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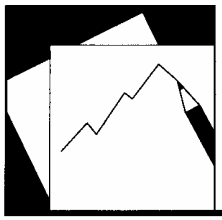

IMF Working Paper

Trade Liberalization, Exchange Rate Changes, and Tax Revenue in Sub-Saharan Africa

Terence Agbeyegbe, Janet G. Stotsky, and Asegedech WoldeMariam

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Trade Liberalization, Exchange Rate Changes, and Tax Revenue in Sub-Saharan Africa

Prepared by Terence Agbeyegbe, Janet G. Stotsky, and Asegedech WoldeMariam[1]

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Abstract

Empirical evidence on the relationship between trade liberalization, exchange rates, and tax revenue is mixed. This paper examines these linkages anew. Using a panel of 22 countries in Sub-Saharan Africa, over 1980–1996, we perform Generalized Method of Moment regressions to test this relationship. We find evidence that the relationship between trade liberalization and tax revenue is sensitive to the measure used to proxy trade liberalization, but that, in general, trade liberalization is not strongly linked to aggregate tax revenue or its components—though with one measure, it is linked to higher income tax revenue. Currency appreciation and higher inflation show some linkage to lower tax revenues or its components. These results show some partial consistency with previous findings, and support the notion that trade liberalization accompanied by appropriate macroeconomic policies can be undertaken in a way that preserves overall revenue yield.

JEL Classification Numbers: F4, H2, H87, O24

Keywords: Trade liberalization, exchange rates, tax revenue, Sub-Saharan Africa

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I. Introduction

Trade liberalization has frequently been the centerpiece of an economic development strategy in Sub-Saharan Africa. Trade liberalization often entails a reduction and unification of tariffs and relaxation of quantitative barriers, and may be accompanied or supported by currency devaluation and domestic tax reform. On devising a program of liberalization, policymakers are often hindered in forecasting tax revenues because of the uncertainty regarding the effects of trade liberalization and exchange rate changes on fiscal outcomes. The relationship between trade liberalization, the exchange rate, and tax revenue is therefore an issue of great practical importance. This paper examines this relationship in Sub-Saharan Africa.

We probe the following questions in this paper:

1. What is the relationship between trade liberalization and tax revenues? Does increased trade liberalization lead to a reduction in tax revenues through its effect on taxes from international trade or other taxes, controlling for accompanying macroeconomic changes?

2. Is the relationship sensitive to the index of liberalization adopted? Is the relationship sensitive to the econometric specification adopted?

3. What is the relationship between exchange rate changes and tax revenues? Does devaluation or currency depreciation increase or decrease tax revenue?

4. Are there any differences between the CFA franc (the currency used by a group of countries in West and Central Africa) and non-CFA franc countries in the revenue response of different types of taxes to trade liberalization changes?

There are two strands of work that this paper draws upon: one examining the relationship between trade liberalization and tax revenue and the other examining the relationship between exchange rate changes and inflation and tax revenue (or fiscal outcomes, more generally). Since trade liberalization is often accompanied by currency devaluation (and higher inflation), a thorough empirical investigation should consider the simultaneous relationship between trade liberalization and changes in macroeconomic variables and revenues.

Section II outlines some theoretical considerations and reviews previous empirical work in this area. Section III describes the data and empirical methodology. Section IV presents the results. Section V concludes. An appendix describes the data set.

II. Theoretical Considerations and Review of Empirical Work

Trade liberalization is mainly thought to be linked to tax revenue through its effect on international trade tax revenue, though the precise relationship depends on several variables,

including the nature of trade liberalization and the response of imports and exports to liberalization. Often the first step in trade liberalization is the replacement of quantitative barriers with import duties. This could result in higher trade tax revenue depending on the level of duties that are set and the change in the value of imports in response to the liberalization measures. Trade liberalization ultimately leads to the reduction of import duties, and thus would be likely to be linked to reduced international trade tax revenue (Ebrill, Stotsky, and Gropp, 1999 discuss these issues). The relationship between trade liberalization and tax revenue, including domestic revenue, is also uncertain and depends on a number of factors, including the structure of the tax system and administrative capabilities (Ebrill, Stotsky, and Gropp, 1999 and Keen and Ligthart, 2002). Often trade liberalization is accompanied by the introduction of a value-added tax (VAT) or other significant domestic tax policy changes.

Macroeconomic changes also have an influence on tax revenue. Tanzi (1989) presents several wide-ranging hypotheses of the relationship between various macroeconomic variables, including inflation and exchange rates, and tax revenue. He observes that there is often an inverse relationship between a country's tax revenue and the real level of its official exchange rate.[2] He argues that overvaluation has a direct effect by suppressing import and export bases measured in domestic currency terms. This reduces collections of international trade taxes and sales and excise taxes, which are usually levied on domestic and imported consumption. Overvaluation also has indirect effects by reducing the incentive to produce goods for export, encouraging capital flight and currency substitution, weakening the balance of payments, encouraging black markets, and encouraging trade restrictions. He concludes that even in heavily indebted countries, where it is generally assumed that devaluation weakens the fiscal balance through its effect on debt service, higher revenues may offset increases in debt service so that the overall effect of devaluation is largely an empirical question.[3]

Countries collect taxes in different ways. It is therefore not possible to generalize about the effect of changes in trade liberalization and the surrounding macroeconomic environment on tax revenues without examining the structure of the different components of revenues and the importance of each different component in the total. In addition, components of tax revenues interact in ways that may either reinforce or offset any changes in one on the other.

Taxes constitute the largest share of revenues for most Sub-Saharan countries, with the main exception being those that rely heavily on natural resource production, where nontax revenue may be dominant. Tax systems encompass a wide variety of taxes, which can be divided into three general categories: taxes on income and profits, taxes on goods and services, and

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[2] Other studies, including Reisen (1990) and Seade (1990), formulate hypotheses on similar issues.

[3] Bevan (1995), Feltenstein (1992), and Tokarick (1995) investigate the effect of exchange rate changes on the fiscal balance in an applied general equilibrium framework with application to specific countries.

international trade taxes. Corporate and personal income taxes are generally the main components of the taxes on income and profits, though sometimes there may be a separate capital gains tax. General sales taxes and excises are the main components of taxes on goods and services. General sales taxes take the form in most countries of a VAT but may also take the form of turnover-type or retail sales taxes.

Table 1 shows the distribution of revenue collections for Sub-Saharan Africa in recent years. Import duties are still a significant source of revenues in Sub-Saharan African countries, though taxes on goods and services are a growing share of revenues. Income tax revenues also constitute a significant share of revenues.

A. International Trade Taxes

Import duties are usually ad valorem levies on import value; similarly, taxes on exports are usually ad valorem levies on exports. However, in some cases these taxes are levied on a specific (or unit) basis or in some more complex form, especially export levies. The effect of trade liberalization on trade tax revenues depends on several factors, including the structure of liberalization. As noted, the replacement of quantitative restrictions with tariffs can raise revenues. The effect of tariff reductions depends on how the level and coverage of tariffs changes. With unchanged import values, a reduction in tariffs reduces revenues from trade taxes and can also be accompanied by reductions in revenues from excises and VATs levied on imports (at least at the importation stage). A change in relative prices would, however, typically induce changes in the level and composition of imports and exports. The revenue outcome thus depends also on the price elasticity of demand for imports and the price elasticity of supply of import substitutes. If imports are sufficiently price elastic, there may be a revenue gain. Since trade liberalization often entails a disproportionate reduction of the highest tariffs, applied to goods that are mainly elastic in demand, the response in terms of higher imports may be sufficient to outweigh the revenue losses from a lower rate of tariff. The elasticity of supply of import substitutes is also relevant. The lower this elasticity, the smaller the reduction in output for a given reduction in price (of imports and the domestic good, in a competitive market), and hence the smaller the increase in import values. Since elasticities vary over the range of prices, the starting point for tariff changes is also relevant. If protectionist motives are dominant or administration poor, tariffs may be above their revenue-maximizing levels. [4]

Changes in the exchange rate translate directly into changes in domestic collections from imports and exports. For a given level of imports or exports, a more depreciated real exchange rate would increase the base of trade taxes in domestic currency terms, which would in turn increase trade tax collections. [5] To the extent that a real depreciation leads to a lower level of imports, this would offset to some extent the higher collections induced by

[4] Ebrill et al, 1999 (pp. 4–6) and Khattry and Mohan Rao (2002) discuss these issues at more length.

[5] If the real exchange rate were unchanged, then there would likely be little change in the share of import tax collections in GDP.

Table 1. Comparative Structure of Tax Revenue in Sub-Saharan Africa Countries, 1980-96 1/
(In percent of GDP)

	Average				
	1980-85	1986-90	1991-93	1994-96	1980-96
CFA and Non-CFA countries					
Total revenue	17.39	16.70	16.80	18.60	16.92
Tax revenue	15.37	14.98	14.95	16.83	15.05
Taxes on income, profits, capital gain	4.20	4.02	4.02	4.64	4.06
Domestic taxes on goods and services	4.64	4.24	5.73	5.27	4.61
Taxes on international trade	5.49	5.71	5.10	6.10	5.44
Non-tax revenue	1.69	1.84	1.80	1.61	1.68
CFA countries					
Total revenue	18.3	18.5	11.4	19.1	17.9
Tax revenue	16.0	16.3	8.5	18.3	15.7
Taxes on income, profits, capital gain	3.9	4.0	2.3	3.4	3.8
Domestic taxes on goods and services	3.8	3.5	...	3.7	3.7
Taxes on international trade	6.4	6.2	...	10.1	6.4
Non-tax revenue	1.9	2.6	2.8	0.8	1.8
Non-CFA countries					
Total revenue	16.9	16.2	17.3	18.5	16.4
Tax revenue	15.1	14.5	15.6	16.4	14.7
Taxes on income, profits, capital gain	4.4	4.0	4.2	5.0	4.2
Domestic taxes on goods and services	5.1	4.5	5.7	5.7	5.1
Taxes on international trade	5.0	5.5	5.1	5.0	4.9
Non-tax revenue	1.6	1.6	1.7	1.8	1.6

Sources: IMF, Government Finance Statistics, International Financial Statistics and World Economic Outlook.

1/ For each revenue classification, only countries for which data are available are included in the calculation.

higher domestic currency values. If aggregate elasticities of import demand were inelastic in the short run, then the valuation effect would likely dominate, leading to an overall increase in revenues from imports. A real depreciation would also tend to increase exports, which would lead to an increase in revenues as both the valuation and volume effect would support each other. In general, however, the tax effects on imports would dominate those on exports, since export taxes are insignificant in most countries today. In the short term, imports are also likely to adjust more quickly than exports to a change in the value of the currency, reinforcing the importance of changes in import collections initially.

Although on an aggregate basis, aggregate import demand is likely to be relatively inelastic in most developing countries, import taxes apply to a wide range of goods, some of which are elastic in demand, especially consumer or finished goods. These goods also tend to face the highest tax rates. Real depreciation of the exchange rate is likely to lead to a shift in

composition toward more price inelastic and less heavily taxed goods, including domestic substitutes, adding to the factors that contribute to lower revenues.

B. Taxes on Goods and Services

In many developing countries, taxes on goods and services (also referred to as indirect taxes) are a significant source of revenues. A large proportion of tax collections from taxes on goods and services are derived from imports, (at least initially with these goods then marked up and resold in retail markets). In some countries, collections derived from imports are one-half or more of total collections from these taxes. [6]

Trade liberalization affects taxes on goods and services mainly through changes in the base of imports subject to these taxes. By international convention, in most countries, tariffs apply to import value (sometimes inclusive or exclusive of stamp duties), excise taxes are then levied on the base inclusive of tariffs (and stamp duties), and broad-based taxes, such as the VAT, are levied on the base inclusive of tariffs and excises. [7]As noted, trade liberalization that reduces tariffs would lead to a fall in the base because tariffs constitute an element of the tax base of taxes on goods and services. However, the value of imports may rise, offsetting this reduction owing to the tariff change. In addition, revenues may decline because of a decline in the output of import substituting goods. Typically the administrative efficiency of collection for taxes on goods and services is lower than for imports, which creates room for additional uncertainty in the effect of tariff reductions on taxes on goods and services. In the long term, however, if economic growth increases because of trade liberalization, the tax base is likely to expand.

A real depreciation of the currency would lead to an increase in excise tax and VAT or sales tax collections from imports. But whether collections rise relative to GDP depends on the economic incidence of the taxes. It is typically assumed, and this assumption is supported by empirical evidence, that the burden of taxes on goods and services is largely shifted to consumers through price adjustments. Typically there is a relatively rapid pass-through of exchange rate depreciation to goods' prices, thereby increasing the relative price of imported goods (or good using imported inputs). Hence tax revenues would change in proportion to the change in the final price. Again, however, there would be an offsetting demand effect induced by higher prices, and the size of elasticities would indicate whether revenue would increase or decrease overall.

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[6] Ebrill et al (2001) report the share of VAT revenue derived from imports for 22 developing countries. More than 50 percent of the VAT revenue comes at importation stage in most of the sample countries. (The highest in the sample is 70 percent.)

[7] Practices vary, however. For instance, in some Commonwealth nations, excises apply only to domestic goods and they are not part of the base for broad-based sales taxes.

Exports are typically freed of excise tax liability (through suspension or rebating) and VAT liability (through zero rating). A real depreciation of the exchange rate would tend to increase exports at the expense of domestic consumption, tending to depress revenues and offsetting the increases from the revaluation effect, in contrast to international trade taxes. The overall outcome would depend on the relative size of the revaluation effect compared to the change in trade volumes. The smaller the elasticity of supply of exports, the more likely it is that the revaluation effect would dominate.

Sometimes excise taxes are levied on a specific (or per unit) basis rather than on an ad valorem basis. Changes in exchange rate values that affect import value do not then automatically translate into changes in revenues. Specific charges may often apply to important excisable commodities, such as alcohol, tobacco, and petroleum. Therefore, as a practical matter, real depreciation of the currency may lead to a decline in excise tax collections, unless excises levied on a specific basis are adjusted to reflect changed prices of goods.

C. Taxes on Income and Profits and Capital Gains

Trade liberalization would mainly have an effect on income and profits taxes in the short run through changes in profitability of imported goods and import substitute producers in the short run and in the longer run on economic growth. In contrast to taxes on goods and services, if reductions in tariffs leads to lower prices for imports, they should lead to higher profit margins and hence higher income and profits taxes. In the long run, however, trade liberalization should have the same effect as for taxes on goods and services by increasing economic growth and the tax base.

Changes in exchange rates would have relatively little direct effect on personal income tax or corporate income tax collections. The principal direct influence would be through changes in tax liabilities resulting from required revaluation of foreign denominated assets and liabilities. Changes in inflation (or other macroeconomic variables) that result from changes in the exchange rate do, however, have important effects on income tax liabilities.

Personal income tax

Higher inflation could increase tax burdens under the personal income tax. There are several avenues by which higher inflation could affect tax liabilities. Most personal income tax systems are structured with progressive marginal tax rates. As a result, taxpayers who receive only nominal increases in wages to offset higher inflation still tend to be pushed into higher tax brackets because of progressive marginal tax rates (a phenomenon known as “bracket creep”). In inflationary environments, with unchanged rate schedules and brackets, personal income tax collections tend to rise. Some personal income taxes are designed to adjust the brackets to inflation, which eliminates bracket creep and the inflationary increase in tax liabilities. Some countries do not build it in to the tax but make frequent adjustments, instead.

Real exchange rate depreciation has potentially an important indirect effect on personal income tax collections if brackets are adjusted for inflation. Real exchange rate depreciation is likely to lead to a decline in real wages and thus a decline in personal income tax collections from wages, as taxpayers are shifted into lower tax brackets. There are thus two offsetting effects—if brackets are not adjusted for inflation, nominal increases in income imply taxpayers are shifted into higher brackets while if brackets are adjusted for inflation, declining real wages implies taxpayers are shifted into lower brackets, and the overall outcome depends on how brackets are adjusted in response to inflation and how real wages adjust. If real wages fall sufficiently and brackets are adjusted, personal income tax collections could fall. If real wages fall to a more limited extent and brackets are not adjusted fully in real terms, bracket creep could still imply that personal income tax collections rise.

Bracket creep is likely to be more pervasive in personal income taxes characterized by many brackets and highly graduated marginal tax rate structures, and no institutional feature that requires automatic adjustment of brackets, as in some countries where brackets are indexed to a price or wage index. With few brackets and little graduation in marginal tax rates, bracket creep is not likely to be significant. In this case, the effects of real wage changes are likely to dominate.

Higher inflation also alters the value of other components of the income tax fixed in nominal terms, such as credits, deductions, and exemptions. Any figures fixed in nominal terms lose value with higher inflation. If these components are not fixed in nominal terms but are instead set as a certain percentage of income or of some type of expenditure, then their value adjusts along with inflation to the extent that income or expenditure adjusts. Erosion of nominal credits and the like would raise tax liabilities, reinforcing the effect of bracket creep.

Overall, it is hard to say a priori the effect of real exchange rate depreciation and higher inflation on income taxes. If the real wages drop significantly, the effect is likely to lower personal income tax liabilities. The tax treatment of individual proprietors, who pay under the personal income tax, raises another set of issues, but these issues are similar to those facing corporate taxpayers, discussed below.

Capital income may rise as a result of real depreciation of the exchange rate, though the extent to which personal income tax collections rise would depend on the extent to which capital income is captured under the personal income tax. In many countries, capital income is scarcely taxed under the personal income tax. Most often, some tax may be withheld or due on interest payments. But often interest on bank deposits and government debt is exempt and corporate bond and equity markets are not well developed, so withholding on interest payments yields relatively little in revenues.

It is rare for capital gains to be part of the personal income tax base in developing countries given the great difficulties in administering capital gains taxes and the desire on the part of many countries to encourage the development of nascent financial markets. Most industrialized countries do tax this component of income, which may be substantial. Payments to foreigners of capital income of various types may be taxed, often through some

form of withholding, though tax treaties frequently eliminate tax on payments abroad and enforcement tends to be weak compared to collections on wages. It is therefore unlikely that any shift in the composition of income toward capital income as a result of real depreciation of the exchange rate would do much to bolster personal income tax collections.

Corporate income tax

As with personal income tax, most of the effect of currency depreciation on corporate profits tax liabilities occurs through the effects of higher inflation on income statements. Higher inflation has several effects on corporate income. Higher inflation would erode the value of depreciation allowances since these are usually set on the basis of historical cost rather than replacement cost. Inventory cost deductions may also lose value in an inflationary environment though in part this depends on the inventory method that is used. A common method, based on the principle of first-in, first-out, results in inventory cost deductions at historical value in an inflationary environment that leads to an overstatement of profits. The last-in, first-out principle is less likely to lead to an overstatement of profits unless inventories are substantially run down. On the other hand, higher inflation would raise nominal interest rates, largely in step with inflation. This increase in nominal interest rates reflects preservation of the capital value or in essence a partial payment of principal. As a result, corporations would be able to deduct not only the true interest component but also a component reflecting repayment of principal, tending to understate true profits, and hence lowering corporate profit tax liabilities.

Changes in the real exchange rate have several direct effects on corporate income. A decline in the real exchange rate would raise the relative cost of imported goods used by corporations as inputs into production and this increase in cost would tend to lower profitability. Exporters might, on the other hand, benefit, offsetting higher input costs through stronger sales.

A final somewhat complicated issue is the effect that foreign exchange revaluation has on overall corporate income. When revaluation of foreign denominated assets and liabilities is undertaken, changes in nominal exchange rates would affect corporate tax liability even in the absence of changes in real exchange rates. For instance, if the currency depreciates foreign denominated assets and liabilities would rise in domestic currency terms. Assets would generate income and liabilities losses. Tax systems differ in how they treat these foreign exchange gains and losses, or even when they require enterprises to declare them and allowable offsets. Hence there is no summary way of stating the overall impact on corporate income and hence taxes.

Econometric approaches

Various econometric approaches have been used to investigate these issues. One approach examines the relationship between economic variables and tax revenues, relying largely on cross-sectional (and more recently, panel) data. These studies relate the variation in the share of tax revenue in GDP (usually central government revenue only) to differences in the level of development, the structure of the economy, quality of governance indicators, indices of

trade liberalization, and macroeconomic variables.[8] Previous tax effort studies have found that the income level, agriculture share, and other economic structure variables, and the share of international trade in GDP (which is sometimes used as an index of trade liberalization and referred to as the degree of openness), among others, are often statistically significant in explaining the cross-country variation in the revenue ratio.[9] While existing studies have identified important determinants of the revenue ratio, these variables do not fully explain the cross-country variation in the ratio. There appears to be a large country-specific component to the tax share, as evidenced by persistence in the tax shares over time.

In order to capture the influence of macroeconomic developments, it is desirable to have a time series of data and to model explicitly both the persistence in tax shares over time and reasons that these tax shares might change. A simple panel analysis, either with fixed or random effects, is generally not sufficient to fully investigate the lag structures inherent in macroeconomic variables. With a sufficiently long time series of data, it is possible to separate the shorter term and longer term effects of macroeconomic variables, though this is generally not feasible with only a short time series. In addition, in a model using macro variables, there are likely to be some endogenous explanatory variables.

Using a panel of 27 countries from Africa, Asia and the Western Hemisphere, covering the period 1980 to 1992 and a panel of 105 countries, spanning 1980 to 1995, Ebrill et al (1999) examine two complementary models of the determinants of import and international trade tax revenue. Using a fixed-effects and an instrumental regression framework they conclude that tariff reforms do not necessarily lead to lower trade tax revenue. They find that, in both models, depreciation of the exchange rate is significantly linked to higher trade tax revenues, confirming Tanzi's hypothesis, but contrasting with Ghura (1998), which did not find a significant relation.

Khattry and Mohan Rao (2002) also examine this issue, using a panel of 80 developing and industrialized countries, covering the period 1970 to 1998. Employing a fixed-effects regression framework, they find that trade liberalization is negatively correlated with total tax revenue and international trade tax revenue, but they find no significant link between the exchange rate and international trade tax revenue. They also find that countries are in general already below their measured revenue-maximizing tariff rate, suggesting that tariff reductions would reduce international trade tax revenues.

Adam, Bevan, and Chambas (2001) examine the relationship between tax revenue, exchange rates, and trade openness in Sub-Saharan Africa, using a difference General Method of Moments (GMM) dynamic panel estimation. Their model adds to this literature in positing both a more general econometric specification (though the time series is too short to fully

[8] See, for example, Tait, Grätz, and Eichengreen (1979). More recent studies include Stotsky and WoldeMariam (1997), and Ghura (1998).

[9] Stotsky and WoldeMariam (1997) provides a summary of the significant variables in the existing studies.

capture the time-related dynamics) and two variables for the exchange rate, one that reflects the equilibrium exchange rate and the other reflecting the degree of misalignment of the exchange rate. [10] Although not a focus of their work, they proxy trade liberalization through an openness variable. They conclude that openness raises overall tax revenue in CFA franc countries while it has little effect in non-CFA franc countries, though the disaggregated revenue outcome suggest that it raises trade tax revenue and lowers goods and services tax revenue.

They also find that depreciation and removal of real exchange rate disequilibrium lowers tax yield in CFA countries while it has the opposite effect in non-CFA countries. Their results vary by component of tax revenue. For income taxes, the exchange rate has no effect in non-CFA countries while depreciation has a strongly positive effect in CFA countries, though it weakens over time. Movement toward equilibrium in the exchange rate has a negative effect on income taxes. For trade taxes, depreciation of the exchange rate is linked to higher revenue, though the precise effect differs across CFA and non-CFA countries. For goods and services taxes, real exchange rate depreciation and movement of misalignment in a more depreciated direction tend to increase goods and services taxes in non-CFA countries but to decrease the tax yield in CFA countries. Overall, they conclude that the poor revenue performance in the CFA countries in that period reflected mainly differences in environmental and structural factors, and to different responses to changes in the equilibrium real exchange rate, but that misalignment of the exchange rate also played a role.

III. Data and Methodology

This section explains our empirical methodology and the data set.

For the estimation, we consider two proxies for the degree of liberalization.[11] The first is the traditional measure of openness, defined as international trade as a share of GDP. A higher ratio is taken to indicate greater trade liberalization. Ebrill et al (1999) and Adam et al (2001) employ the traditional measure of openness. The second is the collected tariff, measured by the ratio of import duties to the value of imports. With this measure, a decline in the index is taken to indicate greater trade liberalization. In addition to the traditional measure of

[10] Adam et al (2001) construct the misalignment variable by estimating an equation for the long run or equilibrium exchange rate and then calculate deviations from this exchange rate as the degree of misalignment. See their study for details (pp. 190–191).

[11] Since there is no ideal measure of trade liberalization, this study presents two measures for conceptual and practical reasons. A number of previous studies have attempted or have developed indicators of openness or trade restrictiveness and measures that summarize the overall stance of a country's trade and exchange rate regime based on multi-year research projects. The appropriateness of these indicators depends on several factors and is discussed in Appendix I of IMF (1998) and the references therein. IMF (1998) develops a trade restrictiveness index that is based on a 10-point scale that combines measurements of the restrictiveness of tariffs and non-tariff barriers.

openness, Ebrill et al (1999) also use the collected tariff rate and the appropriateness of this measure is discussed in that paper. [12] A third possibility is the ratio of international trade taxes to international trade, which includes the export component of taxes and trade. This measure is used by Khattry and Mohan Rao (2002). However, this measure is less likely to be accurate as a measure of trade liberalization since changes in exports are less closely linked to trade liberalization than changes in imports. An alternative approach makes use of episodes of trade liberalization, as in Ebrill et al (1999). However, the difficulty in constructing a sufficient panel data set and the judgment involved in determining what constitutes an episode of trade liberalization precluded the use of this approach.

The data set is that used by Adam et al (2001) augmented by additional variables for the collected tariff and real effective exchange rates. A detailed description of their data is provided in their paper.[13] [14] The sample period is 1980-1996.

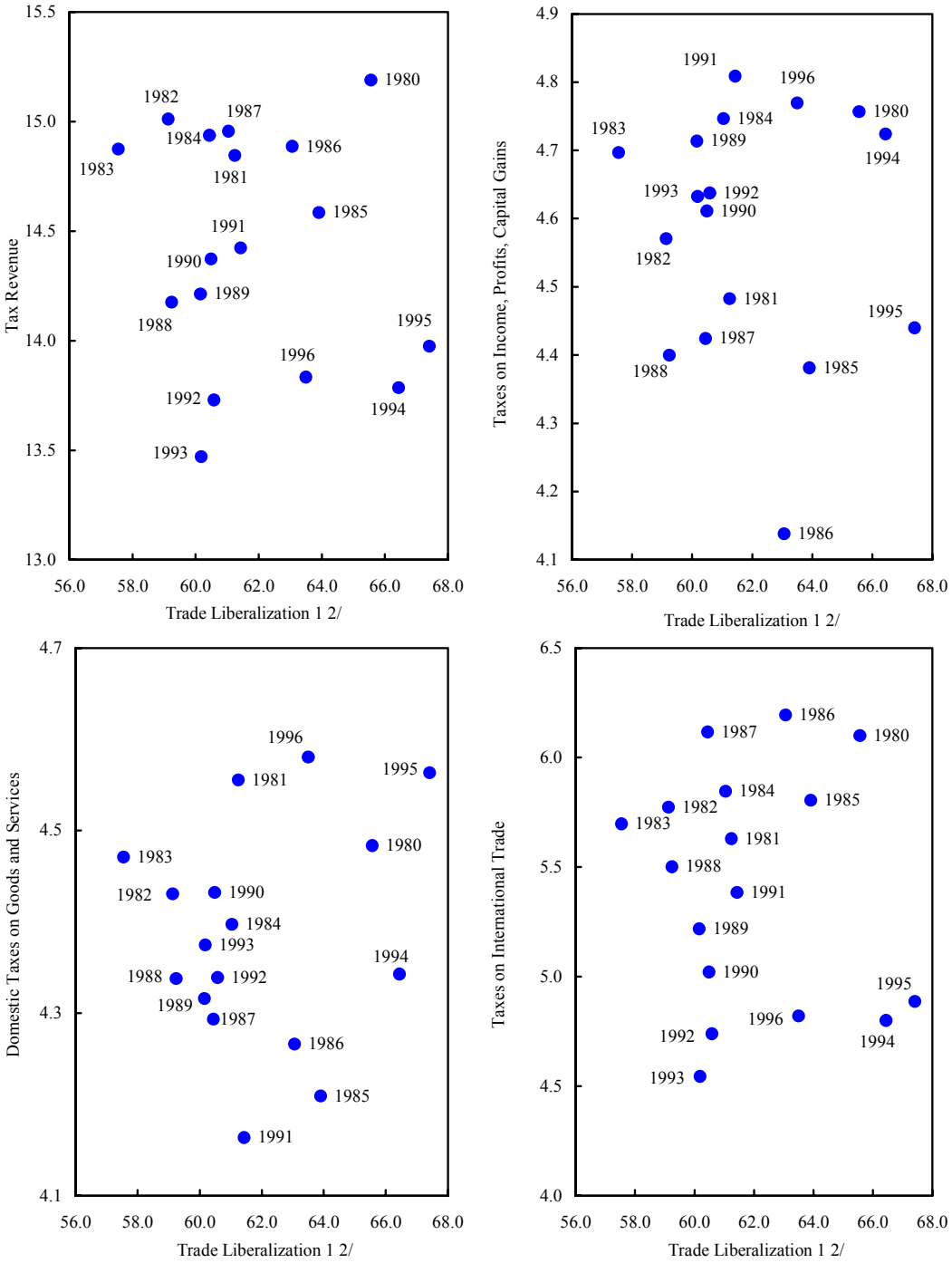
Some plots, using simple year country averages for each variable, are useful to examine. Figures 1–2 show the pattern of the relationship between each major component of tax revenue and the two proxy indicators of trade liberalization. For the first measure of trade liberalization, there does not emerge any clear pattern to the data. For the second measure, there appears to be a positive correlation between overall tax revenues and taxes on international trade and trade liberalization, suggesting that higher effective tax rates (or a less liberal environment) is linked to higher revenues. Figure 3 shows the pattern of the relationship between each major component of tax revenue and the real effective exchange rate. Again, although no clear pattern emerges, for overall tax revenues and taxes on international trade, there appears to be a positive relation between increases in the exchange rate (appreciation) and higher revenues. Figures 4–6 show the regional dimension, with the top figures showing CFA countries and the bottom non-CFA countries. The figures indicates a positive correlation between the two trade liberalization measures for CFA countries and none for the non-CFA countries. Figure 5, showing the relationship between trade liberalization measured as openness and the real effective exchange rate, illustrates quite clearly for the CFA countries the effect of the devaluation in 1994, as there is a sharp break

[12] Although not focused on revenue issues, Greenaway, Morgan and Wright (2002), in their study of the relationship between trade liberalization and growth in developing countries, report results suggesting that problems of misspecification and the variation in the measures of liberalization are in part responsible for inconclusive results relating to the link between trade liberalization and growth.

[13] We would like to thank Professor Christopher Adam for providing us with the data. The collected tariff and real effective exchange rate variables are derived from unpublished IMF African Department data and the IMF's financial statistics database.

[14] Although this paper does not provide an explicit theoretical model to underlie the empirical analysis, the theoretical model outlined in Adam et al (2001) can form such a basis.

Figure 1. Sub-Saharan Africa Countries:Comparative Structure of Tax Revenue and Trade Liberalization 1, 1980-96 1/
(In percent of GDP)

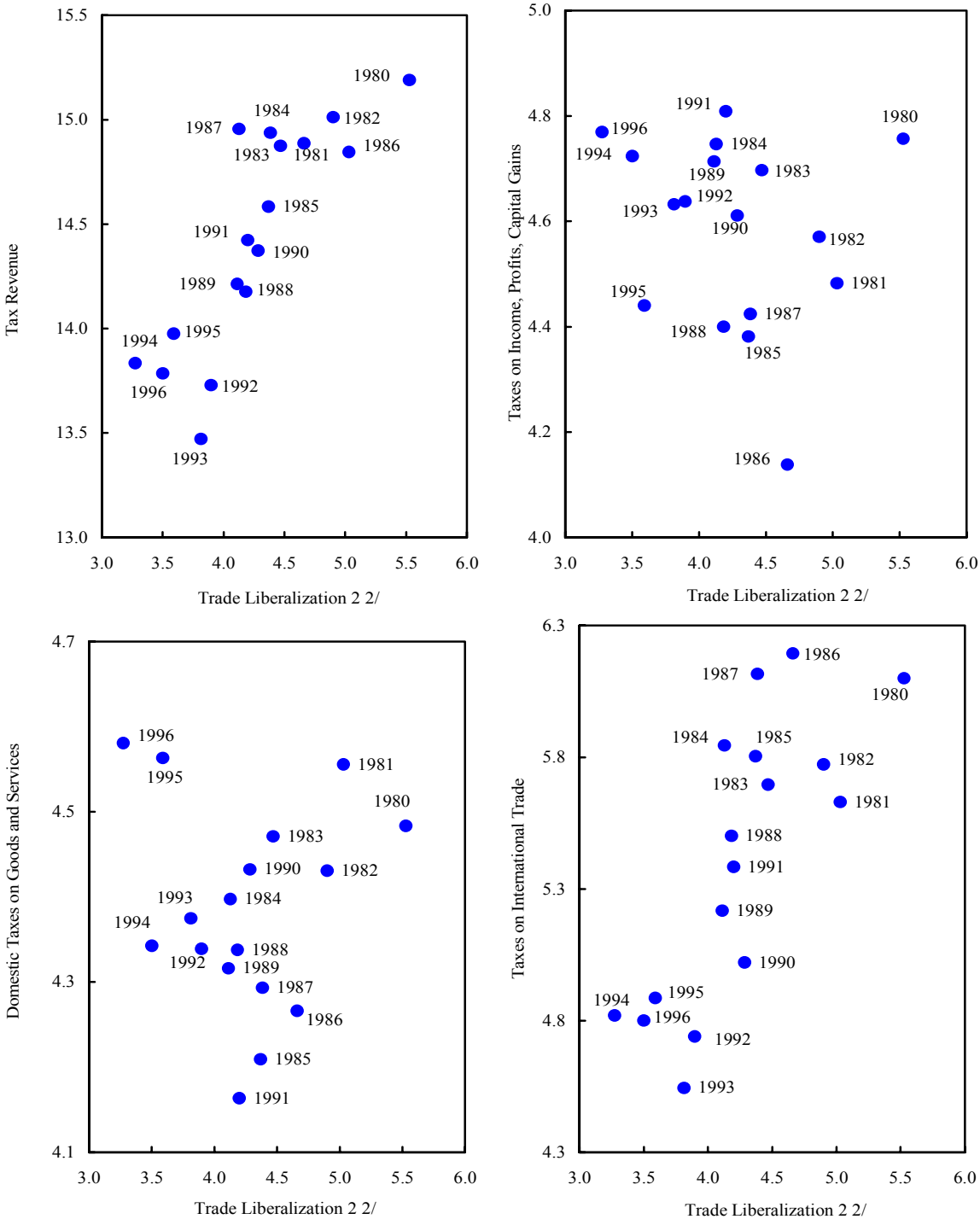


Sources: IMF, Government Finance Statistics, International Financial Statistics; and World Economic Outlook.

1/ Variables are averages over the observations for each year.

2/ Trade Liberalization 1 is defined as international trade as a share of GDP.

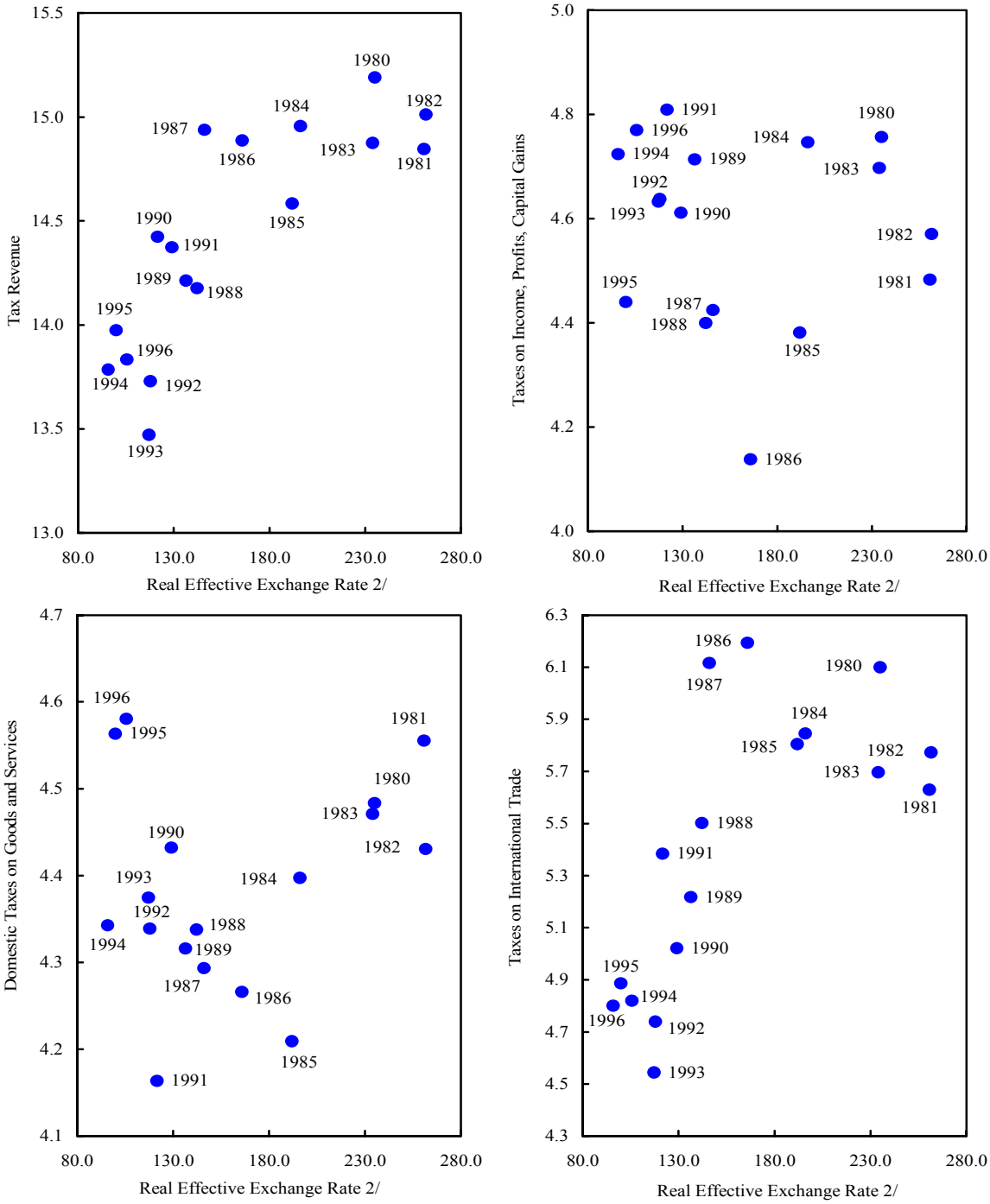
Figure 2. Sub-Saharan Africa Countries: Comparative Structure of Tax Revenue and Trade Liberalization 2, 1980-96 1/
(In percent of GDP)



Sources: IMF, Government Finance Statistics, International Financial Statistics; and World Economic Outlook.

1/ Variables are averages over the observations for each year.
2/ Trade liberalization 2 is measured by the ratio of import duties to the value of imports in percent.

Figure 3. Sub-Saharan Africa Countries: Comparative Structure of Tax Revenue and Real Effective Exchange Rate 1980-96 1/
(In percent of GDP)

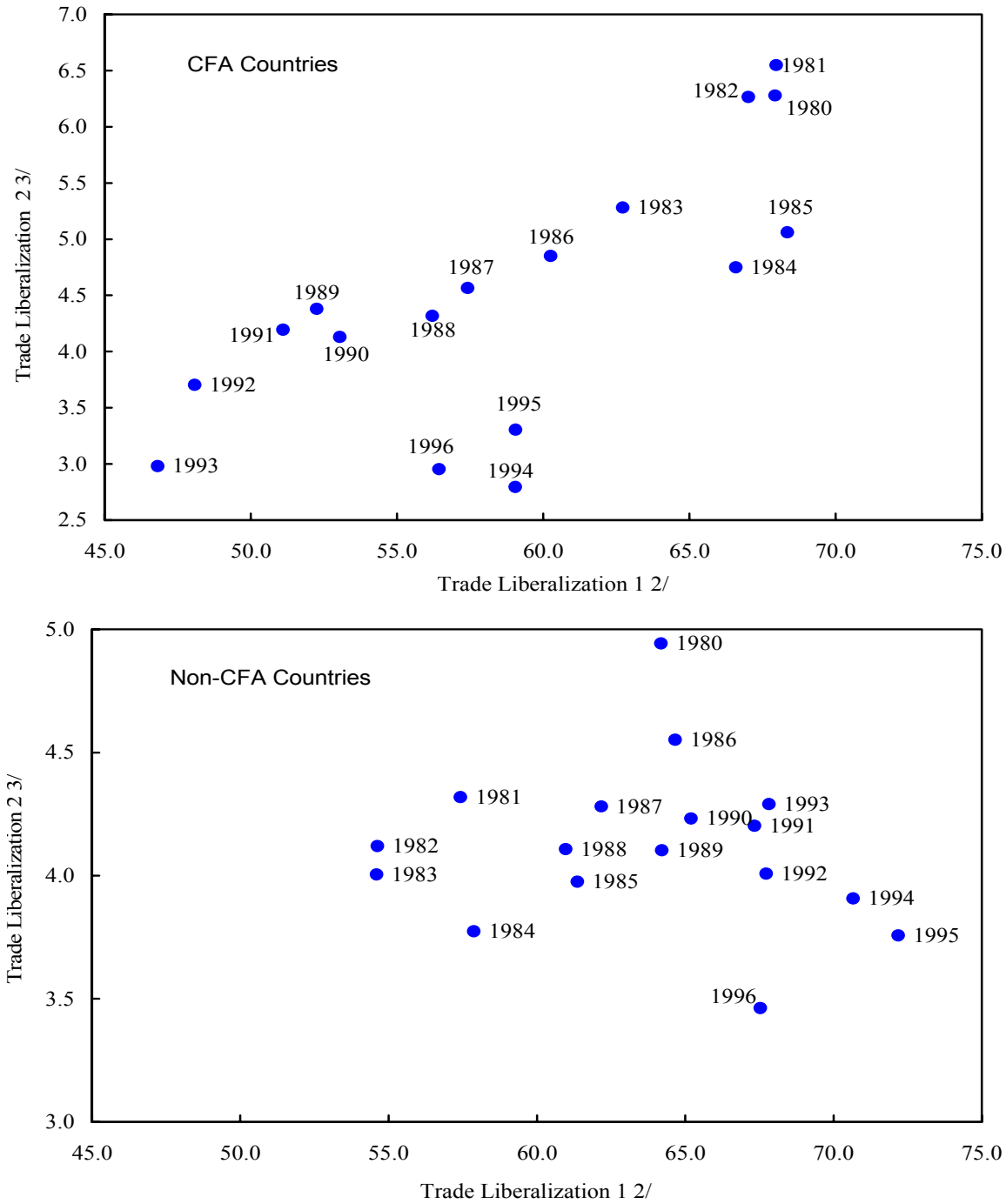


Sources: IMF, Government Finance Statistics, International Financial Statistics; and World Economic Outlook.

1/ Variables are averages over the observations for each year.

2/ Index 1995=100. An increase reflects an appreciation of the real effective exchange rate.

Figure 4. Sub-Saharan Africa Countries: Trade Liberalization 1 and 2 by Region, 1980-96 1/
(In percent)

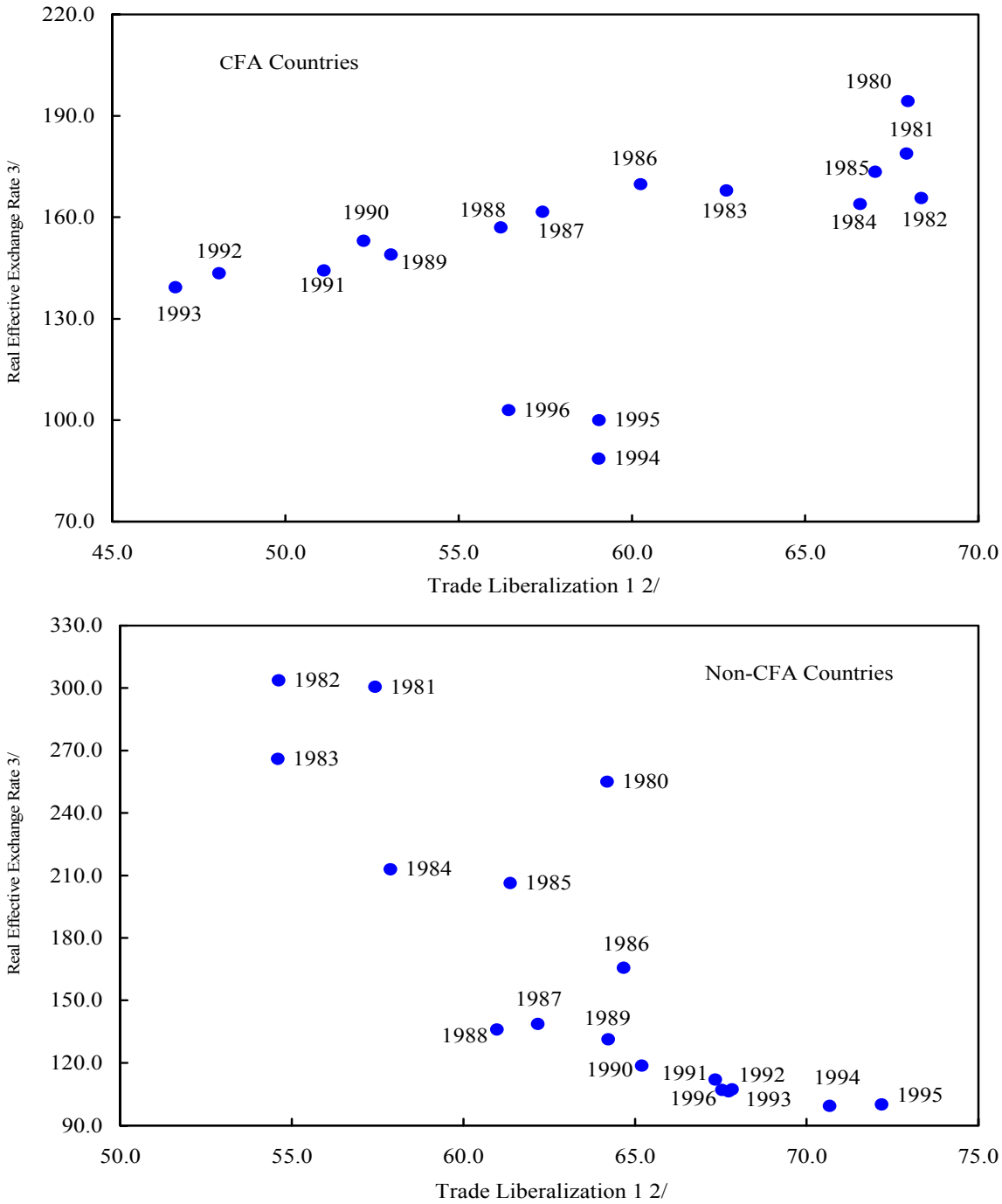


Sources: IMF, Government Finance Statistics, International Financial Statistics; and World Economic Outlook.

1/ Variables are averages over the observations for each year.
2/ Trade liberalization 1 is defined as international trade as a share of GDP.
3/ Trade liberalization 2 is measured by the ratio of import duties to the value of imports in percent.

Figure 5. Sub-Saharan Africa Countries: Real Effective Exchange Rate and Trade Liberalization 1 by Region, 1980-96 1/

(In percent)

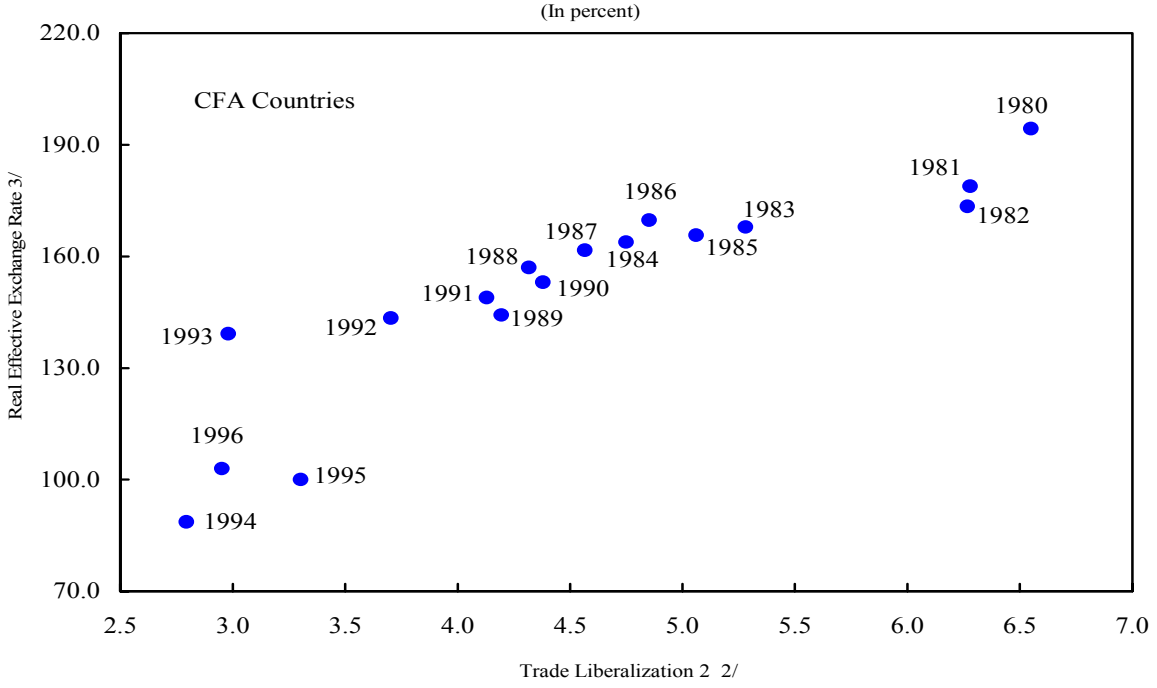


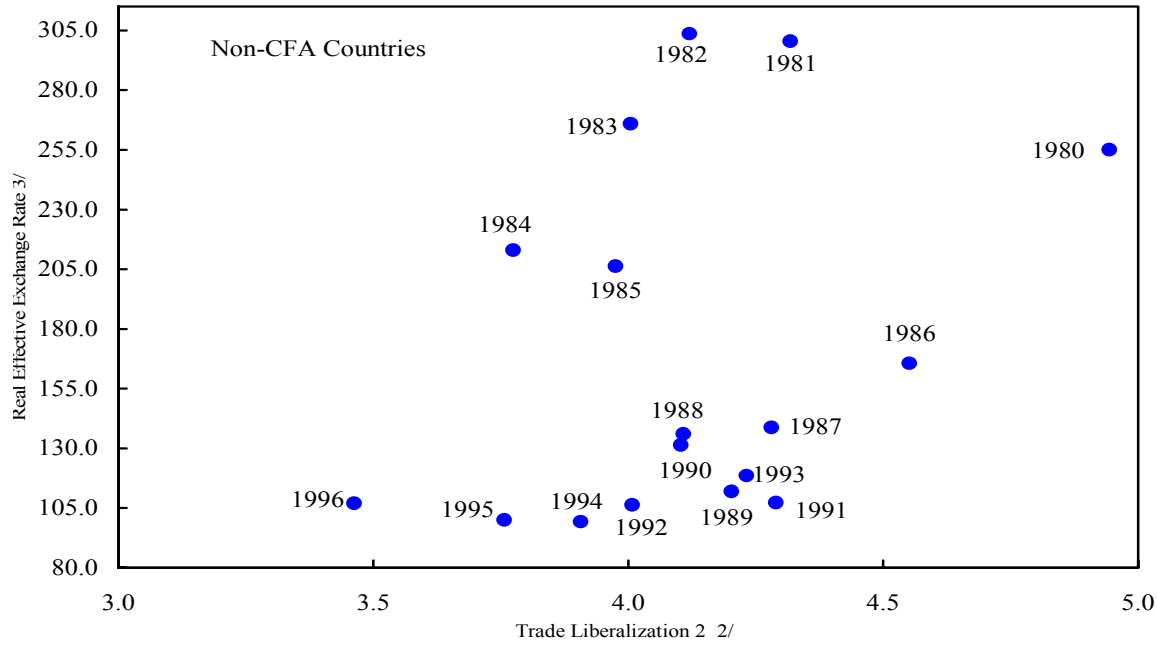
Sources: IMF, Government Finance Statistics, International Financial Statistics; and World Economic Outlook.

1/ Variables are averages over the observations for each year.
2/ Trade liberilazation 1 is defined as international trade as a share of GDP.
3/ Index 1995=100. An increase reflects an appreciation of the real effective exchange rate.

Figure 6. Sub-Saharan Africa Countries: Trade Liberalization 2 and Real Effective Exchange Rate by Region, 1980-96 1/

(In percent)





Sources: IMF, Government Finance Statistics, International Financial Statistics; and World Economic Outlook.

1/ Variables are averages over the observations for each year.
2/ Trade liberalization 2 is measured by the ratio of import duties to the value of imports in percent.
3/ Index 1995=100. An increase reflects an appreciation of the real effective exchange rate.

in the data at that point. The pattern while comparing the CFA and non-CFA countries is quite strikingly different with the CFA generally showing a positive correlation and the non-CFA a negative one. Figure 6, showing the relationship between trade liberalization measured as the collected tariff, shows a rather a somewhat similar pattern for the CFA countries, though without as sharp a break following the devaluation, and no clear correlation for the non-CFA countries. Altogether, these simple plots suggest that no clear and unambiguous patterns emerge for key variables.

Turning to the regression analysis, we estimate a dynamic panel model specification using a GMM estimator. We use the revenue-to-GDP ratios from various tax categories as dependent variables. They include (all as a share of GDP): total tax revenue, taxes on income and profits, taxes on goods and services, and international trade taxes. We exclude some smaller categories of revenues, such as property taxes and payroll taxes

We use the same general approach as in the previous tax effort literature and adopt independent variables similar to these studies as control variables in our analysis. These variables are: an index of trade liberalization (keeping in mind that an increase in the first measure and a decrease in the second measure indicates greater trade liberalization), real GDP per capita, the size of the agricultural sector, the size of the industrial (including mining) sector, net transfer of aid, government consumption, the inflation rate, the terms of trade, and (deviating from Adam et al.) the real effective exchange rate (measured as an index relative to 1995, where an increase in the index value represents appreciation).

In the tax effort literature, GDP per capita is included to capture the level of development. Higher income countries tend to have a more monetized economy and better tax administration, so GDP per capita is expected to have a positive relationship with the tax revenue to GDP ratio, and domestic tax components, and a more ambiguous relationship with trade tax revenue.

Variables reflecting the share of different industries in the economy capture the differences in the ability to tax components of the economy. Typically, agricultural activities are difficult to tax, especially in low income countries, where most agricultural activities are organized on a small-scale basis. Hence the share of agriculture is used as an explanatory variable to control for the difficulty in collecting taxes from this sector. Many studies have found a negative relationship between the share of agriculture and the total tax revenue ratio, even after controlling for per capita income, though a positive relationship might be found in Sub-Saharan African because agricultural exports are sometimes a good tax handle. The industrial share has also been used as an explanatory variable and may in low income countries proxy for mining share. It might be expected to have a positive relationship with total tax revenue, though for this group of African countries, there has been a high association between mineral resources and civil conflict, so a negative relationship is also possible, given that we do not capture the effect of civil conflict on revenues with any explicit variable (only country and time effects). As noted, trade liberalization has an ambiguous effect on revenues, including its components.

In addition to the control variables taken from the tax effort literature, we include macroeconomic and fiscal policy variables: the real effective exchange rate, inflation, the terms of trade, net transfers of aid, and government consumption. Also as noted, the effect of exchange rate changes on revenues is uncertain a priori. With regard to the other control variables, the effect on revenues is also likely to be ambiguous. A strengthening of the terms of trade, measured as the export price index divided by the import price index, suggests that export industries would be more profitable and hence generate higher income tax revenues and possibly taxes related to imports used as inputs. However, since exports are zero-rated, might imply a reduction of VAT. A weakening of the terms of trade might imply the opposite. Hence the overall outcome is uncertain. Similarly, the relationship between net transfers of aid and revenues are uncertain. There is some evidence that aid reduces tax effort, but these results are not uniform and might depend on the purposes of aid, requirements for counterpart funds and other factors. With regard to government consumption, it might be expected that government consumption would be positively correlated with revenues, or some components of it, but in a fully specified model of government decision-making, these fiscal policy variables would both be endogenously determined.

Using the panel data set, we postulate a first-order dynamic panel model of the following form:

$$TAXREV_{i,t} = \alpha_1 TAXREV_{i,t-1} + \alpha_2 \log(GDP)_{i,t} + \alpha_3 AGRI_{i,t}$$
$$+ \alpha_4 IND_{i,t} + \alpha_5 \log(GC)_{i,t} + \alpha_6 \log(NAID)_{i,t} + \alpha_7 \log(TOT)_{i,t} + \alpha_8 \log(EXCHANGE)_{i,t}$$
$$+ \alpha_9 (INFLATION)_{i,t} + \alpha_{10} \log(OPEN)_{i,t} + \alpha_{11} \log(OPEN) * (CFA)_{i,t} + u_i + \gamma_t + \varepsilon_{i,t}$$

where $TAXREV$ is the tax revenue variable, GDP is real GDP per capita, $AGRI$ is the share of agriculture in GDP, IND is the share of industrial (mining) activities in GDP, GC is the real government consumption share in GDP, $NAID$ is net transfers of aid, TOT is the terms of trade, $EXCHANGE$ is the real effective exchange rate, $INFLATION$ is inflation, $OPEN$ is the index of trade liberalization, CFA is a dummy for CFA franc countries, u_i is an unobserved country effect, γ_t is an unobserved time effect, and $\varepsilon_{i,t}$ is an unobserved random error term, where i represents the i-th country and t represents the t-th time period.

We control for the bias that is due to including a lagged dependent variable and the possible endogeneity of several of the explanatory variables. In particular, we hypothesize that in an equation to determine revenue share, any government variables, such as a spending variable or the trade liberalization measure, are likely to be endogenous, as well as any macro variables that might be affected critically by fiscal policy. Hence we treat per capita income, inflation, government consumption, and the trade liberalization variables as endogenous. To control for this endogeneity, we use a generalized method of moments (GMM) framework. The particular approach we adopt is based on the GMM estimators for the AR(1) panel data model and is due to Holtz-Eakin, Newey, and Rosen (1988), Arellano and Bond (1991), and Arellano and Bover (1995), who build on the fundamental work of Hansen (1982).

Specifically, the method involves transforming the above equation to remove the unobserved country effects and then estimating the resulting equation by instrumental variables.[15] Arellano and Bond (1991) derived a GMM estimator for the coefficients of such an equation based on first differences, using lagged levels of the dependent variables and the predetermined variables ("internal instruments"), and, second, taking differences of the strictly exogenous explanatory variables. The approach assumes that there is no second-order autocorrelation in the first-differenced idiosyncratic errors. Tests for autocorrelation and Sargan test of over-identifying restrictions are conducted to determine the appropriateness of the specification.

This paper conducts an instrumental GMM estimation based on an orthogonal deviation transformation as opposed to first differencing. The orthogonal deviation transformation of Arellano and Bover (1995) expresses each observation as the deviation from the average of future observations in the sample for the same unit (country) and it weights each deviation to standardize the variance. The advantage of this transformation is that it has the desirable property of guaranteeing that the transformed errors will be serially uncorrelated and homoskedastic, whenever the original errors are serially uncorrelated and homoskedastic. As noted by Arellano and Honoré (2000), the orthogonal deviation transformation is equivalent first, to applying a first difference transformation to get rid of fixed effects and second, to using generalized least squares to eliminate first degree autocorrelation resulting from first-differencing.

IV. Empirical Results

Tables 2–3 present regression results for the full sample period and the full sample of countries, to examine the determinants of total tax revenue, international trade taxes, taxes on goods and services, and income and profit taxes, under the assumption that revenue behavior can be pooled across exchange rate regimes (although we allow for the differential effect of openness and country specific effects).[16] The Appendix indicates which countries are included in the sample.

Results are reported both for the specification where trade liberalization is measured as the share of external trade in GDP (the first measure), and where trade liberalization is measured

[15] The method of transformation of the data matrix can be in levels, first differences, orthogonal deviations, combinations of first differences (or orthogonal deviations) and levels, or in deviations from individual means. See Arellano and Honoré (2000) for details.

[16] It has been suggested that the effect of our chosen explanatory variables on tax revenues may not be stable over time. While this might indeed be the case, our general conclusion that specification issues and different measures of trade liberalization lead to contrasting results is not affected by sub-sample analysis. Thus we have not reported the result of such analysis.

as the collected tariff (the second measure).[17] [18] To control for the possible endogeneity of several of the explanatory variables, we use previous observations of the explanatory and lagged dependent variables as instruments in the orthogonal deviation regression.[19] Our results are for one-step GMM estimators, with heteroskedasticity-consistent asymptotic standard error reported. We also report results for 1st and 2nd- order serial correlation and the Sargan specification test.[20] In the regressions generally, the assumption of serially uncorrelated errors is appropriate. Furthermore, the null hypothesis of the validity of the moment conditions cannot be rejected. Note that the tests for 1st and 2nd- order serial correlation are based on estimates of the residuals in first differences even though we have estimators obtained using orthogonal deviations. Orthogonal deviations can induce serial correlation in the transformed error term, if the original error term is serially uncorrelated but heteroskedastic.

The regression results in columns headed (1) and (2) in Table 2 present the outcome of examining the determinants of total tax revenue shares for our two different measures of trade liberalization. With respect to total tax revenue, the first thing to note is that the coefficient on the lagged dependent variable is positive and significant in the regressions for both measures of trade liberalization, suggesting that there is a partial adjustment over time in tax revenue. Using the first measure of trade liberalization, although per capita income is not significant, agricultural share, industrial share, government consumption, and the terms of trade all exert a positive effect on total tax revenue, and inflation exerts a negative effect. The positive effect of agricultural share may be explained by the influence of exports in providing a tax handle, as noted earlier. The real exchange rate and the trade liberalization measures are not, however, significant. Using the second measure, we find a somewhat different pattern of results. Industrial share is positive and marginally significant. The real exchange rate and inflation are both negative and significant, suggesting that real exchange rate appreciation and higher inflation depress revenues, consistent with Tanzi's hypotheses.

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[17] Empirical results herein were obtained by implementing the DPD package Version 1.2 of Doornik, Arellano and Bond (2001) which is a class of procedures in the programming language of Ox.

[18] The results for the trade liberalization measure using the ratio of international trade revenues to international trade in percent are only different in a few respects from the results for the second measure. Since this measure is viewed as less accurate a proxy, we do not present the results. They are, however, available from the authors.

[19] In addition to the lagged dependent variables, per capita income, inflation, government consumption, and openness are treated as potentially endogenous. For instruments we use their values dated at time t-2 The choice of instruments is not routine when the number of countries is small relative to the number of time periods. Soto (2003) discusses some issues associated with the choice of instruments.

[20] The Sargan test is designed to test the overall validity of all the instruments, employed to estimate the model, by analyzing the sample analog of the moment conditions. It attempts to answer the question, given that a subset of instrumental variables is valid and exactly identifies the coefficients, are the extra instrumental variables valid? Failure to reject the null should be interpreted as favoring the specified model.

Table 2. Revenue Equations: GMM Estimation 1980–96

(Full Sample Orthogonal Deviation Transformation)

	Dependent Variable			
	Total taxes as a share of GDP		Income taxes as a share of GDP	
	(1)	(2)	(3)	(4)
lag_dv	0.563 [5.02]	0.538 [5.79]	0.738 [5.59]	0.632 [5.35]
lgdp	-0.007 [-0.33]	-0.002 [-0.12]	0.017 [1.08]	0.027 [1.96]
agri	0.137 [2.58]	0.036 [0.42]	-0.057 [-1.71]	-0.054 [-2.05]
ind	0.214 [3.21]	0.133 [1.66]	0.018 [0.54]	0.054 [1.29]
lgc	0.019 [2.28]	0.012 [1.01]	-0.003 [-0.77]	-0.005 [-0.93]
lnaid	0.036 [1.21]	0.017 [0.52]	0.008 [0.46]	-0.000 [-0.01]
ltot	0.029 [2.19]	0.003 [0.19]	-0.002 [-0.40]	-0.002 [-0.26]
lexchange	-0.011 [-0.62]	-0.030 [-2.07]	0.008 [0.84]	0.007 [0.76]
inflation	-0.023 [-4.11]	-0.020 [-4.88]	-0.004 [-1.02]	-0.003 [-0.96]
lib_index1	0.001 [0.11]		0.000 [-0.03]	
lib_index1cfa	0.042 [1.38]		0.016 [1.33]	
lib_index2		-0.010 [-0.92]		-0.012 [-1.94]
lib_index2cfa		0.026 [0.92]		0.024 [1.34]
(m1)	-3.528 [0.00]	-3.481 [0.00]	-3.074 [0.00]	-2.702 [0.01]
(m2)	0.861 [0.39]	0.841 [0.40]	0.871 [0.38]	0.525 [0.60]
Sargan	63.28 [0.90]	69.40 [0.77]	100.70 [0.05]	104.3 [0.03]

Notes.

1. Year dummies are included in all specifications.
2. Equations estimated with one-step heteroscedastic standard errors.
3. Robust t-ratios in parentheses
4. m1 and m2 are tests for first-order and second-order serial correlation in the first differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation, with p-value in parentheses.
5. Sargan is a test of the over-identifying restrictions, asymptotically distributed as a $\chi 2$ under the null of instrument validity, with p-value in parentheses.
6. Definitions of the variables and the country list are provided in the Appendix.

The regression results in columns headed (3) and (4) in Table 2 present the results for income taxes for the two measures of trade liberalization. We observe again a positive and significant effect of the lagged dependent variable. Using the first measure of trade liberalization, agricultural share is negatively linked to income tax revenues, and no other variables are significant. Using the second measure, we find a positive effect of per capita income and a negative effect of agricultural share. Neither the exchange rate or inflation variables are significant. For the second measure of trade liberalization, the coefficient is negative and significant, which suggests that a higher value of the collected tariff (which we interpret as less liberalization) is linked to lower revenues, so trade liberalization appears beneficial for income tax revenues.

The regression results in columns headed (5) and (6) in Table 3 present the results for international trade taxes. The coefficient on the lagged dependent variable is positive and significant. For the first measure of trade liberalization, per capita income, the real exchange rate, and inflation are negatively linked to trade taxes. Agricultural share and government consumption are positively linked. Using the second measure of trade liberalization, per capita income and the real exchange rate are negatively linked to trade revenues. Interestingly, trade liberalization is not significantly linked to trade revenues, using either measure.

The regression results in columns headed (7) and (8) in Table 3 present the results for taxes on goods and services. The effect of the lagged tax share is positive and significant. For the first measure of trade liberalization, the industrial share, government consumption, and terms of trade are positive and significant, while inflation is negative and significant. The real exchange rate and trade liberalization variables are not significant. For the second measure, the industrial share and terms of trade are positive and significant, and inflation is negative and significant. Neither the exchange rate or trade liberalization measures are significant.

Overall, these results suggest that there is strong persistence over time in total tax revenues and all components of revenues. Some evidence is found that trade liberalization has a positive effect on income tax revenue but otherwise is not strongly linked to total tax revenue or its components. The results are not uniform across the specifications, and no significant difference between CFA and non-CFA countries is found. The sensitivity of the results to the measure of trade liberalization suggests the need for careful consideration of the best way to proxy this variable.

Some evidence is found of a negative link of real exchange rate appreciation to overall tax revenues and to trade tax revenues. For the second measure of liberalization, with the exception of income taxes and trade taxes, inflation is negatively linked to revenues.

These results suggest that trade liberalization accompanied by an appropriate monetary and exchange rate policy does not have a significant effect on overall tax revenue though some effect on income tax revenue. Appreciation of the exchange rate and increases in inflation generally speaking lead to lower overall tax revenue, though the results vary by component of taxes. These results show some consistency with the results of both Adam et al and

Khattry and Mohan Rao, though in neither case are the results uniformly consistent. These results also show consistency with Ebrill et al. in the main finding on trade liberalization.

Table 3. Revenue Equations: GMM Estimation 1980–1996

(Full Sample Orthogonal Deviation Transformation)

	Dependent Variable			
	International trade taxes as a share of GDP		Taxes on goods and services as a share of GDP	
	(5)	(6)	(7)	(8)
lag_dv	0.472 [4.40]	0.463 [3.73]	0.765 [7.98]	0.727 [9.14]
lgdp	-0.050 [-3.23]	-0.043 [-2.81]	0.004 [0.18]	0.007 [0.34]
agri	0.127 [1.98]	0.057 [0.83]	0.001 [0.01]	0.045 [0.88]
ind	0.045 [0.80]	0.059 [0.80]	0.114 [2.31]	0.137 [2.85]
lgc	0.015 [1.87]	0.010 [0.81]	0.008 [1.88]	0.006 [1.25]
lnaid	-0.004 [-0.12]	0.013 [0.32]	0.002 [0.11]	0.005 [0.26]
ltot	0.008 [1.05]	-0.002 [-0.12]	0.015 [1.88]	0.018 [2.15]
lexchange	-0.029 [-3.75]	-0.034 [-3.24]	0.009 [0.66]	0.011 [1.33]
inflation	-0.012 [-2.21]	-0.006 [-1.17]	-0.006 [-2.14]	-0.011 [-3.98]
lib_index1	0.002 [0.23]		-0.004 [-0.59]	
lib_index1cfa	0.027 [1.17]		0.018 [1.27]	
lib_index2		0.010 [1.12]		-0.010 [-1.25]
lib_index2cfa		0.011 [0.43]		0.008 [0.42]
(m1)	-3.442 [0.00]	-3.022 [0.00]	-2.774 [0.01]	-2.838 [0.01]
(m2)	-0.858 [0.39]	-0.674 [0.50]	0.051 [0.96]	-0.195 [0.85]
Sargan	64.23 [0.89]	78.47 [0.50]	69.02 [0.78]	84.85 [0.31]

Notes.

1. Year dummies are included in all specifications.
2. Equations estimated with one-step heteroscedastic standard errors.
3. Robust t-ratios in parentheses
4. m1 and m2 are tests for first-order and second-order serial correlation in the first differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation, with p-value in parentheses.
5. Sargan is a test of the over-identifying restrictions, asymptotically distributed as a $\chi 2$ under the null of instrument validity, with p-value in parentheses.
6. Definitions of the variables and the country list are provided in the Appendix.

V. CONCLUSION

This paper has investigated the relationship between the tax revenue-to-GDP ratio, trade liberalization, and changes in the exchange rate using a panel data set of Sub-Saharan countries. Our results suggest that trade liberalization, accompanied by appropriately supportive monetary policies, may preserve tax yield. This result has important implications for countries that have been reluctant to undertake trade liberalization for fear of the revenue consequences.

Data Definitions

Lag_dv	lag of dependent variable.
Lgdp	(log) real per capita income
Agri	agricultural share in GDP
Ind	industry (including mining) share in GDP
Lgc	(log) government consumption as a share of GDP
Lib_index1	(log) openness: international trade as a share of GDP
Lib_index2	(log) openness: ratio of import duties to value of imports
Lnaid	(log) net transfers of aid.
Inflation	annual inflation
Ltot	(log) terms of trade.
Lexchange	(log) real effective exchange rate, 1995=100. Increase indicates appreciation

The country classification is as follows: CFA and non-CFA.

(1) Non-CFA.
Burundi; The Gambia; Ghana; Kenya; Madagascar; Mauritania; Malawi; Mauritius; Rwanda; Sierra Leone; Tanzania; Uganda; Zambia; and Zimbabwe.

(2) CFA.
Benin; Burkina Faso; Central African Republic; Cote d'Ivoire; Mali; Niger; Senegal; and Togo.

Adam et al (2001) excluded from the sample two categories of countries: First, countries whose tax base is dominated by natural resources and second, countries for which there were insufficient or dubious data over the sample period. See, Adam et al (2001) for details.

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