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**Working Paper**

## Globalization and developing countries - a shrinking tax base?

Working Paper, No. 06-01

**Provided in Cooperation with:**

University of California Santa Cruz, Santa Cruz Institute for International Economics (SCIIE)

*Suggested Citation:* Aizenman, Joshua; Jinjarak, Yothin (2006) : Globalization and developing countries - a shrinking tax base?, Working Paper, No. 06-01, University of California, Santa Cruz Institute for International Economics (SCIIE), Santa Cruz, CA

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**SCCIE WORKING PAPER #06-1**  
Santa Cruz Center for International Economics  
<http://sccie.ucsc.edu/>

Globalization and Developing Countries - a Shrinking Tax Base ?

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Abstract\*

This paper evaluates the impact of globalization on the 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, and macro stabilization. This in turn should shift their tax base from “easy to collect” taxes [tariff, seigniorage, etc.] towards “hard to collect” taxes [VAT, income tax, etc.]. We confirm this prediction – the revenue/GDP ratio of the “easy to collect” taxes declined by about 12% in developing countries between the early 1980s and the late 1990s, while the revenue/GDP of the “hard to collect” taxes increased by 16%. The relatively small initial base of “hard to collect” taxes in developing countries implied a net 2% *drop* in total tax revenue/GDP. Applying panel regressions and controlling for structural factors, we find that trade openness and financial integration have a positive relationship with “hard to collect” taxes, and negative relationship with the “easy to collect” taxes. Fiscal revenue from financial repression has also decreased, further reinforcing these results. The high income and the middle income countries managed to more than compensate for the revenue decline of the “easy to collect” taxes, increasing the total tax/GDP. In contrast, the upper and low income developing countries experienced sizeable drop in the tax/GDP. We also identify strong fiscal convergence during 1980s - 1990s: the coefficient of variation of tax revenue/GDP measures across countries declined by about 40% for seigniorage, about 40% for tariff, and about 4% for the “hard to collect” taxes. We confirm the robustness of the main results to IV methodology, where trade globalization is inferred from applying the gravity methodology. These results are consistent with the notion that improving the performance of the “hard to collect” taxes is more challenging than reducing the use of “easy to collect” sources of revenue.

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Keywords: Globalization, tax base, fiscal convergence, VAT, financial repression, tariff  
JEL Numbers: F15, H21

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\* We would like to thank Jake Kendall for excellent research assistance. The views expressed herein are those of the authors and do not necessarily reflect the views of the NBER.

## 1. Introduction and overview

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 revenue 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.<sup>1</sup> In this sense, globalization entails a negative fiscal shock to developing countries, shrinking the traditional tax base. 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.

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.<sup>2</sup> Specifically, we quantify and explain the degree to which globalization has contributed to the diminishing fiscal

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<sup>1</sup> 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, Edwards and Tabellini (1992), Giovannini and De Melo. (1993), Aizenman and Guidotti (1994), Emran and Stiglitz (2005), and Gordon and Li (2005). See the Appendix for a detailed model explaining the reliance on “easy taxes.” The impact of globalization on the pattern of taxation in the OECD countries has been the focus of Rodrik (1997a, b). See also Tanzi and Zee (2000); and Ebrill, Keen, Bodin, and Summers (2002).

<sup>2</sup> 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.

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.<sup>3</sup> 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.<sup>4</sup> Figure 1.e indicates 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 “hard to collect” taxes [VAT + income].<sup>5</sup> 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% in the first group, and a drop of 2% in the second. The position of the 4 South Asian countries 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%. These figures mask significant heterogeneity of the adjustment across countries, an issue that will be investigated in this paper using regression analyses.

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<sup>3</sup> The Appendix B provides the list of countries in our study, and definitions of the various regions. The choice of these countries is dictated by data availability over the period 1980-1999.

<sup>4</sup> We compare a 5-year average separated by ten years due to two reasons. First, a 5-year average should smooth variations associated with business cycles. Second, the cumulative effects associated with globalization should be more visible by comparing two sub-periods separated by longer time. The country coverage in the figures is dictated by data availability.

<sup>5</sup> Limited data availability about 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 section 2 we conduct a regression analysis for the subset of countries where we managed to collect data about tax revenue from financial repression.

Figure 2.a reports total tax/GDP rates in 22 developing countries in the early 1980s (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 collected by “easy taxes” and by “hard taxes”. For most developing countries, the share of “easy taxes” declined, whereas the share of “hard 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 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 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.

Further insight is gained from cross-country regressions as well as a detailed panel study explaining the patterns of taxes over time. Both are described in the next section. Figure 3 summarizes the panel study, reporting the economic impact of globalization and structural factors on the changes in revenue/GDP collected by VAT, seigniorage, and tariff. Globalization has large and robust effects: a one standard deviation increase in financial integration is associated with a decline of the seigniorage revenue/GDP by 0.5%, which is compensated by an increase in the VAT revenue/GDP of 0.5 %.<sup>6</sup> A one standard deviation increase in trade openness leads to a drop tariff revenue/GDP by 0.2%. Among the structural factors, a one

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<sup>6</sup> See Ebrill, Keen, Bodin, and Summers (2001, 2002) for comprehensive studies of the growing importance of VAT, and Aizenman and Jinjark (2005) for empirical evaluation of VAT’s collection efficiency. Baunsgaard and Keen (2005) found that for middle-income countries, revenue recovery following trade liberalization has been about 50 cents for each dollar of lost trade tax revenue, and the revenue recovery has been even weaker in low-income countries.

standard deviation increase in urbanization increases the VAT revenue/GDP by 2.3%, while institutional quality increases the VAT revenue/GDP by 0.3% and reduces the seigniorage revenue/GDP by 1.2%.

To gain perspectives about the net adjustment, Figure 4.a reports the various sources of tax revenue to of GDP in the early 1980s. Interestingly, most of the variation across the four income groups was in the revenue from “hard to collect taxes”, which was about 8% of GDP for the low income, progressing upward and reaching 17% of GDP in the high income countries. In contrast, there was little variation in the revenue from “easy to collect taxes” across the various groups: it was 6% of GDP for the low income and 5% of GDP for the high income countries. The total official tax collection to GDP in the four groups mimics the patterns of the “hard to collect” taxes: it was about 16% of GDP for the low income group, progressing upward with GDP/Capita and reaching 28% of GDP for the high income group. Figure 4.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 four income groups. Overall, the record is mixed. Interestingly, the drop in the revenue from “easy taxes” was larger for the higher income groups [in fact the revenue from easy taxes went up for the middle income group by 8.4%]. Both the high income and the middle income managed to increase the revenue from the “hard taxes” significantly [11% and 40%, respectively] and increasing the total tax/GDP by 6% and 10%, respectively. The increase in revenue from the “hard taxes” was rather timid for the upper and the low income countries [13% and 12%, respectively], less than what was needed to compensate for the drop in the revenue from “easy taxes.” This induced a drop in the total tax revenue of 3% for the upper income countries and 17% 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 4c-4d summarize the changes in the tax bases in the 1990s. Figure 4c reports the patterns of tax bases in the early 1990s, and Figure 4d traces the tax base changes between the 1990-4 and 1995-1999, subject to data availability. The middle income countries experienced a sizable contraction in the easy to collect tax base (by about 35%), reducing the overall tax base by about 1%. The low income countries experienced similar drop of the tax base, accounted by smaller drop in the easy to collect tax base (by about 10%), and a drop in total official tax collection to GDP by about 1%. We continue the empirical section with a cross-country study,

accounting for the changes in revenue contribution of various taxes between the late 1980s and the late 1990s. We find that better institutional quality is associated with a greater drop in seigniorage revenue during that time. Countries with higher degree of financial increased the VAT revenue and reduced the seigniorage revenue by larger extent.

Globalization, being a common shock, may induce fiscal convergence across countries. Figure 5 confirms this conjecture. It shows a gradual decline in the coefficient of variation of tax revenue/GDP measures during 1980s – 1990s. This effect differs across taxes: the coefficient of variation of seigniorage and tariff revenue/GDP during 1980s - 1990s declined by about 40%, as opposed to only about 4% for the “hard to collect” taxes. Apparently, improving the performance of the “hard to collect” taxes is more challenging than reducing the use of “easy to collect” sources of revenue. We conclude the study with a conformation of the robustness of the main results to an IV methodology, where the globalization of trade is inferred from the gravity trade equation, controlling for geography, GDP and other relevant factors.

The next section summarizes the panel and the cross-country regressions. Section 3 closes the paper with concluding remarks. The Appendix outlines a model explaining the factors determining the use of “easy to collect” versus “hard to collect” taxes.

## 2. Estimation

The Appendix B.2 provides the list of 60 countries in our study. The choice of these countries is dictated by data availability over the period 1980-1999. About a third of these countries have observations consistently across the 1980s and the 1990s for both panel and cross-country regression analysis. Our dependent variables are the actual revenue collection via VAT, seigniorage, and tariff revenues divided by GDP. We conduct the Seemingly Unrelated Regression (SUR) analysis that projects these dependent variables on a vector of explanatory variables, including structural and political variables suggested in the literature, plus our globalization factors. The vector of explanatory variables comprises [see Appendix A for a model explaining the impact of these variables on the tax base]:

- (a) Globalization: We expect the globalization factors, measured by trade openness and financial integration, to increase VAT collection, and reduce seigniorage and tariff revenue.

- (b) Composition of GDP: “easy to collect” taxes should be applied more heavily in a country with larger agricultural share in GDP.
- (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.
- (d) Institutional quality and political durability: We expect a country with better institutional quality and more stable politics to collect more from “hard to collect” taxes, and less from “easy to collect” taxes.
- (e) Level of economic development: We expect that higher level of development and income, which we measure by per capita GDP, should be associated with higher collection for “hard to collect” taxes and lower for “easy to collect” taxes.

In this section we take the globalization process, measured by trade openness and financial integration, as exogenous factors, inducing fiscal adjustment in the next periods.<sup>7</sup> Later, we will use instrumental method to control for endogeneity of trade openness to geographic and structural factors advanced in the gravity equation literature. We take into account reverse causality from fiscal adjustment to globalization by lagging ‘institutional quality,’ ‘political durability,’ ‘trade openness,’ and ‘financial integration’ one period (a year).<sup>8</sup> Some of these explanatory variables, however, are also likely to be subjective. We will therefore use several alternative measures of institutional and political quality, and globalization factors in our robustness check. Since the determining processes of VAT, seigniorage, and tariff are likely to be interrelated, the SUR on the panel data of countries is our benchmark estimation methodology. Nevertheless, we will also use other panel data techniques and cross-country

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<sup>7</sup> The exogenous 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.

<sup>8</sup> Note that globalization may have mixed results on tariff revenue/GDP and seigniorage revenue/GDP ratios: lower tariff rates tend to increase imports, with ambiguous effects on the total revenue from trade taxes. 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.



regression to confirm our findings. The Appendix B.1 provides definitions, sources, and descriptive statistics of the data used in our study.

## 2.1 Benchmark Panel Estimation

In this section we ask what are the determinants of VAT, seigniorage, and tariff, and whether the determining processes of these taxes are interrelated. Table 1 reports the benchmark SUR estimates. In total, we have 375 observations of unbalanced panel for 40 countries.

Our benchmark panel estimation accounts for 37 – 91 percent of the variation in the data. Theory suggests that developing countries with worse institutional quality and political conditions are expected to make more use of taxes with low collection and enforcement costs, the “easy to collect” sources. Indeed, this is supported by our empirical findings. According to our coefficient estimates in Table 1, better institutional quality is associated with lower seigniorage. On average, developing countries with better institutional quality and political durability make more use of VAT.

On the impact of globalization on fiscal adjustment, we find that trade openness and financial integration have a positive relationship with “hard to collect” taxes, and negative relationship with the “easy to collect” taxes. An increase in trade openness (exports plus imports divided by GDP) reduced tariff revenue to GDP, which is consistent with empirical findings in previous studies on the relationship between trade liberalization and tariff revenue (see for example Baunggaard and Keen, 2005). Financial integration via the reduction in capital account restrictions (imputed Quinn index, Edwards (2005)) is negatively associated with the use of seigniorage and at the same time increases VAT collection. These estimates support our view that globalization has reduced the effective collection rate of “easy to collect” taxes, forcing developing countries to switch to the “hard to collect” revenue sources.

Most coefficient estimates of other explanatory variables have their expected sign. VAT collection is positively associated with urbanization. Note that the urbanization variable appears, though insignificant, to be negative on tariff, and positive on and seigniorage. As pointed out by Cukierman, et al. (1992), urbanization of population may in effect encourage the use of seigniorage to tax underground/informal economy. It may also represent greater political fractiousness and polarization (often magnified in more urbanized societies), which tend to

increase the use of seigniorage. We also find that high agricultural share in GDP is positively associated with tariff revenues, which is supportive our initial presumption.

For each of the explanatory variables, Figure 3 summarizes their economic significance by calculating its impact of a one standard deviation [henceforth, +1s.d.] change on taxes/GDP. We calculate the economic significance based on the estimates reported in Table 1 as the following. Standard deviation of the urbanization variable for developing countries is 20.53. Using the coefficient estimate of urbanization on VAT from Table 1, which is 0.11 and statistically significant, the effect of +1s.d. change of urbanization is to increase VAT by  $20.53 \times 0.11 \approx 2.3\%$  of the GDP (a +1s.d. change of urbanization in 1999 is equivalent to increasing the urbanization level of Mexico, 74% → Netherlands, 89%). Note that this effect of urbanization is a sizable, further underscoring the notion that the “hard taxes” such as VAT carry significant collection and enforcement costs.

The globalization factors, have been associated with significant fiscal adjustment in developing countries. Firstly, it is useful to note that a +1s.d. change of trade openness is about 22% (in 1999: +1s.d. change in trade openness: Ecuador, 56% → Israel, 79%), and that of financial integration is 22 score out of 100 (in 1999: +1s.d. change in financial openness: Indonesia, 63 → Portugal, 88). We find that the combined effects of trade and financial integration is approximately +0.5% on VAT, increasing on average this “hard to collect” tax from 3.9% to 4.4% of the GDP. At the same time, the globalization factors reduce on average the “easy to collect” taxes all together by 0.7%, lowering seigniorage from 1.9% to 1.7%, and tariff from 2.5% to 2.0% of the GDP.

When we do a comparison of economic significance from all of the explanatory variables thought to influence the fiscal adjustment in our benchmark panel regression of Table 1, the effects of globalization are not much less than the effects of the institutional and political variables combined. Together, the measures of institutional quality and political durability have contributed to an increase in VAT by 0.8% and a decrease in “easy taxes” by 1.2% of the GDP, both of which are about the same as the combined effects from trade and financial integration

## 2.2 Robustness Check

### – *Adding Financial Repression Revenue*

Our first robustness check is to add government revenue from financial repression into the vector of dependent variables. 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.<sup>9</sup> Evidently, there is a high positive correlation between seigniorage and government revenue from financial repression (about 0.50).

In Table 2, the financial repression revenue is added to the set of dependent variables. A drawback with the addition of the financial repression variable is that the sample size drops from 375 observations (40 countries) to 160 observations (22 countries). Nevertheless, with the financial repression revenue added, our regressions account for 43 – 92 percent of the variation in the data when we conduct the SUR analysis on VAT, seigniorage, tariff, and financial repression revenue with the same set of explanatory variables we use in the benchmark specification. Taking financial repression into consideration, our estimation suggests that trade openness and financial integration are important factors affecting fiscal adjustment. Their coefficient estimates are negative for both seigniorage and financial repression revenue. Most of the explanatory variables continue to have their expected sign. The positive coefficient of trade openness on tariff is troublesome and merits further investigation. One possibility is that trade

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<sup>9</sup> Financial repression revenue may be negative (i.e. the 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. See Giovannini and De Melo (1993) for reports of the financial repression revenue in the 1970s and early 1980s, and Appendix B.1 for its calculation

openness is endogenous to structural and geographical factors, the issue which we later deal with shortly.

– *Sensitivity to Explanatory Variables*

Among the explanatory variables included, institutional and political variables are more likely to be subjective. In Table 3, we replace the institutional quality with bureaucratic quality (their statistical correlation is 0.60) and political durability with the measure of government stability (their statistical correlation is 0.09), and drop GDP per capita (its correlation with most other explanatory variables are above 0.50). Most estimates continue to have their expected sign. Higher trade openness is associated with lower tariff revenue. Financial integration continues to significantly affect both VAT and seigniorage. Government stability is associated with higher VAT, lower tariff, and lower seigniorage.

– *Sensitivity to Econometric Specifications*

We next investigate whether our findings are sensitive to alternative econometric specifications. This is reported in Table 4. We conduct fixed-effects and random-effects estimation for VAT, seigniorage, and tariff separately. The estimates are consistent with those obtained from the benchmark SUR estimation. In particular, better institutional quality, higher political durability, and globalization have positive effects on VAT, and adversely affect seigniorage and tariff, suggesting the baseline findings are robust to econometric specifications.<sup>10</sup>

– *Contrasting the late 1980s with the late 1990s in Cross-Country Regressions*

Another important question is whether the effects of globalization on the fiscal adjustment continue to hold in the cross-country regression context. In order to further investigate the robustness of our results, we report in Table 5 the cross-country regressions. All of the dependent and explanatory variables are now measured as their change between the last 5 years of the 1980s and the last 5 years of the 1990s (henceforth denoted in front of each variable by  $\Delta$ ). Ideally we wanted to use the change between the first 5 years of the 1980s and the last

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<sup>10</sup> We tend to rely on SUR as it utilizes the correlation of the disturbances across equations, taking into account the interdependence of tax collection from various sources.

five year of the 1990s like we do throughout with the graphical analyses, but the cross-country estimations is constrained by data availability between such periods.

For the comparison between the late 1980s and the late 1990s, we have information for 23 countries. We proceed with the SUR estimation on these 23 observations, exploring also variation of the explanatory variables similar to what we do in the robustness check for panel regressions. Our cross-country regressions account for 10 – 47 percent of the variation in the data. Except trade openness, most coefficient estimates from the cross-country regressions are consistent with those from the panel estimation. We find that better institutional quality is associated with a greater reduction in seigniorage. Political durability increases VAT. Countries with a higher degree of financial integration tend to rely more on VAT, but less on seigniorage. Overall, these findings are supportive to the panel regressions, though we do not find much variation in the total tax to GDP (see Table 6).

- *Applying IV Methodology to Trade Share*

We close the empirical part by noting the shortcoming of treating globalization as an exogenous process. This approach is subject to the problem that trade openness is endogenous. We conclude the study with a confirmation of the robustness of the main results to an Instrumental-Variable (IV) methodology. Specifically, 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 are 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. Figures 6a and 6b overview on effects the difference between actual trade share and IV constructed trade share.

Table 7 summarizes the main results, confirming that, controlling for the GDP/capita, the IV constructed trade openness has been associated with a rise in the “hard to collect” taxes, and a drop in the “easy to collect” taxes. Capita GDP which accounts for structural and level of economic development has positive effect on the hard taxes and negative on the easy taxes. Overall, applying IV method accounts for 48-97% of variation in the data. As shown in the lower part of Table 7, the main impact of IV trade openness has been increasing the reliance on VAT,

and reducing the reliance on seigniorage. Figure 7 reports the effects of a one standard deviation change of trade share and capita GDP on the tax bases. Though its calculated size is somewhat smaller than that reported in Figure 3, the effects of globalization are significant and about the same as those of capita GDP; IV trade openness would increase the “hard to collect” taxes by 0.02%, but it could reduce the “easy to collect” taxes by as much as 0.1% of a country’s GDP.

### **3. 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 base 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. Our study has focused only on half of the adjustment, as we do not include government expenditure as a potential determinant of the tax base. 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. At this point, we do not have sufficient data that will allow us to do more rigorous analysis beyond a simple period comparison reported in Figure 2.d. Another possible limitation is that the presence of informal economy may overstate the effective tax rates used throughout the paper. Subject to data availability, there is no easy way to fix this measurement error as we do not have consistent panel information about the changing scope of the informal sector.<sup>11</sup>

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<sup>11</sup> See Schneider and Enste (2000) and Friedman, et al. (2000) for various measures 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. See also Dessy and Pallage (2003) and Fortin, et al. (1997). See Fisman and Wei (2004) and Aizenman (2004) for fiscal implications of trade misinvoicing.

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## 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):

$$g_t + f_t + \theta_t \leq \tau_t^a + s_t \quad (\text{A1})$$

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

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  $\theta_t$  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  $\tau_t^a$  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  $\tau_t$  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  $\tau_t^s$ , maximizing her expected utility:

$$\text{MAX}_{\tau_t} \left[ p_t U \left( 1 - \left\{ \tilde{\tau}_t + 0.5\phi_t[\tilde{\tau}_t - \tau_t]^2 \right\} - \left( s_t - \delta(\tilde{\tau}_t) - \gamma(s_t) \right) \right) + (1 - p_t) U \left( 1 - \tau_t - s_t - \delta(\tilde{\tau}_t) - \gamma(s_t) \right) \right] \quad (\text{A3})$$

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

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

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

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

adjustment term,  $\lambda$ , 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  $\lambda \cong \frac{c_{t,n} - c_{t,a}}{c_{t,a}} \frac{-U''(c_{t,a})}{U'(c_{t,a})}$ , hence,  $\lambda$  is negligible

when  $\frac{c_{t,n} - c_{t,a}}{c_{t,a}}$  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  $\tau_t^a$  is the expected tax payment of the atomistic agent,

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

### 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:

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

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  $\pi$  and  $1 - \pi$ : the government in office at time  $t$  has a fixed probability  $1 - \pi$  of being reappointed next period. With probability  $\pi$ , 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  $\phi$ , respectively. We assume that both  $p$  and  $\phi$  are determined by the investment in tax capacity,  $\theta$ . To capture the greater inertia in reforming the tax system than in changing fiscal policy, assume that the investment in tax efficiency,  $\theta$ , along with  $p$  and  $\phi$ , but not the other policy variables ( $\tilde{\tau}_t; s_t; g_t; f_t$ ), must be chosen one period in advance. Thus,  $\theta_{t-1}$  was chosen at time  $t-1$ , but exerts an influence on the efficiency of the tax system only at time  $t$ :

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

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,  $\theta_t$ . 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:

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

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,  $\theta$ , satisfies the first order condition:

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

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.

## Appendix B.1: Data Sources and Definitions

Database	Location		
World Tax Database (WTD)	Office of Tax Policy Research, University of Michigan		
World Development Indicators (WDI)	The World Bank		
International Financial Statistics (IFS)	International Monetary Fund		
Penn World Tables 6.1 (PENN)	University of Pennsylvania		
International Country Risk Guide (ICRG)	PRS Group		
Variable	Code	Unit	Source
<u>Taxes</u>			
Total tax revenue	RO	LCU current	WTD
Total tax revenue to GDP	ROGDP		RO/GDP
VAT revenue	RV	LCU current	WTD
VAT revenue to GDP	RVGDP		RV/GDP
Income tax revenue	RI	LCU current	WTD
Income tax revenue to GDP	RIGDP		RI/GDP
Tariff revenue	RT	LCU current	WTD
Tariff revenue to GDP	RTGDP		RT/GDP
<u>Exchange rates</u>			
Local currency per US dollar	FX	LCU/US\$	IFS line ..RF.ZF...
Rate of currency depreciation	DFX		(FX-L.FX)/L.FX
<u>Foreign and domestic liabilities</u>			
Foreign interest payments	INTPS	US\$ current	GDF line DT.INT.PRVT.CD
Foreign debt outstanding	DODS	US\$ current	GDF line DT.DOD.PRVT.CD
Effective foreign interest rate	EFFINTPS		[INTPS/DODS]
Domestic interest payments	INTPD	LCU current	WB, GFS line 88..
Domestic debt outstanding	DODD	LCU current	WB, GFS line 88..
Effective domestic interest rate	EFFINTPD		[INTPD/DODD]
Interest rate differential	DEFFINTP		EFFINTPS-EFFINTPD
Financial repression tax rate	RPTAX		DEFFINTP+DFX
Financial repression revenue to GDP	RPGDP		RPTAX*DODD/GDP
High-powered (reserve) money	REM	LCU current	IFS line 14...ZF...
Seigniorage revenue to GDP	SNGDP		(REM-L.REM)/GDP
<u>Bilateral trade data for gravity equation</u>			
Distance	ldist		Frankel and Rose (1999)
Common official language	comlang		Frankel and Rose (1999)
Common borders	border		Frankel and Rose (1999)
Land area product	areap		Frankel and Rose (1999)
Population of trading partner	wdipopTOTL	person	WDI line SP.POP.TOTL
Total value of exports and imports	TRADE	US\$ current	NBER-UN World Trade Flows
Real GDP	RGDP	US\$ constant	WDI line NY.GDP.MKTP.PP.KD
US GDP deflator	GDPDUS	index	
Actual trade share	OPEN	ratio	TRADE/(RGDP*GDPDUS)
Constructed trade share	IVOPEN	ratio	Authors' estimation
Years since trade reform	DYLIB	years	Wacziarg and Welch (2003), OED
<u>Level of development</u>			
Financial Integration	FIT	index	Edwards (2005)
Gross Domestic Product	GDP	LCU current	WDI line NY.GDP.MKTP.CN
Real GDP per capita	GDPK	US\$ constant	WDI line NY.GDP.PCAP.PP.KD
Government expenditure to GDP	EXPGRP		IFS
Weighted tariff rate	TAR	%	World Bank
Agricultural share of GDP	AGRI		WDI
Urbanization share of population	URBAN		WDI
Institutional quality	INST	0-100	ICRG
Government stability	GOVT	0-12	ICRG
Bureaucracy quality	BUR	0-4	ICRG
Political durability	DUR	years	POLITY IV Project

## Appendix B.2: List of Developing and High-Income Countries in the Sample

Based on World Bank's region and income classification. Upper [Middle, Low] income countries are codified with \*\*\* [\*\*, \*].

Developing Countries		
AFR	CMR	Cameroon*
	GAB	Gabon***
	GIN	Guinea*
	LSO	Lesotho*
	MUS	Mauritius***
	NAM	Namibia**
	ZAF	South Africa***
	ZMB	Zambia*
	ZWE	Zimbabwe*
EAP	IDN	Indonesia**
	KOR	Korea***
	MYS	Malaysia***
	MMR	Myanmar*
	THA	Thailand**
ECA	AZE	Azerbaijan**
	BLR	Belarus**
	BGR	Bulgaria**
	HRV	Croatia***
	CZE	Czech Republic***
	EST	Estonia***
	HUN	Hungary***
	LVA	Latvia***
	LTU	Lithuania***
	POL	Poland***
	ROM	Romania**
	RUS	Russian Federation***
	TUR	Turkey***
LAC	ARG	Argentina***
	BOL	Bolivia**
	BRA	Brazil**
	CHL	Chile***
	COL	Colombia**
	CRI	Costa Rica***
	MEX	Mexico***
	NIC	Nicaragua*
	PRY	Paraguay**
	PER	Peru**
	TTO	Trinidad and Tobago***
	URY	Uruguay***
	VEN	Venezuela, RB***
MNA	IRN	Iran, Islamic Rep.**
	MAR	Morocco**
	TUN	Tunisia**
	IND	India*
	NPL	Nepal*
	PAK	Pakistan*
	LKA	Sri Lanka**

High-Income Countries	
AUS	Australia
CAN	Canada
CYP	Cyprus
DNK	Denmark
ISL	Iceland
ISR	Israel
JPN	Japan
MLT	Malta
NOR	Norway
SVN	Slovenia
SWE	Sweden
CHE	Switzerland
GBR	United Kingdom

**Table 1: Benchmark Results**

The sample is unbalanced panel data from 1980-1999. Dependent variables are taxes/GDP. Explanatory variables are lagged by one year. The estimation uses the Seemingly Unrelated Regression (SUR), including country-specific dummy variables and intercept term (not reported). Standard errors are in parentheses. Symbol \* [\*, \*\*] denotes statistical significance at the 10% [5%, 1%] level.

<i>Tax Bases</i>	VAT	Tariff	Seigniorage
Explanatory Variables:			
Institutional Quality	0.02 (0.01)***	0.00 (0.01)	-0.09 (0.02)***
Political Durability	0.02 (0.00)***	-0.01 (0.00)	-0.01 (0.01)
Trade Openness	0.01 (0.00)	-0.01 (0.01)**	0.02 (0.02)
Financial Integration	0.02 (0.00)***	0.00 (0.00)	-0.02 (0.01)**
Urbanization	0.11 (0.02)***	-0.04 (0.03)	0.04 (0.08)
Agriculture Share	0.03 (0.02)	0.07 (0.02)***	-0.02 (0.05)
Per Capita GDP	-0.01 (0.05)	-0.06 (0.06)	0.10 (0.17)
R2	0.91	0.85	0.37
Countries/Observations	40/375		

**Table 2: Adding Revenue from Financial Repression**

See Appendix B.1 for the construction of government revenue from financial repression using Giovannini and De Melo (1993)'s approach. The sample is unbalanced panel data from 1980-1999. Dependent variables are taxes/GDP. Explanatory variables are lagged by one year. The estimation uses the Seemingly Unrelated Regression (SUR), including country-specific dummy variables and intercept term (not reported). Standard errors are in parentheses. Symbol \* [\*, \*\*] denotes statistical significance at the 10% [5%, 1%] level.

<i>Tax Bases</i>	VAT	Tariff	Seigniorage	Financial Repression
Explanatory Variables:				
Institutional Quality	0.01 (0.01)	0.01 (0.01)	-0.04 (0.02)**	-0.03 (0.10)
Political Durability	0.02 (0.01)	-0.00 (0.02)	0.01 (0.02)	-0.26 (0.13)**
Trade Openness	-0.01 (0.01)	0.02 (0.01)**	0.00 (0.02)	-0.35 (0.09)***
Financial Integration	-0.00 (0.01)	0.01 (0.01)	-0.03 (0.01)**	0.01 (0.06)
Urbanization	0.16 (0.04)***	-0.13 (0.04)***	0.09 (0.07)	0.29 (0.37)
Agriculture Share	0.07 (0.03)***	0.07 (0.03)**	-0.03 (0.05)	-0.14 (0.26)
Per Capita GDP	0.65 (0.18)***	-0.99 (0.20)***	-0.05 (0.32)	3.08 (1.74)*
R2	0.92	0.87	0.44	0.43
Countries/Observations	22/160			

**Table 3: Sensitivity to Explanatory Variables**

The sample is unbalanced panel data from 1980-1999. Dependent variables are taxes/GDP. Explanatory variables are lagged by one year. The estimation uses the Seemingly Unrelated Regression (SUR), including country-specific dummy variables and intercept term (not reported). Standard errors are in parentheses. Symbol \* [\*, \*\*\*,] denotes statistical significance at the 10% [5%, 1%] level.

<i>Tax Bases</i>	I			II			III		
	VAT	Tariff	Seiginorage	VAT	Tariff	Seiginorage	VAT	Tariff	Seiginorage
Institutional Quality	0.02 (0.01)***	-0.00 (0.01)	-0.08 (0.02)***						
Political Durability	0.01 (0.00)***	-0.01 (0.00)	-0.01 (0.01)						
Trade Openness				0.02 (0.00)***	-0.02 (0.01)***	0.00 (0.01)	0.01 (0.00)	-0.01 (0.01)**	0.01 (0.02)
Financial Integration				0.02 (0.00)***	-0.01 (0.00)	-0.03 (0.01)***	0.02 (0.00)***	-0.00 (0.00)	-0.03 (0.01)**
Urbanization	0.14 (0.02)***	-0.05 (0.03)*	0.00 (0.07)				0.10 (0.02)***	-0.04 (0.03)	-0.03 (0.07)
Agriculture Share	0.01 (0.02)	0.08 (0.02)***	-0.01 (0.05)				0.01 (0.02)	0.08 (0.02)***	0.02 (0.05)
Per Capita GDP	0.04 (0.05)	-0.10 (0.06)*	0.11 (0.16)						
Bureaucratic Quality							0.20 (0.10)**	0.19 (0.11)*	-0.37 (0.32)
Government Stability							0.08 (0.03)***	-0.06 (0.03)**	-0.19 (0.08)**
R2	0.91	0.84	0.36	0.89	0.84	0.33	0.91	0.85	0.35
Countries/Observations		40/375			40/375			40/375	





**Table 5: Cross-Country Regressions, Late 1980s versus Late 1990s**

All variables are the differences between their averages of late 1980s (5 years) and of late 1990s (5 years). Dependent variables are taxes/GDP. The estimation uses the Seemingly Unrelated Regression (SUR), including intercept term (not reported). Standard errors are in parentheses. Symbol \* [\*, \*\*] denotes statistical significance at the 10% [5%, 1%] level.

<i>Tax Bases</i>	I			II		
	$\Delta$ VAT	$\Delta$ Tariff	$\Delta$ seigniorage	$\Delta$ VAT	$\Delta$ Tariff	$\Delta$ seigniorage
$\Delta$ Institutional Quality	0.033 (0.022)	0.010 (0.033)	-0.163 (0.071)**			
$\Delta$ Political Durability	0.024 (0.011)**	-0.002 (0.017)	-0.023 (0.036)			
$\Delta$ Trade Openness	0.004 (0.014)	-0.001 (0.021)	0.105 (0.046)**	-0.009 (0.016)	-0.008 (0.021)	0.129 (0.050)**
$\Delta$ Financial Integration	0.026 (0.014)*	-0.020 (0.020)	-0.082 (0.043)*	0.027 (0.016)*	-0.023 (0.020)	-0.103 (0.050)**
$\Delta$ Urbanization	0.077 (0.069)	0.128 (0.103)	0.390 (0.220)*			
$\Delta$ Agriculture Share	0.074 (0.041)*	0.044 (0.060)	-0.009 (0.129)			
$\Delta$ Per Capita GDP	-0.077 (0.126)	0.076 (0.187)	0.038 (0.399)	-0.078 (0.126)	-0.036 (0.163)	-0.148 (0.397)
R2	0.399	0.178	0.474	0.134	0.093	0.252
N	23			23		

**Table 6: Cross-Country Regression, Late 80s versus Late 90s**

All variables are the differences between their averages of late 1980s (5 years) and of late 1990s (5 years). Dependent variable is total tax revenue divided by GDP. The regressions use OLS, including intercept term (not reported). Standard errors are in parentheses. Symbol \* [\*, \*\*] denotes statistical significance at the 10% [5%, 1%] level.

<i>Tax Bases</i>	I		
	$\Delta$ Total	$\Delta$ Total	$\Delta$ Total
$\Delta$ Institutional Quality	0.002 (0.001)		0.001 (0.001)
$\Delta$ Political Durability	0.001 (0.001)		
$\Delta$ Trade Openness	0.000 (0.001)	-0.000 (0.001)	
$\Delta$ Financial Integration	-0.001 (0.001)	-0.001 (0.001)	
$\Delta$ Urbanization	0.003 (0.003)		
$\Delta$ Agriculture Share	0.000 (0.002)		
$\Delta$ Per Capita GDP	0.004 (0.006)	0.003 (0.005)	
R2	0.387	0.165	0.099
N	23		

**Table 7: Baseline SUR Estimates with Fixed Effects**

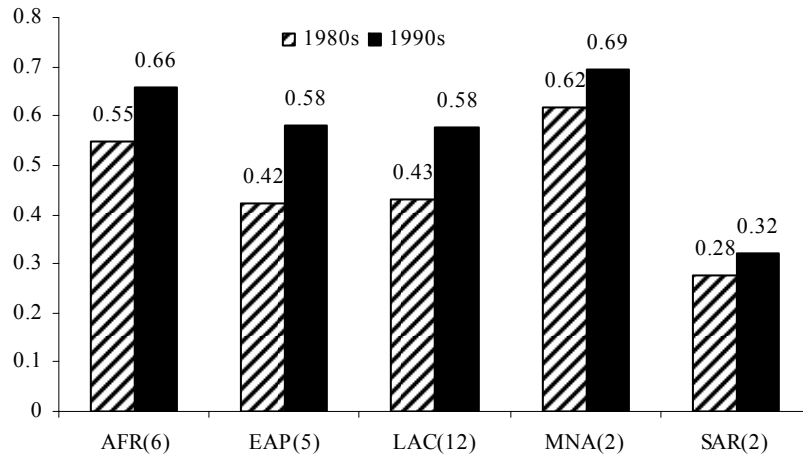
All variables are in log. The dependent variables are taxes/GDP. The “hard to collect” taxes is VAT + Income Taxes. The “easy to collect” taxes is Tariff + Seigniorage + Financial Repression Revenue. Trade Openness is the I.V. constructed trade share as a percentage of GDP estimated from aggregated fitted values of bilateral trade equation with geographic variables. Standard errors are in parentheses. The estimation uses the Seemingly Unrelated Regression (SUR), including intercept term (not reported). Symbol \* [\*, \*\*] denotes statistical significance at the 10% [5%, 1%] level.

Log Tax Bases	Log Trade Openness (I.V. Constructed)		Log Capita GDP (PPP)		R2	Obs.	Countries	Dummies		Trend	
	Year	Country	General	Country-Specific							
"hard to collect" taxes	0.02	(0.01)**	0.05	(0.01)***	0.97	200	27	Yes	Yes	Yes	Yes
<i>"easy to collect" taxes</i>	-0.11	(0.05)**	-0.22	(0.08)***	0.69	200	27	Yes	Yes	Yes	Yes

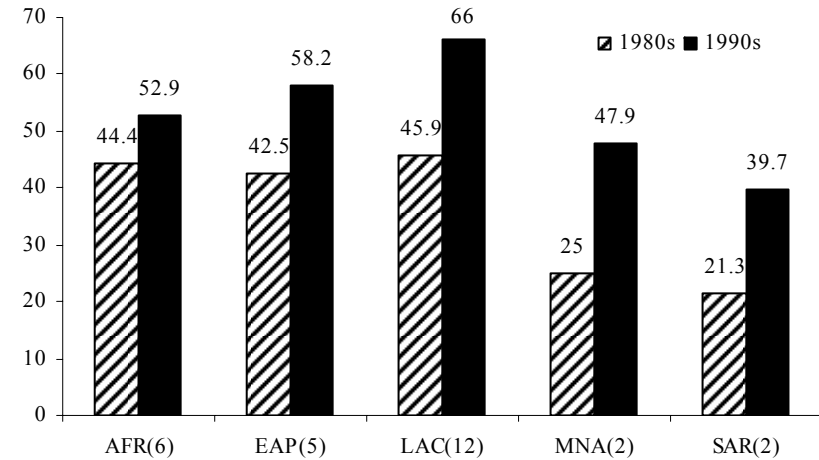
Log Tax Bases	Log Trade Openness (I.V. Constructed)		Log Capita GDP (PPP)		R2	Obs.	Countries	Dummies		Trend	
	Year	Country	General	Country-Specific							
VAT	0.01	(0.01)**	0.01	(0.01)	0.96	200	27	Yes	Yes	Yes	Yes
Income Tax	0.01	(0.01)	0.04	(0.01)***	0.97	200	27	Yes	Yes	Yes	Yes
<i>Tariff Revenue</i>	-0.01	(0.01)	0.02	(0.01)**	0.95	200	27	Yes	Yes	Yes	Yes
<i>Seigniorage</i>	-0.04	(0.02)**	-0.01	(0.03)	0.48	200	27	Yes	Yes	Yes	Yes
<i>Financial Repression</i>	-0.07	(0.05)	-0.24	(0.08)***	0.68	200	27	Yes	Yes	Yes	Yes

**Figure 1.a: (Exports + Imports)/GDP**

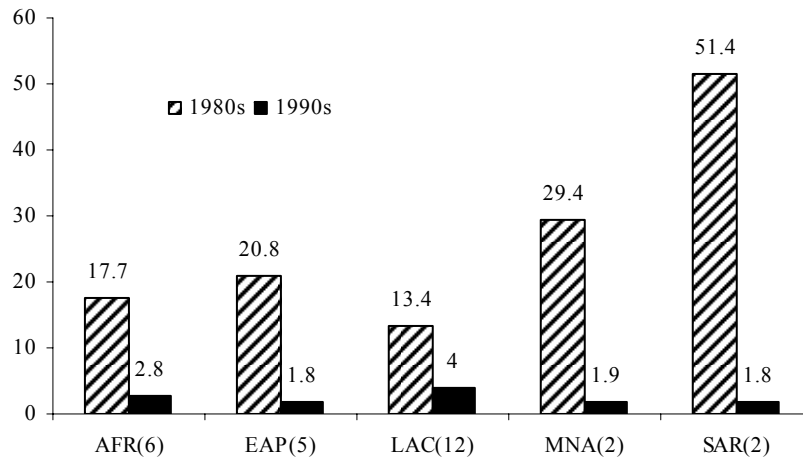
The actual trade share ranges from 0 to 1. Source: Penn World 6.1

**Figure 1.b: Index of Capital Mobility**

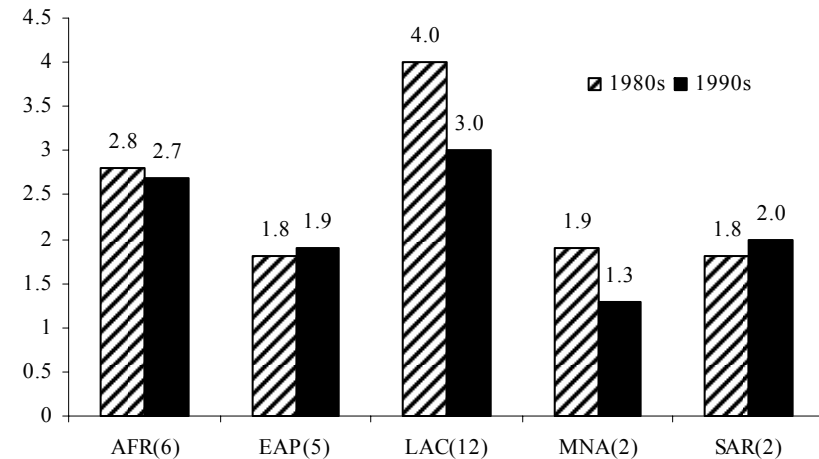
The index ranges from 0 to 100. Source: Edwards (2005)

**Figure 1.c: Tariff Rates**

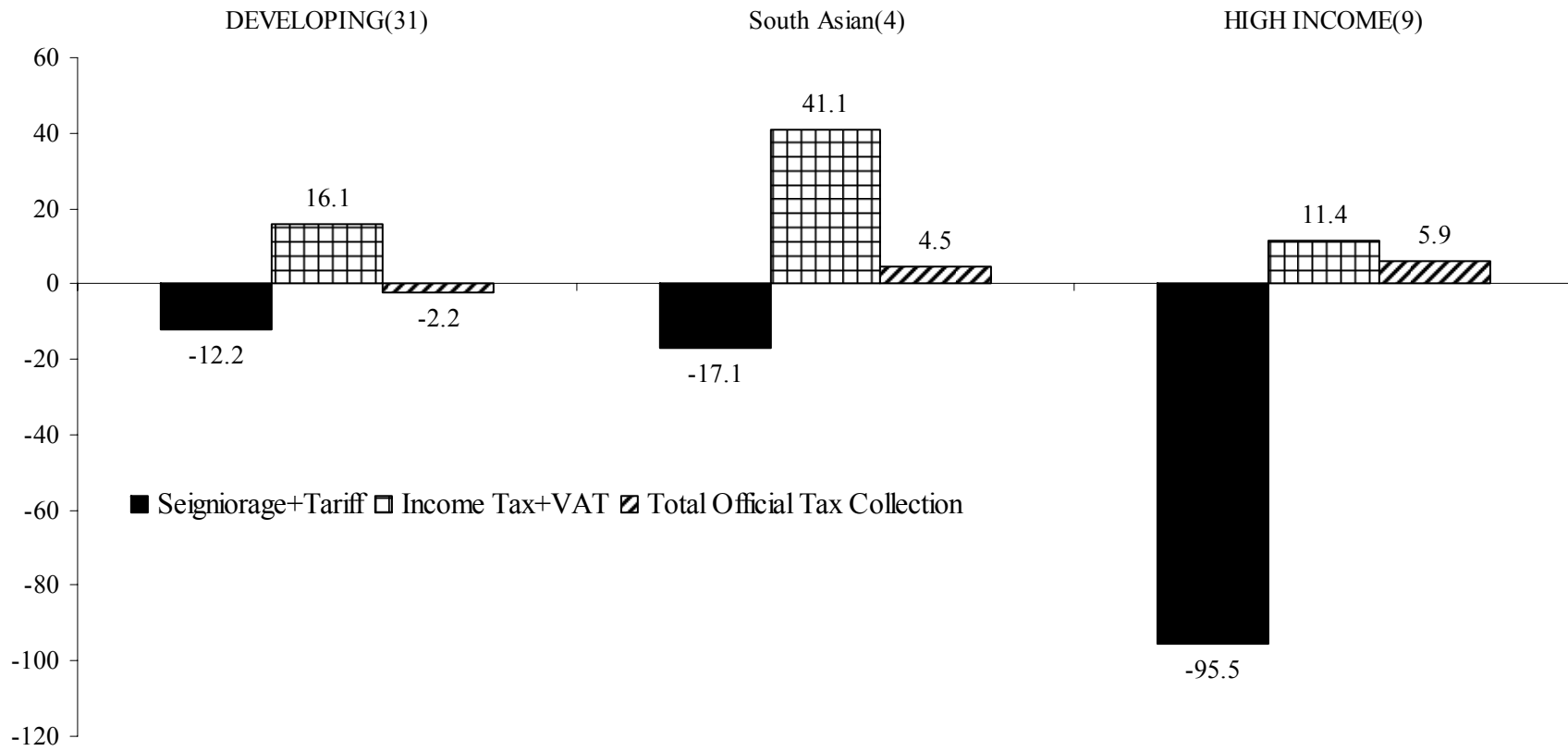
Weighted average rates. Source: OED, the World Bank.

**Figure 1.d: Inflation**

Logarithms of the CPI inflation rates. Source: IFS.

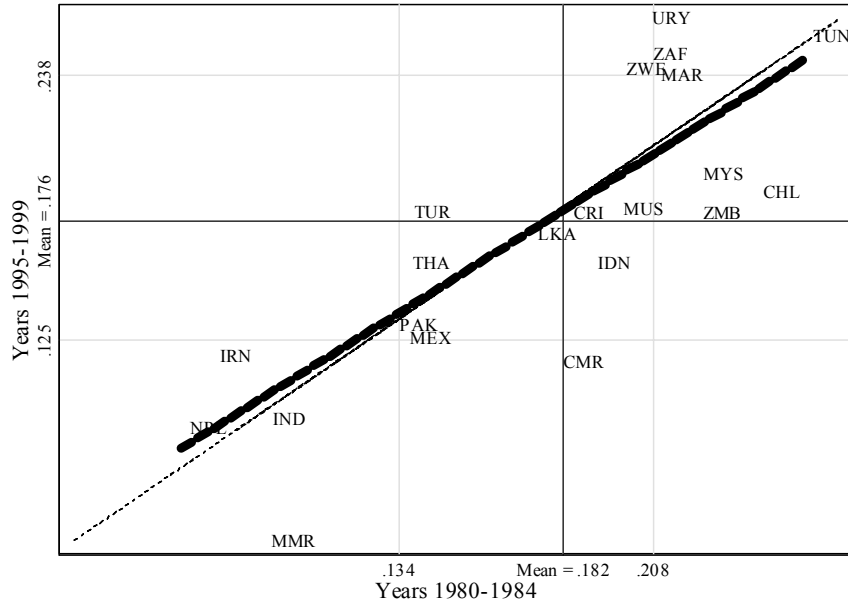


**Figure 1.e: Tax/GDP Adjustment (%) from 1980-1984 to 1995-1999**



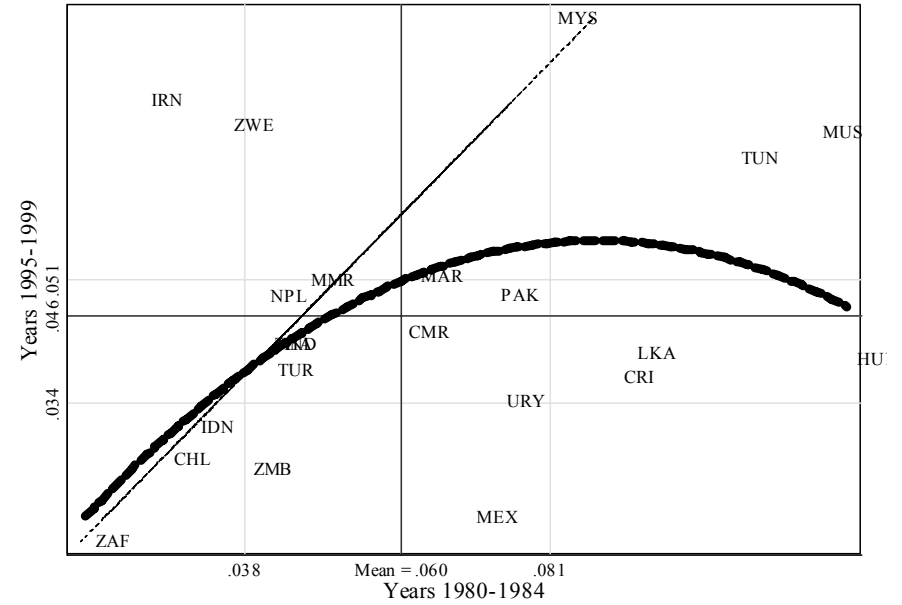
**Figure 2.a: (Total Official Tax Collection)/GDP**

$y=0.04+0.71x$ ;  $R^2=0.71$ , obs.=22



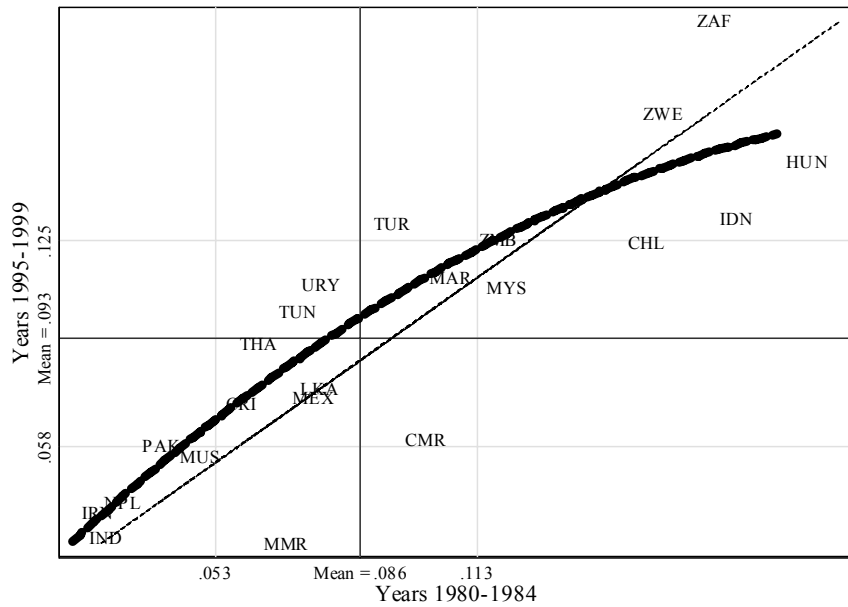
**Figure 2.b: (Seigniorage + Tariff)/GDP**

$y=1.29x-7.35x^2$ ;  $R^2=0.85$ , obs.=22



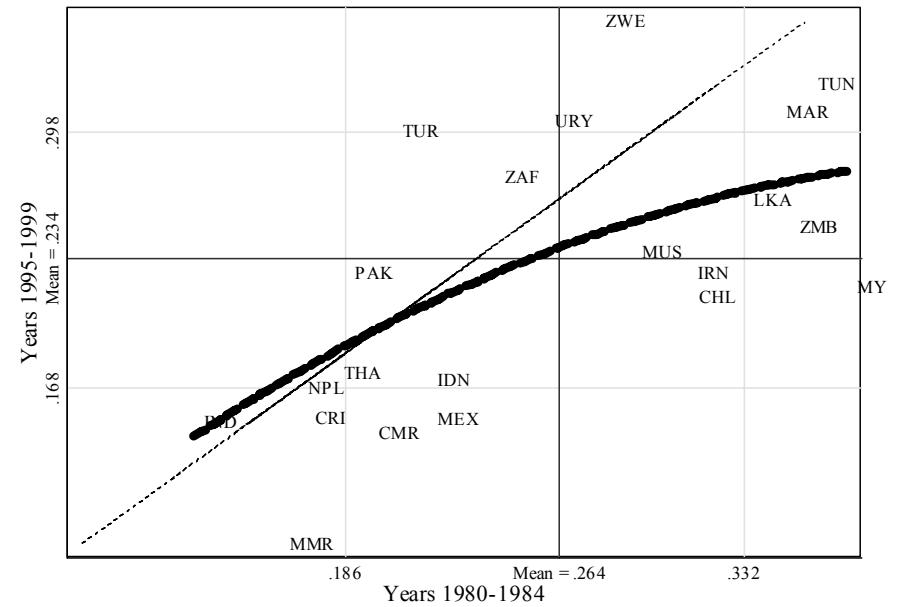
**Figure 2.c: (Income Tax + VAT)/GDP**

$y=0.01+1.17x-1.86x^2$ ;  $R^2=0.75$ , obs.=22



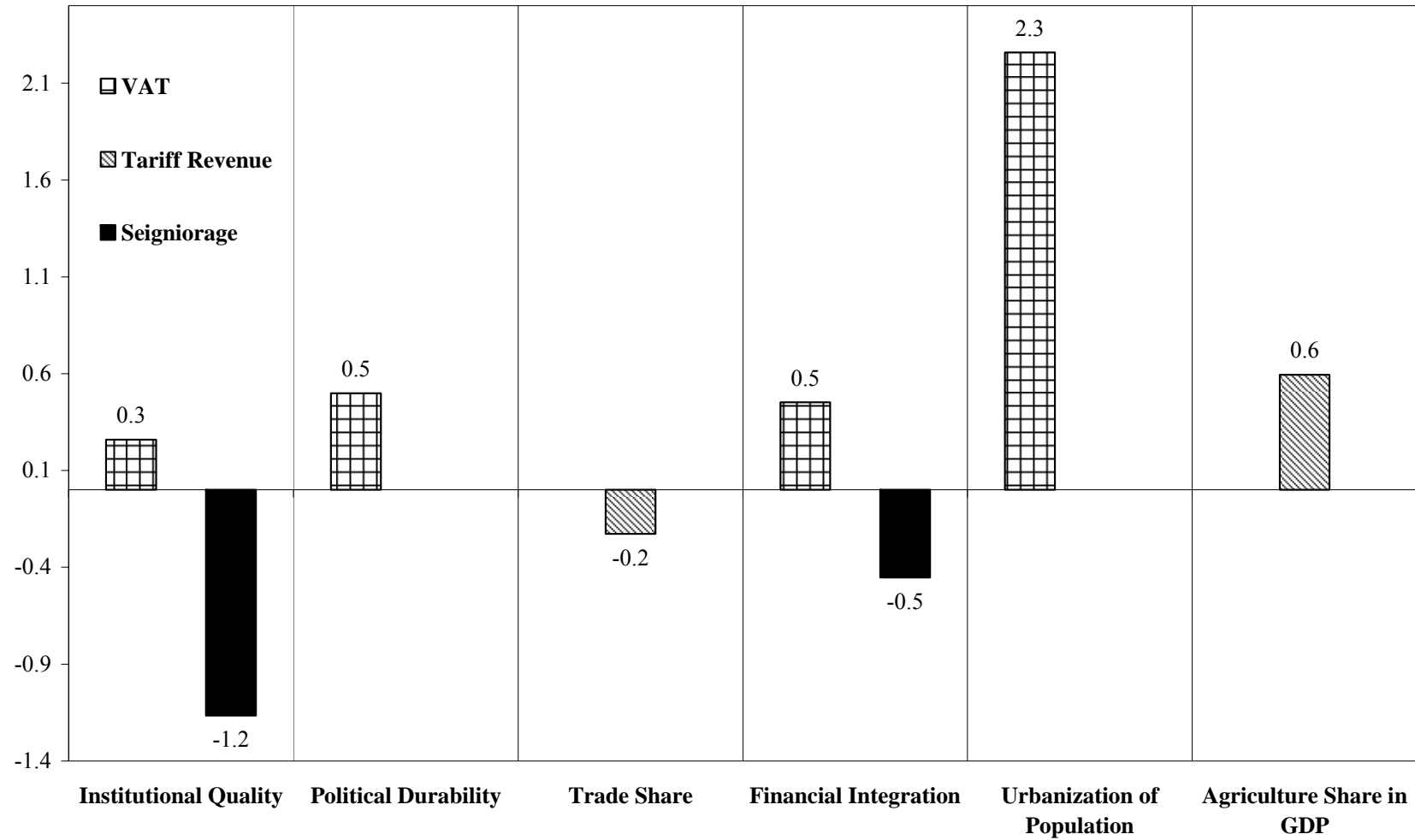
**Figure 2.d: (Total Expenditure)/GDP**

$y=1.03x-0.50x^2$ ;  $R^2=0.95$ , obs.=22



**Figure 3: The Effect (%) of One Standard Deviation Change on Tax/GDP**

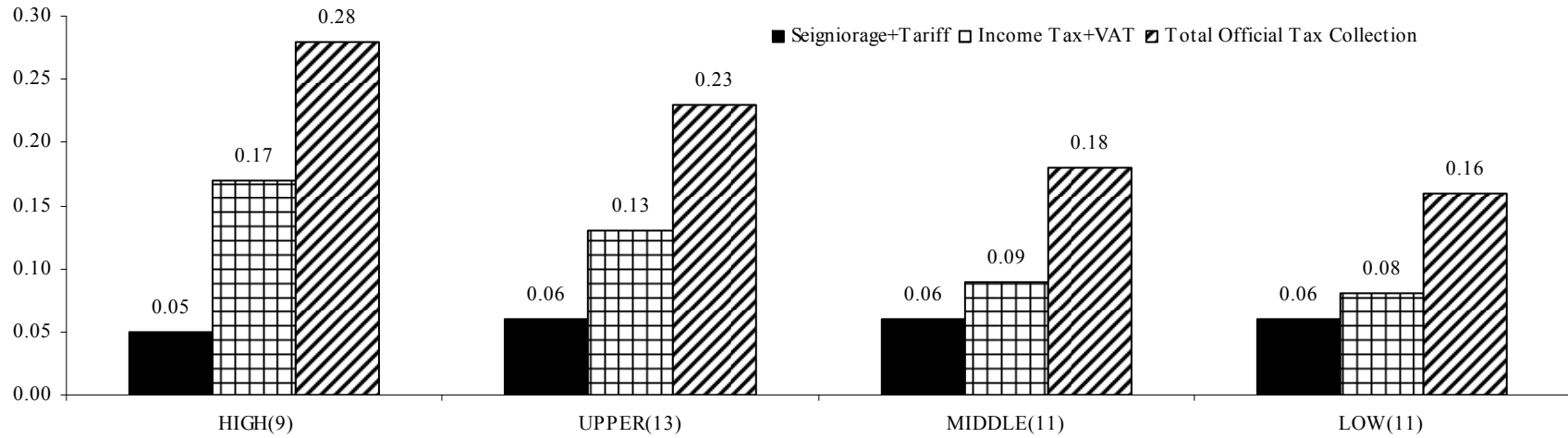
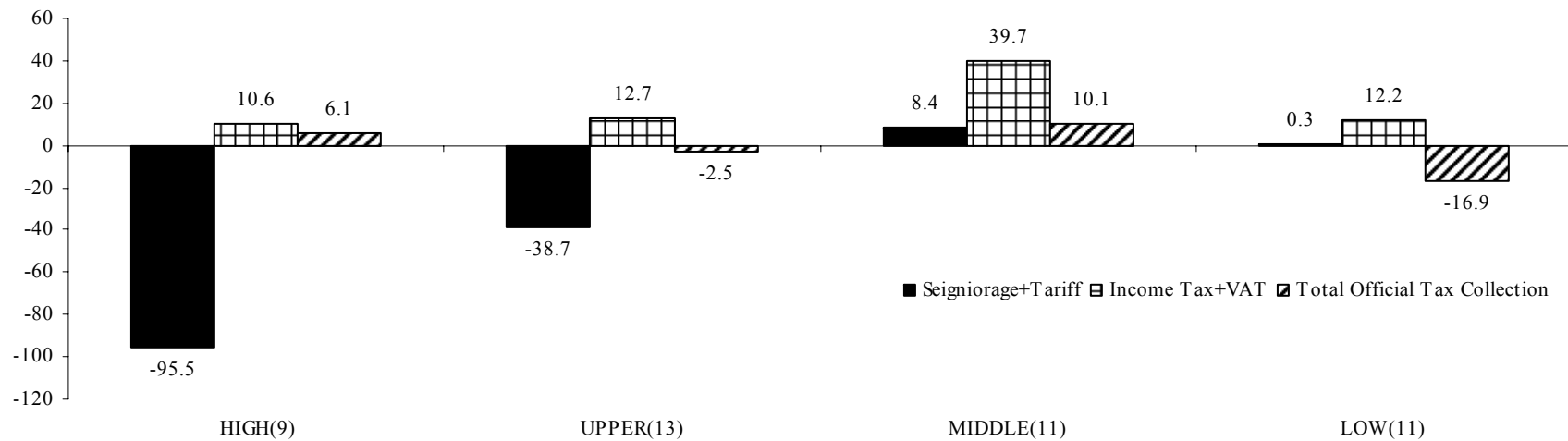
Calculation is based on the estimation in Table 1. Each bar represents the product of the explanatory variable's estimated coefficient (0.02 for Institutional Quality on VAT/GDP) and its standard deviation (12.95 for the Institutional Quality). Coefficients not statistically significant result in missing bars.





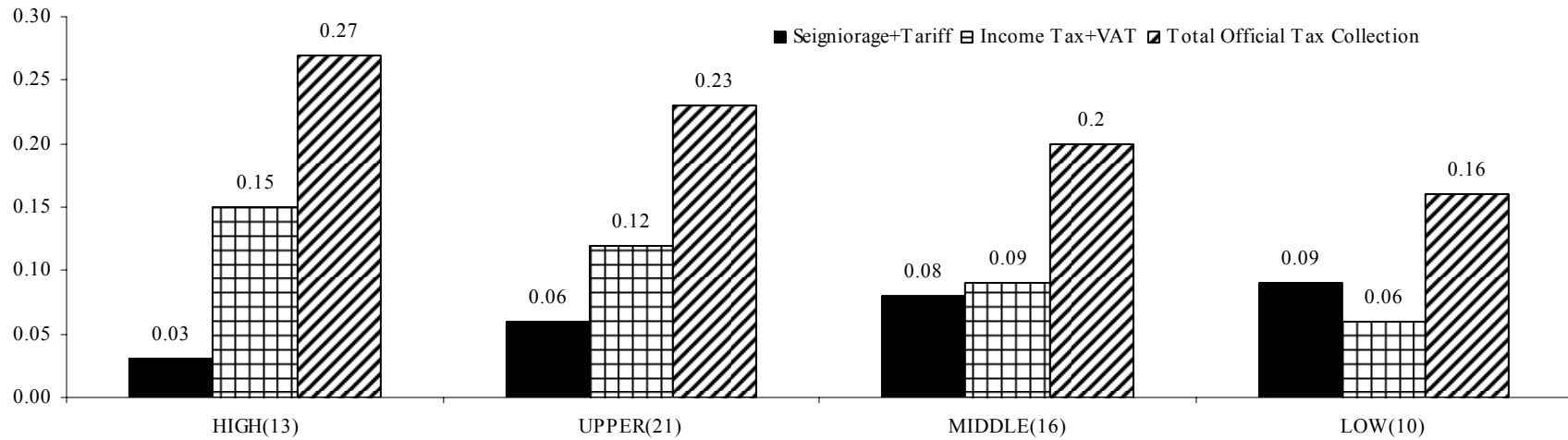
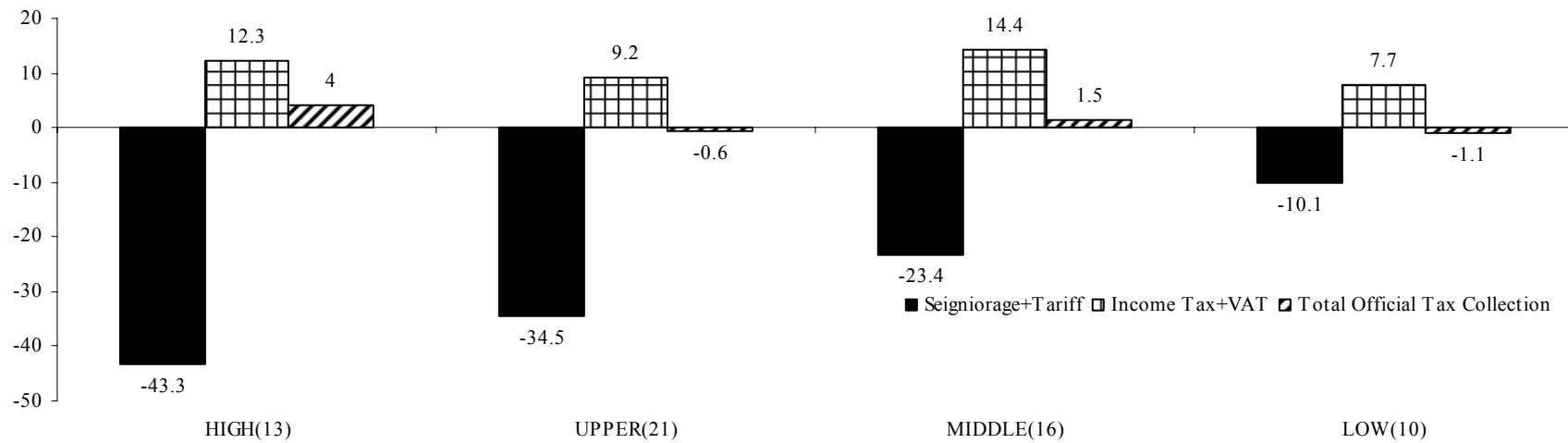
**Figure 4.a: Tax/GDP, 1980-1984**

Countries grouped by the World Bank's income classification (Appendix B.2)

**Figure 4.b: Adjustment of Tax/GDP, % change of 1995-1999 from 1980-1984**

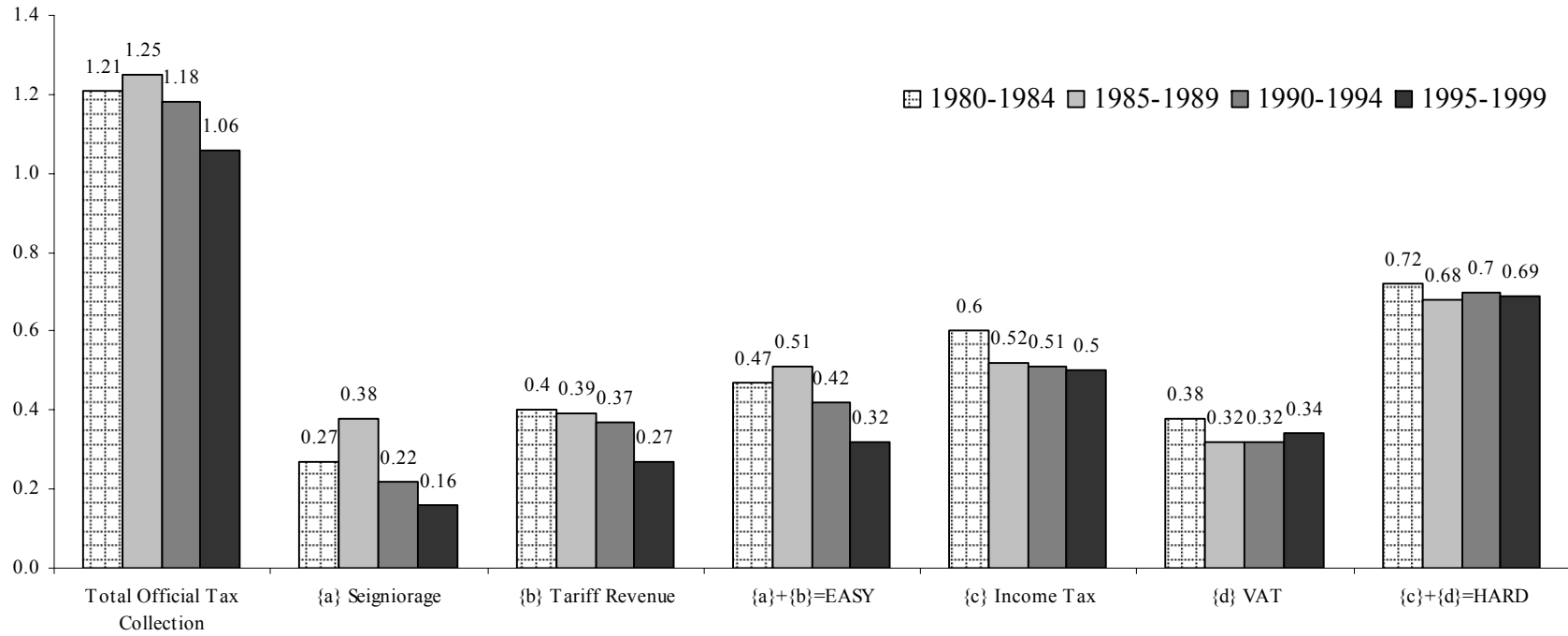
**Figure 4.c: Tax/GDP, 1990-1994**

Countries grouped by the World Bank's income classification (Appendix B.2)

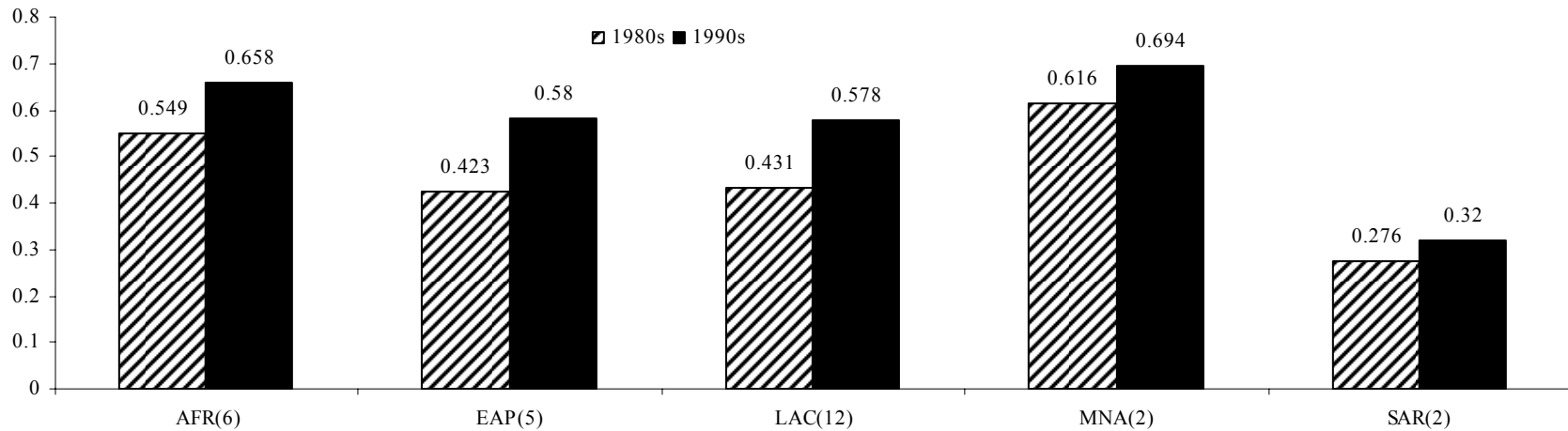
**Figure 4.d: Adjustment of Tax/GDP, % change of 1995-1999 from 1990-1994**

### Figure 5: Fiscal Convergence

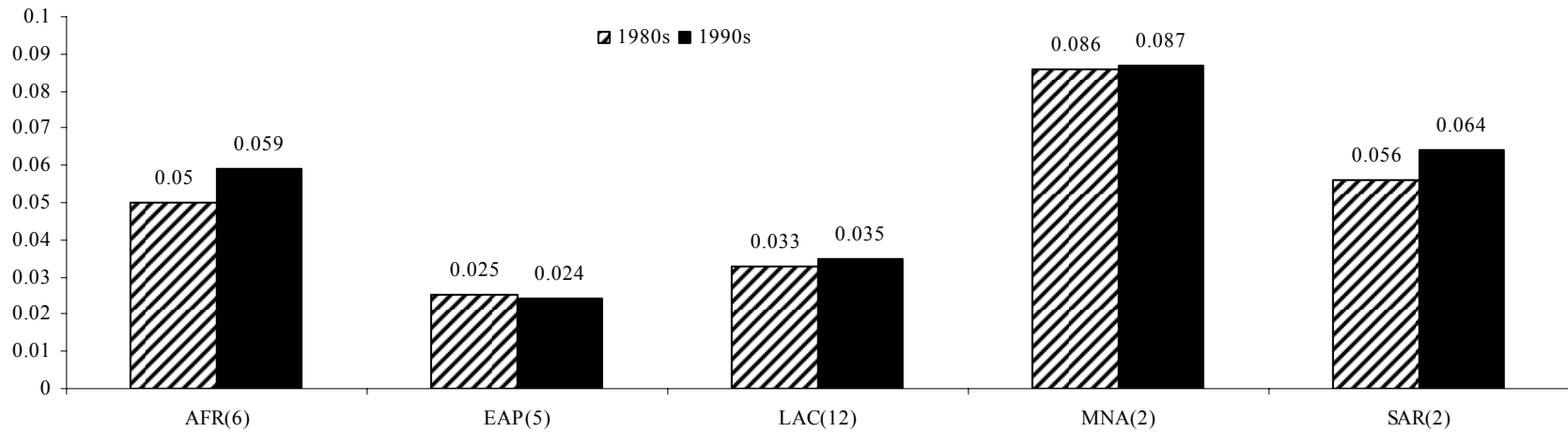
Coefficient of variation is measured over each non-overlapped five-year periods from 1980-1999.



**Figure 6.a: Actual Trade Share**  
(Exports + Imports)/GDP taken from the Penn World 6.1.



**Figure 6.b: Instrumental Variable Constructed Trade Share**  
Based on the gravity equation methodology of Frankel and Rose (1999)



**Figure 7: The Effect (%) of One Standard Deviation Change on Tax/GDP, Controlling for Endogeneity of Trade Share**  
 Calculation is based on the estimation in Table 7. Each bar represents the product of the explanatory variable's estimated coefficient (-0.05 for IV Trade Share on Seigniorage) and its standard deviation (0.93 for the IV Trade Share). Coefficients not statistically significant result in missing bars.

