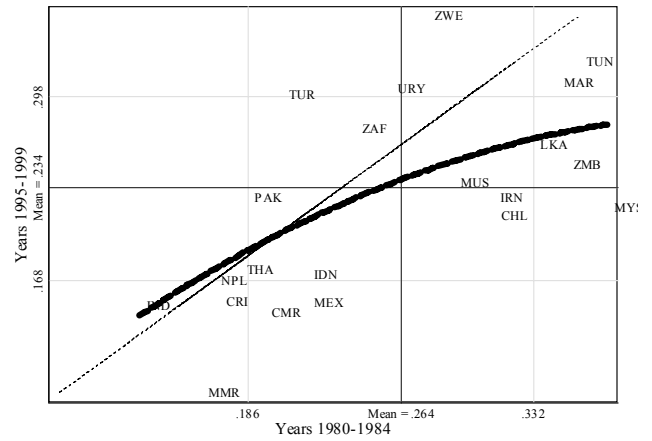$y=0.04+0.71x$; $R^2=0.71$, obs.=22

Figure 2.b: (Seigniorage + Tariff)/GDP
$y=1.29x-7.35x^2$; $R^2=0.85$, obs.=22

Figure 2.c: (Income Tax + VAT)/GDP
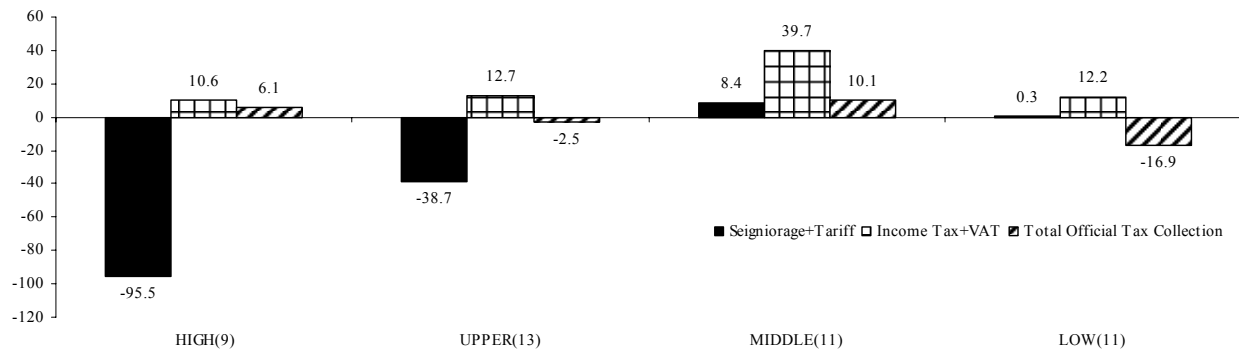$y=0.01+1.17x-1.86x^2$; $R^2=0.75$, obs.=22

Figure 2.d: (Total Expenditure)/GDP
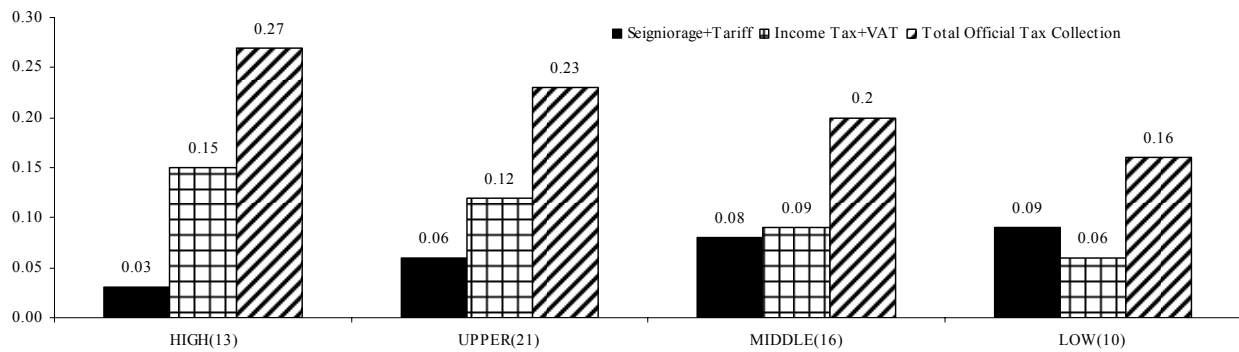$y=1.03x-0.50x^2$; $R^2=0.95$, obs.=22
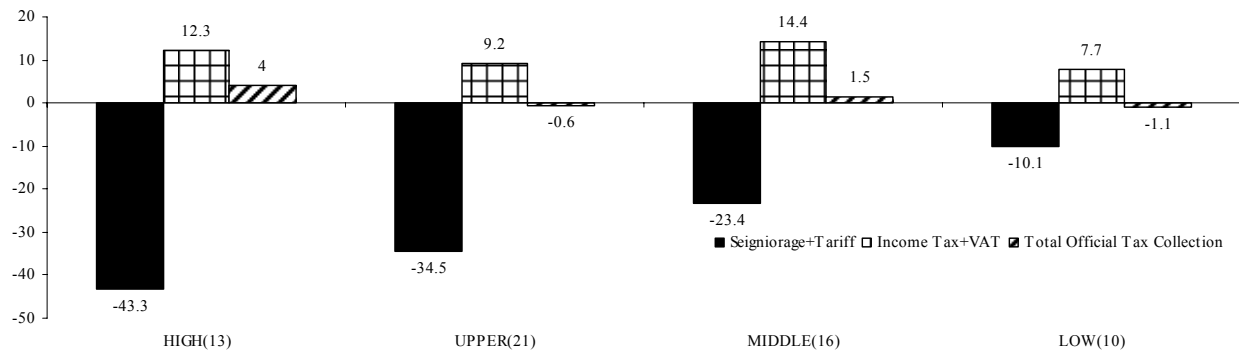
Figure 3.a: Tax/GDP, 1980-1984
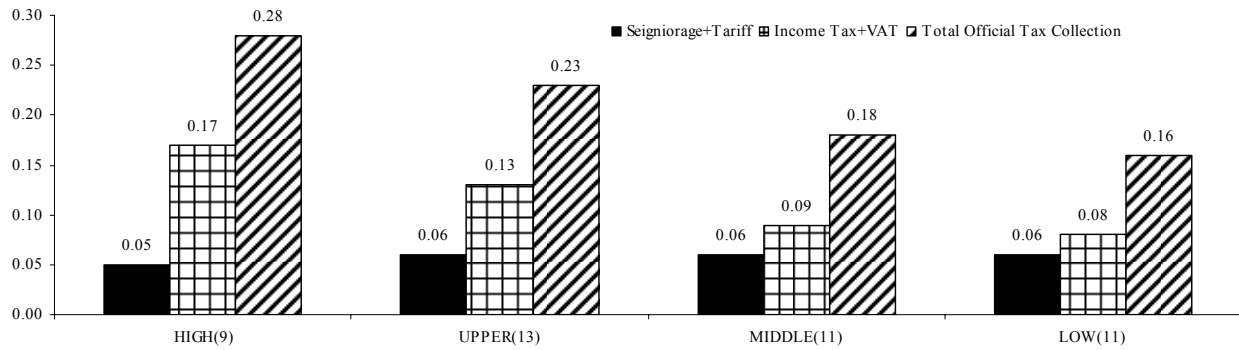
Figure 3.b: Adjustment of Tax/GDP, % change of 1995-1999 from 1980-1984

Figure 3.c: Tax/GDP, 1990-1994

Figure 3.d: Adjustment of Tax/GDP, % change of 1995-1999 from 1990-1994

Figure 4: Fiscal Convergence
Coefficients of variation, measured over non-overlapping five-year periods from 1980-1999.