Fiscal Policy and Tax Incidence

Mozambican tax system in comparative perspective

Sam Jones

Discussion papers

No. 39E, Chapter 6
April 2007

National Directorate of Studies
and Policy Analysis

Ministry of Planning and
Development

Republic of Mozambique

The intent of the discussion paper series is to stimulate discussion and exchange ideas on issues pertinent to the economic and social development of Mozambique. A multiplicity of views exists on how to best foment economic and social development. The discussion paper series aims to reflect this diversity.

As a result, the ideas presented in the discussion papers are those of the authors. The content of the papers do not necessarily reflect the views of the Ministry of Planning and Development or any other institution within the Government of Mozambique.

The Logo was kindly provided by the Mozambican artist Nlodzy.

Contact:

Sam Jones
National Directorate of Studies and Policy Analysis

(DNEAP)

Ministry of Planning and Development
Av. Ahmed Sekou Touré nº 21, 7º andar

Maputo, Mozambique

Tel: (+258) 2 1 499442

Fax: (+258) 2 1 492625

Web: www.mpd.gov.mz

Email: esamjones@gmail.com

Mozambican tax system in comparative perspective

Sam Jones

Abstract

This study analyses Mozambique's historical tax revenue performance from the perspective of taxation potential. It is hypothesised that taxation receipts in developing countries are constrained by relatively slow-moving factors such as economic structure and institutional performance. A cross-country panel dataset is constructed and investigated, leading to a strong confirmation of the proposition. Applied to the specific case of Mozambique, the model provides an accurate prediction of recent taxation performance, suggesting that Mozambique has not been a poor-performing outlier in comparative terms. However, future revenue collection targets must account for expected gains from non-tax revenues including natural resource exploitation.

1.   Introduction

The complaint that developing countries raise inadequate tax revenues and have poor administrative systems is not new. Reforms to 'strengthen tax administration' and bolster domestic revenues are characteristic of IMF programmes across the developing world, in part verified by the rapid uptake of the VAT in Africa and Asia since the late 1980s to the present day (see Ebrill et al., 2001). These issues have been prominent in Mozambique since the pursuit of structural adjustment and stabilization in the mid-1980s. To date the country has undergone various rounds of taxation reform; however, since 1993 these have yet to translate into a sustained enhanced domestic revenue position. The current level of the tax ratio, defined as total tax revenues divided by nominal GDP, is around 11% and is the object of substantial concern particularly in light of external financing (via foreign aid) of the budget at well over 10% of GDP.

> Despite these criticisms, it is helpful to recall the empirical phenomenon described by Wagner's Law. This tells us that the relative size of government in the economy tends to increase with average economic prosperity, which also means that the relative volume of domestic revenues in low income countries tends to be smaller than that raised in richer countries. It remains uncertain, however, to what extent and in what ways domestic taxation possibilities are constrained by empirical conditions in developing countries. This is an important policy issue as a robust analysis would provide an analytical foundation to assess the adequacy of observed tax ratios and/or the realism of fiscal policy goals.

The principal objective of this paper is to evaluate the aggregate performance of Mozambique's tax system against experiences of other developing countries. In the first instance, the nature of constraints to tax revenue generation is investigated at the cross-country level. In turn, this framework is applied to the specific case of Mozambique. Given the explicit focus on aggregate revenue levels, it must be highlighted that the administration of taxes and the fine print of tax policy are not

explored here. This is not to dismiss their importance, however, particularly as administration and policy choices are fundamental determinants of the equity and efficiency outcomes of a given taxation system.

By way of structure, section 2 provides a brief summary of critical perspectives on the Mozambican tax system. This leads, in section 3, to an analysis of the cross-country evidence for the relationship between developmental conditions and overall tax performance via elaboration of an econometric model. Consistent with previous research (e.g., Teera and Hudson, 2004), tax ratios in developing countries are found to be strongly related to 'deep' economic and institutional variables. In Section 0 the model is applied to Mozambique, permitting calculation of the expected tax effort based on economic and institutional conditions. Section 5 concludes.

2.   Current perspectives

The history of the reforms and performance of Mozambique's tax system is documented elsewhere and need not be repeated here (see Chapter 3 to this volume; also IMF, 2005). Two important points may be highlighted however. First, over the last 20 years Mozambique's tax system has undergone two periods of reform. With the dismantling of socialist central planning in favour of market-based reforms in the mid-1980s, a new taxation system was implemented from 1987 including a modified sales tax and various income taxes. According to an IMF report (Lopes and Sacerdoti, 1991), these reforms were integral components of the Economic Recovery Programme (stabilization and structural adjustment) pursued under the ambit of World Bank and IMF support. From 1996, however, a further wave of reform was initiated which involved replacing many of the principal taxation instruments with

'improved' variants such as a VAT (instead of a cascading sales tax) and comprehensive income tax instruments. Wide-ranging reforms to customs duties and administrative procedures were also introduced, including the employment of external consultants as temporary administrators of the entire customs organization. As before, this second period of reform was supported heavily by external actors, with IMF experts providing detailed advice on the content of new instruments. Towards the end of this phase the IMF was able to conclude that the country owns "a comprehensive tax system that is broadly in line with best practice" (IMF, 2005: 20).

Second, and despite the above, it is evident that since the first phase of reforms tax revenues have remained relatively stable as a percentage of GDP. This is depicted in Figure 1, which plots total and tax revenue for the period 1980-2004. Although there is short-term volatility, the long-term trend in both total and tax revenues has been flat during the post-war period (since 1992), averaging 12.1% and 11.0% respectively. One also notes that the increase in total revenues registered in 2005 was primarily a non-tax phenomenon, in part associated with the inclusion of certain sectoral revenues (user-fees) previously not captured at a central level. The post-civil war period simply shows that real revenues have grown *pari passu* with real income.

With respect to criticisms of the current taxation system in Mozambique, two main perspectives stand out.[1] The first is motivated primarily by a concern that the tax ratio is insufficient and argues that increases in the ratio are necessary not only to enhance the sustainability of public finances but also to reduce the extent of fiscal non-compliance. The resulting recommendations focus on a combination of administrative

---

[1] What follows is a characterization of two divergent perspectives and, thus, deliberately ignores more nuanced positions.

improvements and a slight tightening of tax policy, the latter aiming to cut certain tax privileges and exemptions that have come to erode the tax base. This view is most prominent in two recent IMF studies for Mozambique (Varsano et al., 2006; IMF, 2005). Although these avoid defining concrete targets for overall revenues, they both suggest that the tax ratio potential of the country is around 20% of GDP and that non-compliance and exemptions are the main causes of the observed ratio. Varsano et al. (2006), for example, cite Kenya as a suitable comparator due to its apparently similar economic structure and strong revenue effort of around 22%. They assert that even a 'medium' tax effort by Mozambican authorities would be commensurate with a tax ratio of approximately 17% of GDP. Importantly, underpinning this perspective is the opinion that the current set of tax instruments generally is adequate and tax rates should not be adjusted, at least before consolidation of the current system. Rather, tax administration is considered the priority, to be supported by a stable tax policy environment.

An alternative viewpoint is advocated by analysts who emphasise private sector development. In common with the first view, this perspective places substantial weight on the need for comprehensive administrative upgrading as well as simplification of the tax system to support compliance among smaller firms. In particular, improvements in the processing of VAT reimbursements and an increase in minimum taxation thresholds to reduce the tax burden for smaller tax operators are recommended (e.g., Bolnick, 2004a; Ernst & Young, 2004). This perspective goes further, however, contending that the structure of incentives in the tax system is distorted in favour of larger, import- and capital-intensive firms who also are comparatively well-resourced in terms of their administrative capacity. These studies

suggest that over the medium-term, Mozambique should move towards a system with a set of lower tax rates applied more equitably. This is in contrast to the current system, described as consisting of high effective tax rates by regional standards (Bolnick, 2004b), which only are softened if a company is able to gain access to fiscal benefits and/or tax exemptions. FIAS (2006) estimate, for example, that small businesses operating in full compliance with the normal tax system face a marginal effective tax rate (METR) of over 70% against 11% for a manufacturing firm operating under the investment incentives regime. Furthermore, as the fiscal benefits regime raises high bureaucratic transaction costs and directs significant reductions or exemptions towards capital items and/or intermediate imports, the regime effectively operates in favour of larger companies and capital-intensive investment. This argument asserts, therefore, that administrative improvements must be accompanied by deeper measures to reduce sector- and size-based distortions via a reallocation of the effective tax burden. Evidently, and at least in the medium-term, such a reorientation of the tax system would not be compatible with measures designed to achieve significant increases in the tax ratio.

3.   Tax revenue performance

3.1.   Background

A fundamental difference between the above viewpoints turns on the appropriate medium-term revenue target for Mozambique. While this invokes a broad range of issues, taxation theory and experience informs us that in the pursuit of taxation goals there exist inherent trade-offs between equity, economic efficiency, revenue generation and simplicity concerns (for elaboration see Slemrod, 1991; also Bolnick, 2004a). For developing countries in particular, it is recognised that the government's

scope to achieve specific objectives in any of these four dimensions often is limited by administrative capabilities as well as deep structural factors (Burgess and Stern, 1993; Heady, 2001).

With respect to the relative level of revenue that may be considered appropriate or desirable for a given country, the theoretical (optimal taxation) literature fails to provide clear guidance (Tanzi and Zee, 2000; Slemrod, 1991). However, empirical insights are plentiful and point in two analytical directions. First, are Musgrave's (1969) famous "tax handles" which refer to the extent of economic diversification as well as the nature of economic activities which may be inherently more or less difficult to tax. For example, low income countries dependent on a small number of (low return) agricultural activities are expected to raise less tax revenue than countries where economic activity is highly varied and concentrated in the formal sector. Empirical scholarship which seeks to identify the structural determinants of tax performance is well-established and need not be appraised here.[2] Suffice to say that real per capita income and trade openness are frequently found to be highly significant positive correlates of tax ratios across countries while dependence on agriculture is a negative correlate. It is trivial to illustrate the existence of a positive relationship between average per capita income and the relative size of government revenues in GDP, as described by Wagner's Law. This is shown in Figure 2 for low and middle income countries, based on the dataset employed in this study (see below).

A second analytical direction comes out of the extensive literature on the underlying determinants of economic growth (see Rodrik et al., 2004 for an overview). Taking

---

[2] For a general review of the literature see Bird et al., 2004; for sub-Saharan Africa see Ghura, 1998 also Stotsky and WoldeMariam, 1997

the argument that exogenous factors such as institutions are deep determinants of growth, it is a short step to contend that they may also have a strong influence on taxation performance. This derives from recognition that taxation is inherently contested (Slemrod, 1991). As such, the nature and effectiveness of taxation is dependent on the political relationship between tax payers (society) and tax raisers (state), which itself is closely associated with the quality of governance institutions. This line of argument, given prominence in the institutional economics literature, is supported by a considerable weight of historical evidence for both developed and developing countries as detailed in Moss et al. (2006); also see Bird et al. (2006). A related line of scholarship argues that the institutional and political features of developing countries have deep roots in exogenous geographic characteristics as well as former colonial experiences (Acemoglu, 2000; Ylönen, 2005). Institutional factors related to colonial heritage are particularly relevant in the case of taxation. First, tax legislation in most developing countries, as well as the structure of the judicial system, was directly inherited from colonial administrations. Second, the political acceptance of both the level and certain forms of taxation may have deep colonial roots. As such, these factors are likely to represent slow-moving constraints on the economic possibilities and/or interests of the state to achieve rapid, sustainable increments in the tax ratio.

3.2   Analytical framework

The above insights can be used to develop a general framework to inform analysis of taxation performance. The contested nature of taxation indicates that the observed level of taxation may deviate from the level envisaged by government in accordance with fiscal policy. Rather, the actual level reveals the preference of economic actors to

pay. Assuming that taxation enforcement is both costly and limited, the decision of a given actor to fully comply with his legal requirement to pay therefore will depend on a range of factors. Critical among these will be the perceived enforcement capacity of the government vis-à-vis the supposed difficulty of enforcement in light of the structure of economic activity. Furthermore, assuming that economic actors are imperfectly informed it follows that past trends in aggregate economic performance and taxation compliance are likely to guide current tax payment decisions.

Following from the above, and without developing a formal model from first principles, the observed nominal level of taxation R at time t can be defined as:

$$R_t = a_t Y_t \qquad\qquad (1)$$

$$a_t = f(\mathring{a}_t,\ r_{t-1},\ \mathbf{Z}_{t-1},\ \cdot\ ) \qquad\qquad (2)$$

where Y is the nominal level of income, a is the effective average rate of taxation (or the revealed preference to pay), $\mathring{a}$ the desired average rate of taxation as set per government policy, r the tax ratio ($r = a = R/Y$), and $\mathbf{Z}$ a vector of variables capturing economic structure, such as per capita GDP, and government enforcement capacity. In other words, $\mathbf{Z}$ refers to the demand and supply-side factors referred to in the previous subsection.

An important theoretical and empirical issue to address is the influence of the taxation system on growth and the structure of economic activity more generally; i.e., that the vector $\mathbf{Z}$ may not be strictly exogenous to a.[3] Economic theory certainly indicates that fiscal policy can have an affect on output growth. However, the channels by which it can do so are considered to be numerous, with the final outcome being dependent on

---

[3] For a general discussion of endogeneity in econometric modelling see Engle et al. (1983).

the combined effect of all forms of government financing and expenditure allocations on economic incentives (Gemmell, 2004).[4] In this sense, analysis of the relationship between growth and individual aggregate fiscal variables, such as the tax ratio, is unlikely to give robust results in the absence of more detailed fiscal policy measures. This is confirmed by empirical studies which fail to show a consistent or unambiguous partial impact of the aggregate taxation burden on output growth (Gemmell, 2004; Easterly and Rebelo, 1994; Gerson, 1988). Furthermore, given the existence of numerous non-fiscal (deep) determinants of growth, as well as the proposition in equation (2) that economic structure influences taxation performance with a lag, it is reasonable to agree with Tanzi and Zee (2000) that the *primary* direction of causation runs from these structural variables to taxation performance. Even so, one must not dismiss the point that the effective tax burden may be a material variable in a given country's growth function. As such, possible simultaneity between equations (1) and (2) must be considered in any empirical estimation; this point is discussed further below.

An immediate contribution of this framework is the clear suggestion of path-dependency in taxation performance, in turn giving an explanation for the frequently observed phenomenon of 'fiscal inertia' (World Bank, 1988; Bird and Zolt, 2005). The existence of fiscal inertia, which refers to the relative stability of the tax ratio over time within countries, is demonstrated in the available data. Figure 3 plots the cumulative distribution of the median rate of growth in taxation ratios, (the rate of growth of the weight of taxation in GDP), over the period 1990-2003 for each country

---

[4] Even the direction of the relationship between growth and taxation is not obvious *a priori*. For example, where coordination problems or other externalities mean that public investment is more productive than that of the private sector, a higher tax ratio may be consistent with a higher rate of growth (*ceteris paribus*).

in the dataset (see below, Section 0). It reveals that the distribution is tightly packed around zero, with over 75% of countries achieving a growth rate of under 3% per annum. As Burgess and Stern (1993) remark, without political will and the support of the private sector, attempts at revenue expansion are often systematically frustrated. This is exemplified by the 'Mexico paradox', discussed in Bird and Zolt (2005), where the tax ratio has remained stable for over 25 years despite marked enhancements in both tax administration and fiscal policy. This leads the authors to conclude that long-term changes in the tax ratio for Mexico will be possible only when an explicit consensus is reached between the private and public sectors as to both the level and suitability of higher revenues. Referring to equation (2), this implies that the credibility of both government taxation policy and desired revenue targets may be key determinants of effective taxation performance.

3.3   Regression model

The analytical framework suggests that Mozambique's revenue performance may be constrained by slowly-changing structural features of the economy. If this is the case, and especially given current concerns, it follows that estimates of the magnitude of these structural constraints would represent valuable inputs into policy and planning processes. To put it another way, the optimal choice for the revenue target ($\mathring{a}$) can only be made in light of other elements of equation (2). With this motivation in mind, the hypothesis for empirical investigation is that differences in economic structure and institutional quality explain a considerable share of the observed long-term differences in tax ratios. Remaining unexplained variation could then be attributed to differences in tax policy and administration, as well as to idiosyncratic country-specific effects of either a long- or short-term nature.

To test the hypothesis, a regression model of equation (2) must be constructed. Although this could be stated in either static (levels) or dynamic terms, the former is preferred given our interest in slowly-changing structural factors, including time invariant effects. Moreover, given the proposed form of equation (2), a robust dynamic specification would be problematic given the complex lag structure and endogeneity issues involved. To avoid these difficulties, a static specification is chosen in which 4-year period averages are used for both the dependent and independent variables. Given this approach, and assuming values for a are highly correlated with the vector Z, it is unnecessary to include a lagged value of the tax ratio as a regressor in this specification. Thus, the model simply focuses on the relationship between average levels of the observed tax ratio and Z for a given period. Note that comparative, cross-country analysis is valuable precisely because there is not sufficient time series data or counterfactual evidence to analyse the relationships of interest at the individual country level.

The demand-side structural factors included in the model represent variables encountered frequently in the relevant literature. They are used to capture the key 'tax handles' available to the government. Specifically they are:

- real per capita GDP (measured in constant 2000 US$);

- the share of industry in total value added;

- exports as a percentage of GDP; and

- imports as a percentage of GDP.

Institutional factors are notoriously difficult to measure, a particular problem being that of how to deal with the endogeneity of policies and institutions to current economic conditions. This is relevant with regard to taxation performance as adequate public revenues are required to finance a sound tax administration system. Thus, weak public institutions may be endogenous to low tax revenues, setting in motion a vicious circle. In order to minimize the theoretical and econometric problems associated with institutional endogeneity, however, the model does not include (either directly or via instrumentation) measures of *current* institutional quality. Rather, a set of 'deep' variables are selected that are evidently both prior to taxation performance and frequently associated with institutional quality in the research literature. As their values are time invariant, these variables represent a set of background factors or fixed effects on cross-country taxation performance. The chosen variables are:

- the percentage of the country's territory located in the tropics or sub-tropics based on the Koeppen-Geiger climate zones dataset;[5]

- dummy variables representing the primary, long-term colonial power which historically governed the country (if any), based on the CEPII geodesic distances dataset;[6]

- a dummy variable to indicate whether the country is landlocked, also taken from the CEPII dataset; and

- dummy variables representing the major continent in which the country is found.

---

[5] Available from the collection found at: www.ksg.harvard.edu/CID/ciddata/geographydata.htm
[6] Available from the *Centre d'Etudes Prospectives et d'Informations Internationales* (CEPII): www.cepii.fr/anglaisgraph/bdd/distances.htm

According to the framework set out in Frankel (2002), the tropics variable captures the influence of tropical geography on both institutional evolution and economic performance more generally. Use of this specific variable follows Dalgaard et al. (2004) who find it to be a robust predictor of economic performance. The colonial variables refer to the impact of colonial systems on current taxation performance. In contrast to the 'standard' employment of settler mortality rates to instrument for the overall quality of institutions in developing countries (see Acemoglu, 2000), only colonial dummy variables are included in the model. This strategy reflects the specific interest of this paper in taxation institutions, which in the cases of colonized countries were directly inherited from the colonial power. Both the landlocked and continental dummy variables are used to reflect aspects of trade openness as well as broader neighbourhood effects. Finally, the time trend variable is included in order to capture global shifts in taxation policy or ideology, such as international movements toward multilateral trade liberalisation.

At this juncture, discussion of the nature of the dependent variable is pertinent given the important distinction between taxation and total government revenues. The former set of revenues is relatively well-defined, referring principally to the direct and indirect taxation of economic activity. The latter is considerably wider in scope, capturing all revenues raised by the government including both tax revenue and a broad range of non-tax revenues such as fees, service charges and (natural resource) rents.[7] As shown by the summary statistics given in Table 1 referring to the dataset constructed for this study (see below), the size of the gap between taxation and total

---

[7] Note, 'below the line' financial resources such as external grants, loans or internal debt-financing are not included in these measures and are not in focus here.

revenues is neither insignificant nor homogenous across countries or regions.[8] A host of explanatory factors for variations in this gap across countries could be cited, including differences in policies (e.g. the application of user-charges) and the extent of natural resource extraction. However, the position adopted here is that the possibilities for raising such financing are both highly country-specific and poorly documented. As such, it is more appropriate to restrict cross-country comparison of revenue performance to the more circumscribed concept of tax revenue performance.

Even so, it would be simplistic to dismiss the possibility that the level of tax revenues may be endogenous to the availability of non-tax income sources. Assuming this effect will be greatest where natural resources are under-extraction, it follows that the availability of substantial natural resource rents may diminish the government's financial dependence on domestic taxation and thus reduce incentives for the government to develop a constructive (growth-conducive) relationship with the private sector via fiscal policy. Practical measurement of such an effect clearly is not straight-forward, particularly as mineral wealth is not homogenous and natural resource access rights can be allocated in numerous ways, in turn influencing government taxation instruments. However, taking a kind of 'dual' approach, an alternative is to focus on a less ambiguous set of resource-poor countries. The corollary argument here is that these countries may face comparatively greater incentives to raise revenue via taxation alone. Such countries can be identified by the wealth estimates in World Bank (2006), defining a resource-poor country as one which falls in the bottom quartile of the distribution of per capita subsoil and timber

---

[8] The standard error of the mean gap between taxation and total revenues by country is 5.96 percentage points of GDP.

resource assets under exploitation.[9] Thus the final regressor, added to the set of structural (supply-side) variables, is a dummy variable taking the value of one for resource-poor countries.

3.4   Dataset and regression estimators

Unless otherwise indicated (see above), the World Bank's World Development Indicators (2005a) are used to construct the dataset, providing the most extensive coverage of taxation data for developing countries in a standardized format. Although originally not included, aggregate tax revenue information is inserted for Mozambique based on the standard IMF classification. As noted above, the time series dimension of the dataset consists of non-overlapping 4-year averages for the chosen variables, a standard practice of the empirical (cross-country growth) literature. In terms of the cross-section dimension, only low and middle income countries are included so as to avoid contamination from higher income countries which arguably face greater flexibility in their choice of revenue target.[10] The resulting sample covers 113 countries for the period 1990-2003, composed of African (39%), Latin and Central American (20%), Asian (27%) and East and Central European (13%) states. Table 1 presents summary statistics, showing the average tax and total revenue ratios for the period covered.

With respect to the model estimator, a fixed effects (within) panel estimator is not suitable primarily because the research hypothesis focuses on the static influence of

---

[9] While the World Bank (2006) data is extensive, a small number of countries for which taxation data is available are not covered; thus, in order to maximize the size of our dataset we define such missing countries as being non-resource poor.

[10] The classification follows that of the World Bank (2005a). As a result, the sample contains countries with real GDP per capita ranging from under US$100 (for Ethiopia and the Democratic Republic of the Congo) to a maximum of US$8210 in the case of Oman.

observed structural variables, including time invariant effects, rather than changes over time *within* each country. Additionally, and on the assumption of moderate fiscal inertia, the effects of our explanatory variables are expected to be most clearly discernible across (between) countries for the relatively short time period observed. However, in the absence of consensus theoretical guidance as to the correct (panel) estimator to apply, results are presented from a range of estimators regularly employed in the literature. These include a standard OLS estimator with robust standard errors, a GLS random effects (RE) estimator, and a Prais-Winsten panel-corrected standard errors (PCSE) estimator which adjusts for the effects of autocorrelation and heteroskedasticity in the residuals (see Beck, 2001).[11] In order to explore the merit of including the demand-side variables, a restricted model representing only the supply-side regressors plus time is examined first, followed by the full specification.

3.5   General results

From the regression results given in Table 2, two findings are immediately apparent. First, the estimated coefficients are extremely consistent across estimators. Second, the coefficients for the supply-side variables are stable to the introduction of the demand-side variables, in terms of their size, direction and significance. For model validation, a Hausman (1978) test is used to distinguish between the suitability of a fixed- versus random-effects estimator. The results indicate that while the random-effects estimates are not consistent under the restricted model, they are both efficient and consistent when the institutional variables are added. In other words, country

---

[11] All estimations are run in STATA. The PCSE estimator is applied via the *xtpcse* command using options for auto-correlation (not panel-specific) and heteroskedasticity. This is preferred to a (panel) Feasible Generalized Least Squares estimator due to the more conservative disposition of the results.

fixed-effects become obsolete once the demand-side variables are entered. This is confirmed by the greater explanatory power of the full model – under the RE and OLS estimators the restricted model explains approximately 30% of variation in tax ratios, rising to 65% with the full specification.

A more detailed review of the regression data, however, suggests that despite the 4-year panel structure, certain time series problems remain. Arellano-Bond (see Roodman, 2004) tests for serial autocorrelation in the OLS specification, for example, indicate non-stationary in the residuals. Consequently, the PCSE estimator is preferred due to the adjustments it makes for serial autocorrelation.[12] Moreover, for both the restricted and full specifications the PCSE estimator has a relatively stronger explanatory power, as indicated by both the R-squared and Chi-squared measures.

In general terms the results confirm the hypothesis that *both* supply- and demand-side factors represent robust determinants of tax ratios across countries and over time. The direction and significance of the coefficients on the structural regressors are consistent with empirical results from previous studies (e.g., Teera and Hudson, 2004). In particular, the strong result that the share of imports is positively related to tax ratios confirms the established argument that cross-border flows are a relatively easy 'tax handle' for developing countries to grasp. However, neither the share of industry in total value added nor the share of exports in GDP is significant in any of the models / estimators (thus they are omitted from Table 2). This may be the case as these

---

[12] The AR(1) autocorrelation parameter for the full PCSE model is estimated to be 0.642, confirming the need for this adjustment. If nothing else, this finding may be interpreted as evidence of substantial 'fiscal inertia' in the observed tax ratios. Dynamic panel specifications, such as inclusion of a lag of the dependent variable among the regressors, can be employed to adjust for the problem of serial autocorrelation. However, given the interest of this study in long-term effects from relatively static variables, such techniques are not deemed appropriate in this case.

variables provide little independent information once per capita GDP and the share of imports are included. The strong positive result for the resource-poor dummy supports our hypothesis that these countries face relatively stronger incentives to raise revenue via taxation. While this does not shed specific light on any 'resource curse' argument, it does confirm the broad argument that observed taxation (revenue) choices are endogenous to economic structure including the availability of resource rents. Finally, the negative time trend found for all estimators indicates there has been a moderate decline in tax ratios once the effect of other variables has been taken into account. Again, although the processes behind this result is somewhat opaque, trade liberalization effects and/or reforms to improve conditions for business investment by reducing tax burdens may be at play here.

Results for the supply-side variables also are consistent with previous research. The robust negative effect of the fraction of land in the tropics affirms the general finding that this factor is associated with weaker economic and institutional performance (Dalgaard et al., 2004). The partial effect of colonial legacy is also significant in certain cases. For the major colonial powers, the strongest and most significant influence is found for countries formerly colonized by Great Britain or France. The model suggests, (*ceteris paribus*), that these countries achieve an average tax ratio of up to 1.5 percentage points higher than countries not colonized for any long period (e.g., Turkey).[13] This effect may derive from inherited colonial administrative procedures and/or a legacy of formal sector taxation compliance. The significant result for the landlocked dummy, which tells us to expect a higher tax ratio for landlocked countries (*ceteris paribus*), appears counter-intuitive given arguments that

---

[13] Results for Chinese and Dutch colonization are somewhat stronger; however, these refer to a very small number of countries and therefore are not of general interest.

landlocked countries face a more constrained set of economic growth opportunities (e.g., MacKellar et al, 2000). Possible factors behind this result, however, are differences in the nature of the 'tax handles' and corresponding institutions in landlocked countries. For example, one can speculate that sea borders create greater opportunities for smuggling and tax evasion than possible over land. In any case, the overriding message is that in addition to structural economic features, exogenous determinants of institutional performance also explain a large portion of the observed variance in tax ratios across countries over time.

4.   Application to Mozambique

Turning to the specific case of Mozambique, Table 3 states the predicted tax ratios for each of the four-year periods in the panel using the PSCE estimator. For illustrative purposes only, Figure 4 plots the predicted (and actual) tax ratios calculated by applying the same (panel) coefficients to annual data. In both cases the results are highly informative. First, and in support of the regression results, movements in the predicted tax ratio for Mozambique closely correspond to actual changes both within *and* outside the model's sample period (1990-2003). The model correctly determines the direction of all major changes in Mozambique's tax ratio over the last 25 years, including the drop in tax revenue in the early 1980s, its rise from 1986 to 1993, as well as the subsequent decline from 1993 to 1996. Recall the model is based on cross-country data, contains no (direct) information regarding either tax administration or tax policy and includes no county "fixed effects". Given the explanatory power of the model, it is therefore reasonable to conclude that observed shifts in the tax ratio in Mozambique have been strongly driven by movements in underlying economic structure ('tax handles') despite changes in policy or administrative efficiency.

Moreover, as can be ascertained from Figure 1, changes in the import share appear to have been a critical factor behind short-term movements in the ratio, particularly during the period 1988-1994 which witnessed large humanitarian inflows as well as a significant UN peacekeeping operation (see Arndt et al., 2007) charged with overseeing the peace agreement reached in 1992.[14]

Secondly, although Mozambique's observed tax ratio is relatively low by regional and international standards (see Table 1), averaging 11.1% for the period 2000-05, its historical performance has been extremely faithful to its predicted level according to either the full or restricted models (see Figure 4; also Table 3). Once one takes into account the expected effect of exogenous influences on Mozambique's institutional performance, which act to reduce the predicted tax ratio, actual tax collections appear to have been marginally higher than the model's predictions. Accordingly, cross-country evidence suggests we should not expect Mozambique's current tax ratio to be equal to the regional or international average for (low income) developing countries. To put it another way, Mozambique's past performance is not an outlier in comparative terms once the effects of structural and institutional conditions are taken into account.

Following from the above, the model allows us to evaluate Mozambique's tax effort over time. Tax effort is defined as the observed tax ratio divided by the ratio predicted by the model, in this case based on the results from the PCSE estimator(s). The results of this calculation are presented in Table 3 for the sample period. They suggest that since achieving robust improvements during the mid- to late-1980s, broadly

---

[14] The regression results reveal that tax revenues in developing countries have a high *effective* import share; thus, a 10% increase in imports is associated with a 3% increase in the tax ratio.

coinciding with the initiation of structural adjustment reforms (and thus improved access to foreign exchange and taxation reforms), the tax effort has remained relatively stable. According to the results from the full specification, Mozambique has sustained an average tax effort within the expected 95% confidence interval predicted by the model since 1990.

Notwithstanding these strong results, it is important to assess the validity of applying the framework to the case of Mozambique. In other words, are there specific factors germane to Mozambique's tax performance (or potential) which are not adequately reflected in the model? On the one hand, the country's close proximity to South Africa and the strong economic links they share may have a positive influence on taxation via higher levels of trade and investment. However, in principle these factors should be captured by the model, not least by the income per capita variable which reflects the overall level of economic activity. Furthermore, Mozambique is not a member of the Southern African Customs Union (SACU) which operates a revenue sharing mechanism. As discussed further in Chapter 13 to this volume, revenue sharing with South Africa goes a long way to explain the comparatively high tax ratios recorded in Swaziland, Lesotho and other SACU member countries.

A second potential critique is that the model is of limited relevance to cases of rapid and sustained real output growth, such as in Mozambique.[15] This would have force if the effect of raid / sustained growth on the tax ratio was not fully captured by movements in the structural explanatory variables, i.e., there are omitted variables. Alternatively, the coefficients may be biased if the association between growth, structural change and taxation performance did not correspond to the 4-year periods

---

[15] For the period 1994-2003, Mozambique is one of only 8 countries in the dataset that achieved an annual average rate of *per capita* income growth in excess of 5%.

employed to estimate the model. For example, a slow dynamic lag running from income growth and other structural changes to the tax ratio, (see equation 2), could mean that the model in fact over-estimates the impact of *recent* structural change on the tax ratio. This comes from the fact that the main sources of variation in the dataset derive from differences between, rather than within countries. For Mozambique, however, neither of these two concerns appears to be highly relevant. Firstly, analyses of the drivers of post-war growth highlight strong post-conflict recovery effects as opposed to more fundamental structural changes (World Bank, 2005b; Arndt et al., 2007). Second, despite ongoing tax reforms in Mozambique, the strong predictive performance of the model when applied to annual data would seem to reject the argument that there are important factors omitted from the model. This is confirmed by a comparison of the prediction errors (regression residuals) for 'high growth' countries versus the rest.[16] A (non-parametric) Wilcoxon rank-sum test indicates there is no significant difference in the size of these errors between the two groups. Moreover, when the model is estimated only for the same group of 'high growth' countries, the tax ratio for Mozambique for the period 2002-03 is predicted as 10.9%, falling inside the 95% confidence interval estimated from both the restricted and unrestricted specifications on the full dataset.

Finally, the role of non-tax revenues merits comment. In overall terms the country's non-tax revenues have been comparatively low at around 10% of tax revenue or one percentage point of GDP (see Table 1). This compares to an average contribution from non-tax revenues of over 4 percentage points of GDP in both resource poor and low income countries. In part the low contribution in Mozambique is attributable to

---

[16] High growth countries are defined as those achieving a median level of per capita growth in excess of 3.5% per annum over the full period.

the existence of substantial, but unrecorded (off-budget), non-tax revenues raised by individual government sectors, typically as user fees. As shown in Figure 1 for 2005, these revenues are slowly being included in official government figures, namely the budget, a trend which has continued into 2006.[17] As such, one aspect of improving Mozambique's 'official' revenue position must embrace enhancements to the transparency of public financial management at all levels.

Relatedly, (non-tax) revenues pertaining to natural resource extraction are recognised to be extremely low at under 5% of revenues (World Bank, 2005b). However, this is not for an absence of available natural resources. Rather, according to the resource definition used in the dataset used for this study, Mozambique falls in the second quartile of the distribution of countries, ranking alongside Ghana and Namibia in terms of estimated *per capita* wealth of non-renewable subsoil (energy and mineral) and timer resources. However, this estimate is based on figures for reserves under production as of 2000, rather than unexploited deposits. Indeed, a number of large mineral extraction operations are currently under construction or proposed in Mozambique, including one of the largest unexplored coal deposits in the world,[18] not to omit the recent establishment of operations by SASOL (a South African energy conglomerate) to pipe extensive natural gas deposits into South Africa. From this perspective, while the question of the exact level of natural resource taxation cannot be considered, a substantial upward shift in total government revenues should be expected once production from these projects comes on-line. In a general survey, World Bank (2005b) estimate that natural resource rents raised by the government

---

[17] For example, preliminary figures for 2006 suggest that user fees raised in the health sector were twice their budgeted amount.
[18] These are found in the District of Moatize (Tete Province); exploration rights have been granted to the Brazilian multinational CVRD (*Companhia Vale do Rio Doce*).

could double in size relatively easily in the short-term to around 11% of tax revenue, expanding over the medium-term to around 3 percentage points of GDP.

The necessity of ensuring domestic revenue gains from (future) natural resource extraction in Mozambique has been emphasised by the IMF, particularly in light of generous fiscal benefits conceded in the early post-war period to attract first-mover foreign investors. Not only are the total costs of these benefits are unknown, but the *same* fiscal benefits have been given to internationally mobile investors, who can use taxation as a core lever in any negotiations, as to geographically fixed natural resource operations (see Chapters 16 and 17 in this volume for elaboration). Thus, while the empirical analysis of this study suggests that Mozambique's past tax effort has not been below expectations by international standards, future revenue plans must account for gains from natural resource activities.

5.   Conclusions

The principal argument of this study is that governments are not unconstrained as to the volume of tax revenue they can raise. Analysis has shown that institutional and structural variables explain much of the differences in tax revenue levels across countries over time. In other words, and in line with previous scholarship, deep slow-moving economic characteristics including the diversity and size of potential 'tax handles' act to fix plausible parameters for the tax ratio. It should be underscored, however, that this argument specifically refers to one of various taxation goals, namely the level of taxation revenues, and therefore should not be taken to undermine the importance of tax policy or administration concerns. Indeed these dimensions are

crucial determinants of the efficiency and equity of the taxation system, which have not been in focus.

Even so, it stands to reason that tax policy and administrative design must be sensitive to revenue constraints and be guided by a realistic aggregate target. Inflated revenue targets risk encouraging tax policies and/or administrative measures that are at best ineffective and, worse, distort long-term private sector development. These points are germane to Mozambique given underlying disagreement as regards an appropriate medium-term tax ratio. When applied to Mozambique the cross-country model provides a remarkably robust prediction of movements in actual tax revenues over a 25 year period to the present day. On this basis alone, the results indicate that institutional and structural constraints have been sizeable and that Mozambique's recent taxation performance has not deviated significantly from its predicted levels. Cross-country evidence does not indicate the current tax ratio of approximately 11% in Mozambique is a (poor performance) outlier; nor does it suggest that the relative inertia in taxation performance is unusual despite the broad range of tax policy and administration reforms undertaken.

What, then, might be a realistic medium-term tax ratio target for Mozambique? Excluding considerable expected gains associated with natural resource extraction, the analysis suggests that large increases in tax revenues are unlikely to be achieved in the near-term despite ongoing reforms. Thus, a realistic medium-term target for Mozambique may be in the region of 13% of GDP for tax revenues only, assuming continued economic growth and access to foreign exchange via the support of external aid. Of course, natural resource production growth should lead to substantial

additional revenues; however, this will depend on specific policy changes regarding the treatment of natural resource operations and the regime of fiscal benefits more generally. An important advance in this regard, to support policy development, will be efforts to estimate the aggregate opportunity costs of these fiscal benefits.

Finally, it is evident that this conclusion runs counter to IMF analysis for Mozambique. However, returning to the analytical framework developed in this study, revenue outcomes can be understood as revealed preferences to pay on the part of economic agents. Thus, revenue targets should not be chosen in isolation from contextual factors such as the economic structure and the overall credibility of fiscal policy. Adopting more moderate and realistic revenue expectations in Mozambique would reduce pressure on collection authorities. In turn this would provide greater policy space to consider equity and efficiency reforms. It is exactly these reforms that are emphasised by the private sector on whom taxation ultimately must depend.

References

Acemoglu, D., Johnson, S., & Robinson, J. A. (2000). *The Colonial Origins of Comparative Development: An Empirical Investigation* (NBER Working Papers No. 7771): National Bureau of Economic Research, Inc.

Arndt, C., Jones, S., & Tarp, F. (2007). Aid and development: The Mozambican case. In S. Lahiri (Ed.), *Theory and Practice of Foreign Aid* (Vol. 1, pp. 235-288): Elsevier B.V.

Beck, N. (2001). Time-series cross-section data: what have we learned in the past few years? *Annual Review of Political Science* 4, 271–93.

Bird, R. M., & Zolt, E. M. (2005). *Redistribution via Taxation: The Limited Role of the Personal Income Tax in Developing Countries* (Working Papers No. 0508): International Tax Program, Institute for International Business, Joseph L. Rotman School of Management, University of Toronto.

Bird, R. M., Martinez-Vazquez, J., & Torgler, B. (2004). *Societal Institutions and Tax Effort in Developing Countries* (Working Papers No. 0411): International Tax Program, Institute for International Business, University of Toronto.

Bolnick, B. (2004a). *Tax Reform and the Business Environment in Mozambique: A Review of Private-Sector Concerns*: Nathan Associates for USAID, Mozambique.

Bolnick, B. (2004b). *Effectiveness and Economic Impact of Tax Incentives in the SADC Region*: Nathan Associates for SADC Tax Subcommittee.

Burgess, R., & Stern, N. (1993). Taxation and Development. *Journal of Economic Literature, 31*(2), 762-830.

Dalgaard, C.-J., Hansen, H., & Tarp, F. (2004). On The Empirics of Foreign Aid and Growth. *Economic Journal, 114*(496), F191-F216.

Easterly, W., & Rebelo, S. (1994). *Fiscal Policy and Economic Growth: An Empirical Investigation* (NBER Working Papers No. 4499): National Bureau of Economic Research, Inc.

Ebrill, L. P., & International Monetary Fund. (2001). *The modern VAT*. Washington, D.C.: International Monetary Fund.

Engle, R. F., Hendry, D. F., & Richard, J.-F. (1983). Exogeneity. *Econometrica, 51*(2), 277-304.

Ernst & Young (2004), *A reforma da tributação das pequenas actividades empresariais em Moçambique* (Technical Report): Ernst & Young, Mozambique.

FIAS. (2006). *Mozambique: Study of the Impact of Tax and Licenses on Five Priority Sectors* (Technical Report): Foriegn Investment Advsiory Service, International Finance Corporation and the World Bank.

Frankel, J. A. (2002). *Panel Discussion Remarks - Promoting Better National Institutions: The Role of the IMF*. International Monetary Fund, Third Annual Research Conference, November 7-8

Gemmell, N. (2004). Fiscal Policy in a Growth Framework. In T. Addison & A. Roe (Eds.), *Fiscal Policy for Development: Poverty, Reconstruction and Growth* (pp. 149-176): Palgrave Macmillan, New York.

Gerson, P. R. (1998). *The Impact of Fiscal Policy Variables on Output Growth* (IMF Working Papers No. 98/1): International Monetary Fund.

Ghura, D. (1998). *Tax Revenue in Sub-Saharan Africa - Effects of Economic Policies and Corruption* (IMF Working Papers No. 98/135): International Monetary Fund.

Hausman, J. A. (1978). Specification Tests in Econometrics. *Econometrica, 46*(6), 1251-1271.

Heady, C. (2001). *Taxation Policy in Low-Income Countries* (No. 2001/81): WIDER.

IMF. (2005). *Republic of Mozambique: Selected Issues and Statistical Appendix*. (IMF Country Report No. 05/311): International Monetary Fund.

Lopes, P. S., & Sacerdoti, E. (1991). *Mozambique: economic rehabilitation and the poor* (IMF Working Paper No. WP/91/101): International Monetary Fund.

MacKellar, L., Woergoetter, A., & Woerz, J. (2000). *Economic Development Problems of Landlocked Countries* (Transition Economics Series No. 14): Institute for Advanced Studies.

Moss, T., Pettersson, G. & van de Walle, N. (2006), *An Aid-Institutions Paradox? A Review Essay on Aid Dependency and State Building in Sub-Saharan Africa* (Working Paper No. 74): Center for Global Development

Musgrave, R. A. (1969). *Fiscal systems*. New Haven: Yale University Press.

Rodrik, D., Subramanian, A., & Trebbi, F. (2004). Institutions Rule: The Primacy of Institutions Over Geography and Integration in Economic Development. *Journal of Economic Growth, 9*(2), 131-165.

Roodman, D. (2004). ABAR: Stata module to perform Arellano-Bond test for autocorrelation: Statistical Software Components, Boston College Department of Economics.

Slemrod, J. (1991). *Optimal Taxation and Optimal Tax Systems* (NBER Working Papers No. 3038): National Bureau of Economic Research, Inc.

Stotsky, J. G., & WoldeMariam, A. (1997). *Tax Effort in Sub-Saharan Africa* (IMF Working Papers No. 97/107): International Monetary Fund.

Tanzi, V., & Zee, H. H. (2000). *Tax Policy for Emerging Markets - Developing Countries* (IMF Working Papers No. 00/35): International Monetary Fund.

Teera, J. M., & Hudson, J. (2004). Tax Performance: A Comparative Study. *Journal of International Development, 16*(6), 785 - 802.

Varsano, R., de Oliveira, M. O., Villela, R., & Yackovlev, I. (2006). *Mozambique*: *Post-reform evaluation of the tax system* (Unpublished Report): International Monetary Fund, Fiscal Affairs Department.

World Bank. (1988). *Opportunities and Risks in Managing the World Economy: Public Finance in Development*. (World Development Report 1988): World Bank.

World Bank. (2005a). *World Development Indicators 2005*. The International Bank for Reconstruction and Development / The World Bank.

World Bank. (2005b). *Mozambique Country Economic Memorandum: Sustaining Growth and Reducing Poverty*. (Report No. 32615-MZ): World Bank.

World Bank. (2006). *Where is the Wealth of Nations? Measuring Capital for the XXI Century*. The International Bank for Reconstruction and Development/ The World Bank.

Ylönen, A. (2005). Institutions and Instability in Africa: Nigeria, Sudan, and Reflections from Mises's Nation, State and Economy. *New Perspectives on Political Economy*, 1(1), 38 – 60.

Tables and Figures

Table 1: Total revenue and tax revenue ratios (% GDP) for low and middle income countries

	N	1990-1997		1998-2003		1990-2003		
		Total	Tax	Total	Tax	Total	Tax	Diff.
Africa	44	25.0	18.8	25.3	19.5	25.1	19.2	6.0
America	23	18.1	14.1	18.7	13.2	18.4	13.7	4.7
Asia	31	20.0	13.6	17.4	11.9	18.7	12.8	5.9
Europe	15	30.1	18.5	30.4	17.0	30.2	17.7	12.5
All	113	22.5	16.2	21.8	14.8	22.2	15.5	6.7
Low income	59	18.9	15.2	17.9	13.2	18.4	14.2	4.2
Resource poor	19	21.4	17.1	19.5	15.0	20.5	16.0	4.4
Mozambique	1	11.8	10.6	12.2	11.3	12.0	11.0	1.1

Source: World Bank (2005a); Government of Mozambique (internal)

Notes: "N" refers to the number of countries in each group; "Low income" refers to countries with real average GDP per capita below US$1000; countries included correspond to the sample used for empirical estimation.

Table 2: Regression results, 4 year panels

Dependent variable: Natural logarithms of average tax revenue as % GDP						
	RE		OLS		PCSE	
	Restricted	Full	Restricted	Full	Restricted	Full
Variables:	A	B	C	D	E	F
Constant	11.88***	11.07**	21.17**	12.29	14.57**	10.39*
	(2.67)	(2.52)	(2.12)	(1.56)	(2.13)	(1.81)
GDP per capita	0.14***	0.16***	0.12***	0.10***	0.12***	0.12***
	(4.17)	(3.84)	(5.22)	(3.11)	(4.72)	(3.36)
Imports % GDP	0.30***	0.28***	0.34***	0.26***	0.33***	0.28***
	(4.09)	(3.89)	(4.27)	(5.03)	(4.41)	(4.70)
Resource poor	0.17**	0.29***	0.20***	0.27***	0.18***	0.28***
	(2.00)	(3.68)	(4.46)	(6.13)	(3.18)	(5.27)
Time trend	-0.01**	-0.01**	-0.01**	-0.01	-0.01**	-0.01*
	(-2.53)	(-2.45)	(-2.11)	(-1.52)	(-2.05)	(-1.75)
% Land tropics		-0.17*		-0.26***		-0.22***
		(-1.83)		(-4.18)		(-3.37)
Landlocked		0.14*		0.09		0.12**
		(1.83)		(1.61)		(2.00)
Belgium (colony)		0.21		0.28**		0.23**
		(1.06)		(2.46)		(2.06)
China (colony)	…	0.83***		0.80***		0.79***
	…	(2.82)		(8.35)		(7.87)
Germany (colony)	…	0.53***		0.53***		0.56***
	…	(2.66)		(5.09)		(3.97)
France (colony)		0.41***		0.38***		0.42***
		(3.03)		(4.04)		(3.64)
Great Britain (colony)		0.38***		0.39***		0.40***
		(3.30)		(5.16)		(4.24)
Netherlands (colony)		0.51*		0.49***		0.52***
		(1.89)		(4.75)		(4.05)
Portugal (colony)		0.24		0.27**		0.26*
		(1.08)		(2.45)		(1.83)
Asia		-0.32***		-0.32***		-0.30***
		(-3.43)		(-5.01)		(-4.53)
N	235	235	235	235	235	235
R squared	0.30	0.64	0.31	0.66	0.90	0.93
Chi squared	55.6	151.1	…	…	107.6	1116.8

* p<.1, ** p<.05, *** p<.01; t-statistics given in parentheses

Source: author's estimates

Notes: variables are as described in the text – specific countries and continents are specified as (0 / 1) dummies; variables which are not significant in any specification are excluded; RE, OLS and PCSE refer to the different regression estimators, also described in the text.

Table 3: Observed and predicted values for Mozambique's tax ratio by panel period

|		1990-93	1994-97	1998-01	2002-03	Average
Restricted	Tax ratio	10.4	11.6	11.1	10.9	11.0
	s.e.	1.1	1.1	1.1	1.1	1.1
	Tax effort	103.0	89.4	101.2	104.5	99.3
Full	Tax ratio	9.3	10.3	10.0	10.2	10.0
	s.e.	1.1	1.1	1.1	1.1	1.1
	Tax effort	115.2	100.5	111.3	111.8	109.5
Observed	Tax ratio	10.8	10.4	11.2	11.4	10.9

Source: author's calculations

Notes: results derive from the PCSE estimator for the full sample of countries using the restricted and full model specifications; 's.e.' refers to the standard error of the prediction; 'Tax effort' is the observed tax ratio divided by the predicted ratio (as a percentage).

Figure 1: Historic total revenue and tax performance as % GDP, Mozambique
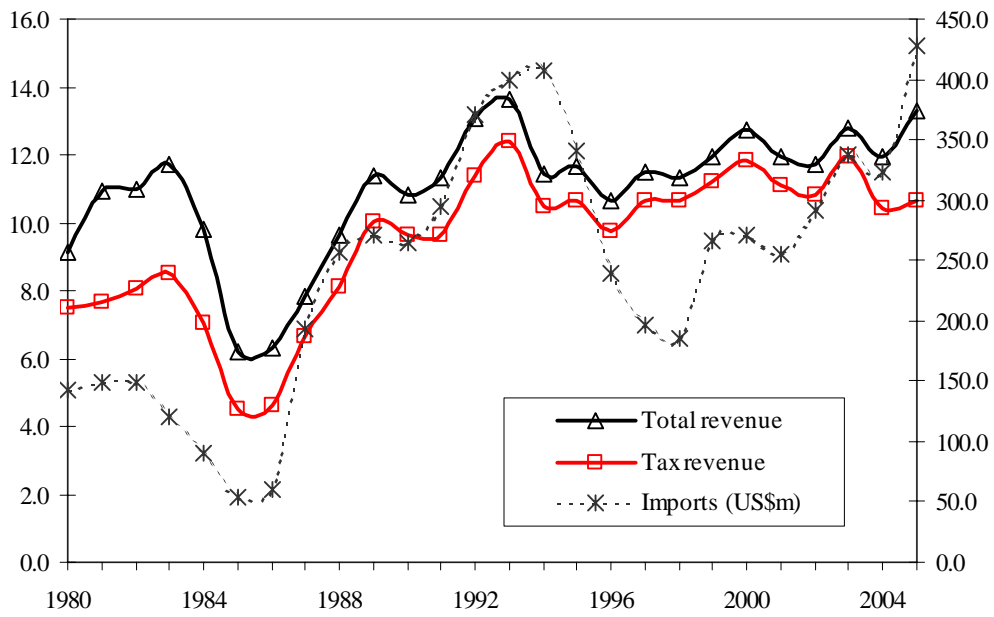

Source: Government of Mozambique

Figure 2: Comparison of (total) government revenues against logs of per capita income, averages for low and middle income counties for the period 1990-2004
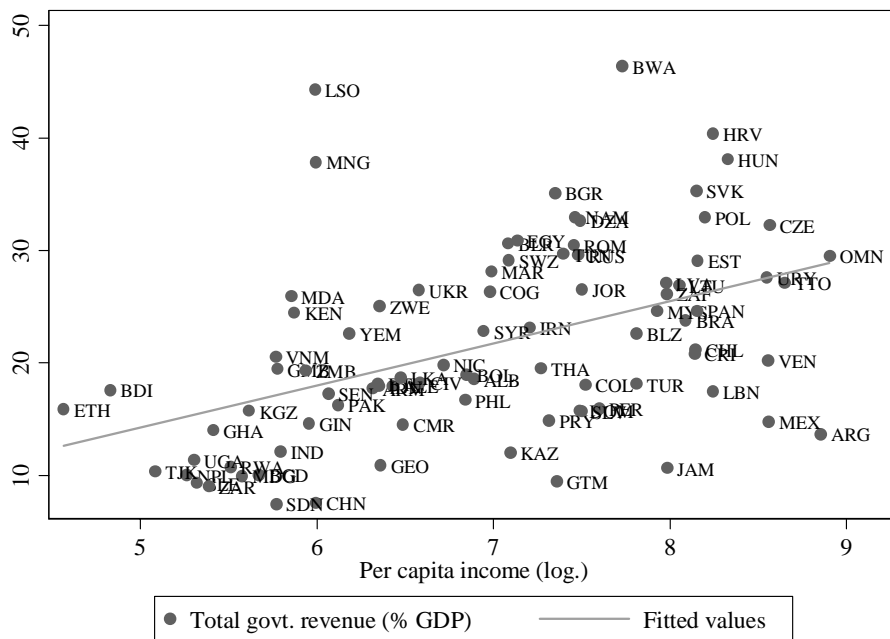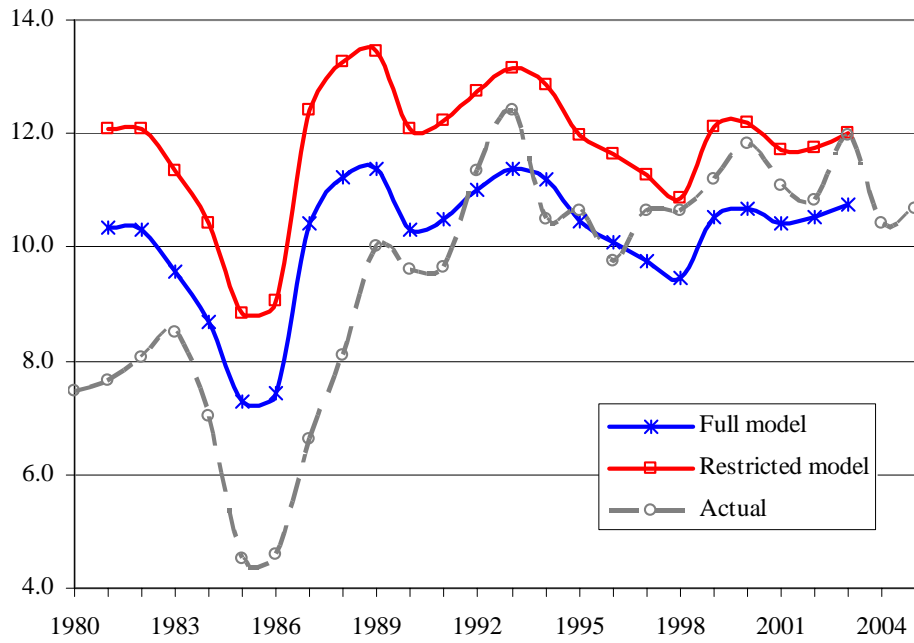

Source: author's calculations based on World Bank (2005a)

Figure 3: Cumulative distribution of median annual rates of growth in the taxation ratio for 1990-2004, low and middle income countries only
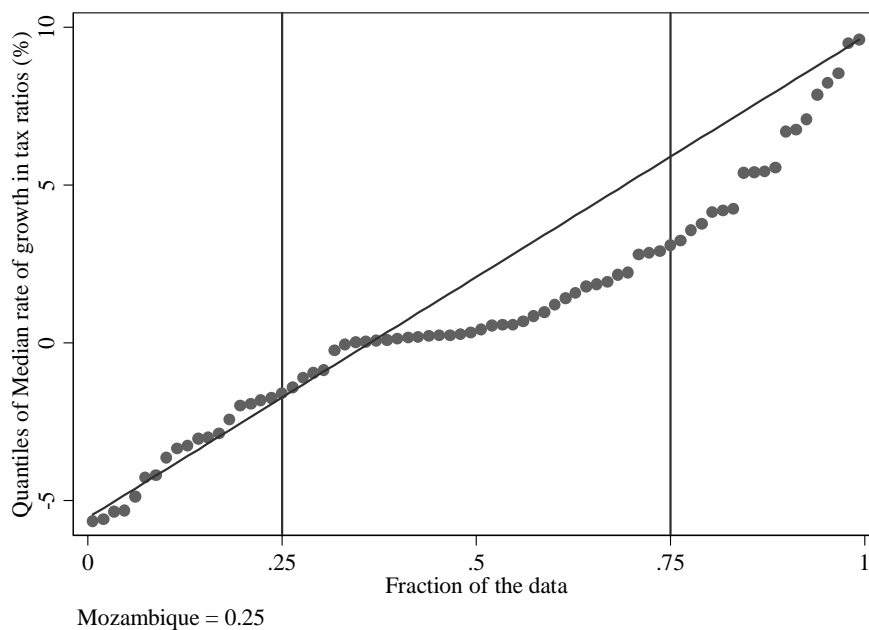
Mozambique = 0.25

Source: author's calculations based on World Bank (2005a)

Figure 4: Actual versus predicted tax ratio for Mozambique, restricted and full PCSE models

Source: author's estimates
Notes: calculations based on coefficients from PCSE panel model applied to annual data.