Assessing Tax Revenue Productivity in Developing Countries

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DECLARATION

I, the undersigned, declare that this thesis is my original work and that it has never been presented for any academic award at this or any other Academic Institution. Where indebted to the work of others, acknowledgement has been made.

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CERTIFICATE OF APPROVAL

I, the undersigned, declare that this thesis is from the student's own work and effort. Where he has consulted and used secondary sources of information, he has duly acknowledged. This thesis is thus submitted with my approval.

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Tax reform thus conceived has two stages: changing what is said (the law) and changing what is done (the administration of the law)

~ *Vito Tanzi*

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LIST OF ACRONYMS

AER	Annual Economic Report
ARDL	Auto-Regressive Distributed Lag
COMESA	Common Market for Eastern and Southern Africa
GDP	Gross Domestic Product
GRD	Government Revenue Dataset
ICTD	International Centre for Tax and Development
LTO	Large Taxpayer Office
MOF	Ministry of Finance
NPM	New Public Management
ODA	Official Development Assistance
OECD	Organization for Economic Cooperation and Development
SADC	Southern Africa Development Committee
SAPs	Structural Adjustment Programs
SARA	Semi-Autonomous Revenue Authority
SDGs	Sustainable Development Goals
SSA	Sub-Saharan Africa
UN	United Nations
UNU-WIDER	UN University - World Institute for Development Economics Research
WDI	World Development Indicators

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EXECUTIVE SUMMARY

With ever increasing social service, public good and infrastructure investment demands on the public purse, the domestic resource mobilization agenda is increasing in priority with special emphasis on tax revenue and its administration particularly in developing countries. With that has come an embrace for tax reforms to boost revenue collection capacities and performance.

To gauge tax revenue performance, the central thesis in this paper proposes (over indicators such as the tax share of GDP) some measure of tax revenue productivity, specifically tax buoyancy, which measures the responsiveness of a tax to changes in its base or GDP. Tax-to-GDP ratios which are typically low for poor countries, reflect more the characteristics of their economic structures, and are not necessarily an indicator of poor tax revenue performance as is typically interpreted.

In this paper, we demonstrate tax revenue productivity as a measure of performance of the tax system in Malawi. We show that real total tax revenues which account for about 17 percent of GDP, respond by 0.8 percent for every 1 percent change in real GDP in the long run. Among individual tax categories, real personal income tax is the most responsive to real GDP, followed by the consumption tax real VAT to changes in real household consumption.

The performance of taxes can however also be exogenously affected by other factors called determinants. This paper shows that per capita GDP, the service sector share in GDP, broad-money supply, and the official exchange rate are strong positive determinants in Malawi. Declining agriculture and increased trade openness also positively relate with total tax revenue. Domestic debt disincentivises revenue collection, but external debt induces it in the long run.

Tax-to-GDP ratios also yield inconclusive results when used in attempts to evaluate reforms. This paper demonstrates applying the tax revenue productivity analysis to test for changes in tax revenue responsiveness, and thus evaluate the implementation of a major tax administration

reform that has swept across sub-Saharan Africa (SSA) and Latin America replacing centralised bureaucracies with partially decentralized and partially privatized tax agencies called semi-autonomous revenue authorities (SARAs) that are legally established and mandated to administer taxes.

We thus drew pre and post reform pair samples from a panel of 21 countries. With the exception of the Latin America sub-sample, the estimated dynamic OLS and fixed effects model buoyancy coefficients were statistically higher in post reform samples by about 13 to 28 percent, with most gains by SARAs established later most of which are consequently in SSA.

Similar results were obtained for a single country assessment, following the implementation of the SARA reform in Malawi the responsiveness of real total tax revenue improved by 0.15 and 0.16 percentage points in the short run and long run respectively for every 1 percent increase in real GDP. Of six individual tax categories examined, there was a significant positive shift in the short run responsiveness of two taxes, and in the long run responsiveness of three taxes. This analysis thus showed the impact of SARA reform on various tax categories may be disproportionate.

However, the magnitude of these shifts in responsiveness is not necessarily entirely to the credit of the reform and subsequent new administration. An account of other exogenous variables was necessary. Noting that the significant determinants of tax revenue performance in Malawi particularly per capita GDP, service sector share in GDP, broad money supply and the exchange rate would have certainly exogenously effected substantial increases in total tax revenue and thus biasing upward revenue performance in the post reform period, we conclude that the significant portion of the increased performance in Malawi, was due to the exogenous effects from the growth patterns of the determinants other than the reformed tax administration itself

GENERAL INTRODUCTION

The myriad of social services, public goods, and infrastructure investment all depend on the public purse. For such reasons and more, domestic revenue mobilization is a priority for every country regardless its stage of development. This is perhaps even more crucial in developing countries, where government is the most active or significant economic agent playing a major role in society. In most developing countries, public expenditure forms a significant part of GDP and public sector institutions are substantial employers and major capital market participants.

An effective public sector is undoubtedly a prerequisite to achieving socio-economic growth and development and alleviating poverty. Essential services such as health and education to large segments and majority of the population almost entirely depend on public coffers which must be financed in some way. Typically, these ways can be categorized into three; tax revenue, non-tax revenue, and debt.

Tax revenue is sourced as taxes on income and profits levied on wages and corporate profits; taxes levied on property; and taxes levied on goods and services among others. The OECD (2017) also counts social security contributions as taxes though this is not a standard measure. Non-tax revenues are all other revenues received by general government that is not classified as taxes. These include grants or foreign aid; property income from rents and royalties, interest and dividends and other property fee incomes; sales of goods and services including administrative fees; fines, penalties and forfeits; other donations, and other miscellaneous revenues.

Of these sources, tax revenue has the most economic rationale and is the most relied upon as a mandatory and regular source. In 2015 the Africa average was about 18.2 percent of GDP compared to about 4.8 percent non-tax revenue. Since 2000, tax revenues have increased

significantly driven by strong increases in revenues from taxes on income and profits and from VAT (OECD 2018b). On the other hand, non-tax revenues tend to vary more between years mainly due to changing commodity prices and the variability of grants. Nevertheless, in general non-tax revenues have been on a downward trend in recent years. As a future liability, debt financing is typically unfavorable, furthermore considering the adverse effects foreign debt may have on the value of currency, and the ramifications domestic debt may have on private sector investment. Worse-still debt has tended to be excessive in developing countries such that sub-Saharan Africa for example experienced the largest increase in the median public debt-to-GDP ratio, 20 percentage points from already high levels over the 2013 to 2017 period (IDA 2018).

Towards achieving the United Nations SDGs, no one disputes the need to mobilize additional finance. The current development ideology is however emphasizing sourcing particularly from domestic resources. Thus, domestic resource mobilization now features as SDG target 17.1 to "improve domestic capacity for tax and other revenue collection," and as a strategic priority in some regional plans such as the Addis Ababa Action Agenda and the African Unions Agenda 2063. Focusing on domestic resources, any significant strides towards these goals will almost entirely be contingent on what happens in taxation.

It can be argued that to raise tax revenue from a given tax system, politically and perhaps even economically unfavorable measures such as raising tax rates would have to be implemented. This may be true for some developed countries with mature tax systems, such as Japan which however has delayed hiking the consumption tax rate twice in 5 years amidst its persistent recession. Developing countries on the other hand, may not necessarily need to raise tax rates to yield more revenue.

In recent years sub-Saharan African countries for example have embarked on major efforts in modernizing their VAT tax systems with notable results. The greatest source of tax revenues are taxes on goods and services which account for 54.6 percent of total tax revenues, with VAT alone contributing 29.3 percent of total tax revenues. Between 2000 and 2016 VAT grew from 3.3 percent of GDP to 5.3 percent (2016 average of 21 African countries, OECD 2018b). Botswana, Cabo Verde and Rwanda introduced VAT in 2002, 2004, and 2001 respectively, and both the Democratic Republic of Congo and Eswatini (previously Swaziland) introduced VAT in 2012. In many countries, the introduction was accompanied by major tax administration reforms. The average of 25 Latin America and Caribbean (LAC) countries also shows a similar tax structure and a similar growth pattern. Consequently, the Africa average tax-to-GDP ratio has increased by 5.0 percentage points since 2000, similarly LAC average 4.7 percentage points, relative to the OECD average 0.4 percentage points during the same period (OECD 2018b).

Reforming tax systems and administration is thus seen as a proven means to boost revenue for much needed development initiatives in developing countries. Simply put, the idea behind reforming a tax system is to make it more productive. But what exactly does that mean and how can it be assessed or measured?

Tax revenue productivity and performance measures

In general terms and using the economic concept of production, productivity is a measure of the output per unit of input. Tax revenue productivity has sometimes been loosely used as a generic term with some underlying measure that relates the size or value of tax revenue collected to its base typically as an indicator of performance. However, strictly applied in tax terminology and scholarly literature, tax revenue productivity measures the amount of tax revenue generated per unit of its base, often expressed in percentage terms. The base is the

component tax rates are levied on to yield the revenue, for example, the value realized from capital gains is the base for capital gains tax.

For decades, tax elasticity and tax buoyancy are such measures that have typically been employed by those in tax policy analysis and researchers in particular. Every country enacts tax law modifications and tweaks in tax codes that affect the applicable tax rates and determines the size of the taxable base. Such includes but is not limited to; tax exemptions, deductions, credits and other incentives that reduce tax liabilities. By distinguishing between tax elasticity and tax buoyancy researchers attempt to "clean" time series data to rid it of those tax code modifications that affect the tax buoyancy coefficient in order to capture the true underlying elasticity of a tax. Tax elasticity is thus a measure of tax revenue productivity that estimates how tax revenues respond to changes in the tax base in the underlying tax system free of discretionary tax measures and code modifications. On the other hand, tax buoyancy is a measure of productivity that gauges how tax revenues change in response to changes in base all factors encompassing.

There are a variety of other performance measures. In research analysis, common measures include; tax effort indices and tax efficiency ratios. The tax effort index is a ratio of the share of actual tax revenue collected in GDP and taxable capacity. Taxable capacity is the predicted tax-to-GDP ratio that can be estimated empirically given a countries specific structural or macroeconomic, demographic, and institutional features (Minh Le et.al 2012). Put simply, tax effort measures the extent to which the actual level of tax revenue deviates from the potential tax as predicted by these features (Youhou & Goujon 2017). This measure thus gauges how effectively a country uses its available tax instruments in collecting taxes, relative to what it could reasonably be expected to collect.

Efficiency ratios are tax specific. For example, to calculate the VAT efficiency ratio, suppose the VAT rate is 16 percent, 0.16 multiplied by GDP is the denominator, and the actual VAT revenue collected is the numerator in the efficiency ratio of that year expressed as a percentage.

As each of these components may change with time, periodic tax effort indices and efficiency ratios can be computed, and trends analyzed. Another common measure that is treated this way, most widely used as a standard is the tax-to-GDP ratio. Using the share of tax revenue in GDP is used as a quick and easy way to understand the performance of the underlying tax system, however it does have its limitations particularly for research analysis.

In a 'rule of thumb' sense, a country with a low tax ratio such as one way below 20 percent, would be characterized as having a poorly rated tax system. This poor rating frequently scored by African States for example is partly a consequence of the features of their economic structure such as a large agrarian sector infamously difficult to tax – indeed many studies have proved the negative relationship that exists. For such reasons, tax ratios for developing nations are likely to remain persistently low, however one of the central arguments in this thesis is that this does not necessarily mean the tax system performs poorly.

A more informative approach would be to estimate tax revenue productivity; more specifically, estimate how tax revenues respond to changes in the tax base or GDP. Suppose over a period, the average tax ratio for country A is 18 percent and country B is 28 percent. Over the period, suppose the long run buoyancy estimate for country A is 1.06, meaning on average a 1 percent increase in GDP yields a 1.06 percent increase in total tax revenue *ceteris paribus*, and for country B is 1.02. This tell us that the tax system of country A is not necessarily a poor performer at all. Even though the ratio is low, tax yields are more than proportionate in response to GDP growth. Table I.1 further illustrates this point comparing some OECD and sub-Saharan African countries.

Table I.1: Tax ratio and buoyancy[1] – selected OECD and SSA countries

OECD	Tax/GDP Avg. (%)	Buoyancy	**Sub-Saharan Africa**	Tax/GDP Avg. (%)	Buoyancy
Greece	18.6	1.14	Uganda	8.0	1.12
Denmark	31.5	1.11	Malawi	10.2	1.08
United Kingdom	23.8	1.06	Kenya	14.7	1.05
New Zealand	32.2	0.98	Tanzania	9.6	1.02
France	17.2	0.76	Zambia	16.8	0.96
Japan	10.8	0.71			

Source: Authors computation using 1980 to 2016 (Malawi from 1983) central government tax revenue (excluding social security contributions) from the GRD 2018 (UNU-WIDER, 2018).

France and New Zealand for example, with an average ratio of 17 and 32 percent, have buoyancies less than 1 at 0.76 and 0.98 respectively. Since local government plays a substantial role in developed countries, we further considered general government revenues (excluding social security contributions). The tax ratio for France was 25 percent and buoyancy went up to 1.15, New Zealand was 34 percent, and buoyancy was still below 1 at 0.97. Japan's ratio was up to 18 percent but still with a less than proportionate buoyancy 0.84. On the other hand, Uganda and Malawi have low ratios, 8 and 10 percent, yet have good buoyancies 1.12 and 1.08 respectively. Further note that Zambia has a higher ratio but a lower buoyancy.

It must be noted however that higher buoyancies for developing countries may be reflecting the fact that over the years their systems have had more room to grow and develop as they capture more bases into the tax net. Indeed, in general the average growth rate of the tax share

[1] Buoyancy (β_1) is estimated by: $LogTax_t = \beta_0 + \beta_1 LogGDP + \varepsilon_t$. Stationarity and cointegration were checked prior to estimation, nonetheless, considering the time span and simple OLS, the model is unreliable. Thus, these estimates are for indicative purposes only even though similar to prior studies in SSA (see Chapters 1 and 2).

of GDP over the period was relatively higher for the developing countries. Therefore, the higher estimates do not mean Kenya's tax system is performing better than Japan's for example. Nevertheless, it does make the point of the inadequacy of the mere use of tax ratios, and the relevance of employing some measure of revenue productivity; the basis of this thesis.

The tax share of GDP may thus be a great indicator of capacity but should not be used on its own to gauge performance. High ratios in developed countries show that they are yielding revenues from all the bases; in a sense their systems have matured over the years and are now operating at capacity taxing everything they can. On the other hand, low ratios in developing countries indicate limited tax bases from which to yield revenue. This may indeed indicate there is room to grow, however given the size of their current respective bases, gauging tax responsivity is a better measure of performance, which can be achieved by estimating tax revenue productivity.

Prior studies have estimated elasticity and buoyancy applying simple Ordinary Least Square (OLS) regressions to annual time series. However, the second chapter of this thesis develops this approach by employing modern econometric analysis methods utilizing the more appropriate autoregressive distributed lag model (ARDL) to gauge the performance of taxes in Malawi.[2] The secondary objective was to deduce whether there has been any significant change in how taxes respond to bases following the implementation of a popular tax administration reform overhaul that saw the establishment of a tax collection agency that operates semi-

[2] The choice of Malawi was primarily due to the fact that the Author has at hand time series data of various tax categories (6) sourced from Annual Economic Reports from early 1970s from the Malawiana Archives at the University of Malawi Library (not publicly available remotely or online), collected since 2009 when the Author was studying at the University. This permitted a more disaggregated and thorough analysis in addition to the standard categorization of taxes available from online databases.

independent of government. For this objective, the inadequacies of utilizing the tax-to-GDP ratio as a unit of analysis is further highlighted, and the first chapter of this thesis is dedicated to devising a new quantitative approach to evaluating this reform that has swept across Latin America and Africa in particular. As a preamble to chapters one and two, the following brief historical context of how less developed states came about to embrace such a major reform is informative and aids understanding.

Tax administration reforms in developing countries: A historical overview

It is often wrongly assumed that tax reform always implies tax administration changes, however that is not always the case. Tanzi (1977, in Bird 1991) perhaps best illustrated it by distinguishing between the statutory and the real (or effective) tax system. Tax reform thus conceived has two stages: changing what is said (the law) and changing what is done (the administration of the law). The tax administration system encompasses both the laws governing, and how things are done to collect tax revenue. Law change without administrative change is nothing, but the converse is not true. In this thesis, tax reform, synonymously used with tax administration reform, does imply changes to both, as is logically conceived. This section gives a historical account how less developed countries came about to embrace the most significant reform to date.

During the colonial era, the tax administration systems in less developed states were basically modelled after various forms of centralized bureaucracies that existed in the colonial countries (Kiser & Sacks 2009). The idea of centralized bureaucracy lies in principal-agent relations derived from agency theory. In effect, centralized bureaucracy confines functions to the principal – in this case say central government's ministry of finance, other than the agent – the actual tax collector.

In a centralized bureaucracy the agent comes from within the principal, and that close arrangement can be regarded as the most efficient form of agency. However, those efficiencies can quickly erode under certain conditions due to its limitations chief among which are problems associated with information asymmetry – problems arising from agents knowing more about what they are doing than principals. In general, principal-agent relations work well when monitoring systems are present and effective or strong, but do not work well where that capacity is weak. The former was the status of tax administrative systems in colonial states such that centralized bureaucracies worked well as they continue to do today. The latter however was the status of colonies mainly due to poor communications and transportation infrastructure, and record-keeping.

The centralized bureaucracy model adopted for tax administration thus did not work. The legitimacy or superiority of western centralized bureaucratic systems was taken for granted and imitated with little regard to differences in relevant conditions. Bureaucratization requires adequate monitoring capacity, and colonies simply did not have it, they lacked sufficient technological foundations. Not surprisingly then, administrative structures were not effective given the conditions (Wallis 1989).

In the post-colonial period, many developing countries implemented administrative reforms, but until recently they still looked to tax systems in the developed world as their primary model (Gillis 1989, in Kiser & Sacks 2009). Like the colonial systems before them, these centralized bureaucracies did not function effectively (Bird 1989, Gillis 1989, Shaw 1981 in Kiser & Sacks 2009). Given their primarily agrarian economies and poor technologies in communication and transportation, centralized bureaucratic administration was entirely ineffective (Kiser & Baker 1994). Furthermore, as Becker and Stigler (1974, in Kiser & Sacks 2009) put it, when monitoring is inefficient and sanctions are weak, corruption of various forms will be high, *ceteris paribus*. This was true particularly to the African experience.

Given the lack of adequate monitoring and the resulting failure, the need to develop new models of tax administration became clear to African leaders. Agency theory posits that when monitoring capacity is poor, decentralized and privatized administrative systems will be more efficient than centralized bureaucratic tax administration. Evolving from centralized bureaucracies, rulers in pre-modern states compensated by shifting residual clamancy to agents to increase their incentives to maximize net tax revenue.[3] This was achieved by decentralization (to local notables, in feudal societies) or by privatization (tax farming for example, Kiser & Kane 2001).[4]

Efficiency debates aside, it seems clear that these systems worked better. Local political units such as provinces, feudal manors, peasant villages, or towns retained full autonomy to hire, fire, monitor, and pay officials (Kiser & Sacks 2009). Studies show that rulers in several pre-modern States who experimented with both tax farming and centralized administration for indirect taxes consistently chose the former because administrative costs, corruption, and tax evasion were each lower (Dietz 1932, Jones 1974, Kindleberger 1984, Kiser 1994, Thompson 1976, Wolfe 1972, in Kiser & Sacks 2009).

Over the past three decades, modern African states have begun to replace centralized bureaucracies with partially decentralized and partially privatized tax administration agencies, and the establishment of semi-autonomous tax revenue administration agencies typically known as semi-autonomous revenue authorities (SARAs) is the most visible expression to date. They are seen as a means to improve tax revenue performance. Recent reports suggest they are meeting this objective – strengthening of tax administrations has been cited as among the

[3] With residual clamancy the agent has a claim to part of the proceeds in accordance with the principal-agent contract.

[4] For a more comprehensive discussion on the alternative administrative systems to centralized bureaucracy in premodern states see Kiser and Sacks (2009)

significant factors accounting for the 13.1 to 18.2 percent growth in the tax share of GDP in Africa between 2000 and 2016 for example (OECD 2018b).

Nevertheless, how to credibly evaluate the effectiveness of these reforms has proved elusive as researchers continue to grapple with the immense analytical challenge of netting out other factors to attribute post reform changes to the reform itself. Indeed, other factors accounting for the recent growth are tax policy and favorable macroeconomic conditions.

Over the next three chapters, this thesis utilizes the concept of tax revenue productivity to provide a general evaluation of SARA tax administration reform; demonstrate a suitable way of analyzing tax revenue performance; and discuss how the macroeconomic environment and policies relate to the performance of tax revenue collection. Specifically, the chapters are outlined as follows.

Outline of this thesis

Chapter one contributes to the ongoing discussion a new quantitative approach to evaluating the most significant and popular tax administration reform to date in developing countries. It overcomes limitations enshrined in analyzing tax ratio trends that led to varying and thus inconclusive outcomes in the past by estimating the buoyancy coefficient of two samples from a panel of 21 countries. The first sample is an untreated group – all the countries from the panel are in their pre-reform phase. The second sample is a treated group and contains the same countries, now all in the post reform period. About five pairs of samples are drawn depending on the period in which the reform was implemented, and an established SARA begun operations. Another pair was geographical to compare Latin America and sub-Saharan Africa. The estimates from all pairs were then tested for significant statistical difference.

Estimating fixed effects and dynamic OLS models using data from 1980 to 2014, we show that real tax revenue collections were anywhere between 13 to 28 percent more responsive to changes in real GDP. The most gains were by SARAs implemented in later years most of which are consequently in sub-Saharan Africa. In Latin America, though the estimated coefficient suggests the performance of the tax system was higher post reform, the statistical test shows that the difference was not statistically significant suggesting that there exist substantial elements that hindered the success of the reform in that region.

Noting that the analysis in chapter one focuses on the total tax revenue alone, the secondary objective in chapter two was to demonstrate application to a single country case Malawi.[5] This permits an in depth look at how overall change in performance distributes between disaggregated components of tax revenue. The primary objective however was to demonstrate an appropriate or applicable method for assessing the performance of a country's tax system, in this case, one that gauges how tax revenues respond to changes or growth in the tax base both in the short and long run.

Applying ARDL estimation to 1979 to 2017 annual time series we found that real personal income tax is the most responsive to changes in real GDP in both the short and long run. This sensitivity and its 23 percent largest share of total tax revenue make this tax the most important in Malawi. There was however no significant change in responsivity following the reform.

[5] In addition to the author having rare disaggregated tax data, Malawi was chosen to compare with prior studies. For example, Sarr (2016) found the SARA reform had positive impact but with a two-year lag, Dom (2017) found no robust evidence for SSA countries. Further, the author noted Malawi tax ratios show increased variation post reform. Prior studies also estimated revenue productivity measures elasticity and buoyancy (Banda 2006, Mkwara 1999, & Chipeta 1998), thus a basis for comparison exists supplementing the primary objective of chapter two.

Among indirect taxes, VAT performs best in response to growth in real household consumption, closely followed by local excise tax. In general, the responsiveness of taxes on goods and services altogether increased by 0.99 percentage points following the reform. On the other hand, trade taxes, lumped as customs duties, show a low responsive rate indicating weak performance. However, there was improvement following the reform.

The performance of the overall tax system could be better. The responsiveness of real total tax revenue to growth in real GDP was less than proportionate. The reform coefficient suggests however that performance of total tax revenue, thus the tax system overall, did improve in the post reform period.

This disaggregated analysis shows where performance is strongest and weakest and could potentially draw tax administrators to act accordingly. It also shows the most performance gains following the reform were in taxes on goods and services particularly VAT, and in custom duties.

This preceding analysis however is subject to an important caution that is; it does not control for all the exogenous variables that affect tax collection. In gauging tax revenue performance by assessing its responsiveness to changes in base, the analysis assumes these factors are captured in the error term, but it is also important to know the partial effects of these on tax revenue collections more so in attempts to assess tax administration efforts for example. Indeed, over time, collections are partially a function of administrative efficiency, but tax performance also depends on other factors, some of which the administration has little or no control. Such factors include tax law modifications (such as tax bracket exemptions, thresholds and incentives) that affect the size of tax bases, changes in tax rates, economic structural composition and 'hard-to-tax' informal sectors, trade liberalization coupled with increased imports and lower tariffs, the porousness of borders, and the strength of anti-corruption

agencies and judicial systems among other institutions. It is thus difficult (almost impossible) to attribute post reform results solely to tax administration efforts, however knowledge of how other exogenous factors determine performance can aid value judgements.

Chapter three thus ascertains the significance and direction of the relationship between macroeconomic factors and total tax revenue collections. Noting that there are numerous studies assessing a panel of developing countries, this chapter focuses on Malawi to fill a literature gap and to aid the secondary objective in the preceding chapter. Moreover, literature also shows that the significance and even direction of the relationship between some exogenous factors and tax revenue can be different between countries.

By estimating ARDL models using 1980 to 2016 time series, we ascertain a negative relationship with the agricultural share of GDP, however, we discover a significant positive relationship with the services sector which can be classified, along with the recent trends in Africa, as an emerging sector. Other strong positive determinants are per capita GDP, money supply, and the exchange rate. We further find that domestic debt disincentivizes tax collection, but external debt induces it in the long run, and that inflation is not a significant predictor of tax revenue. This paper thus gives insight into the fabric of the Malawi economy and opportunities arising from structural change for tax collection, and how fiscal attributes and economic policies may affect tax revenues.

A general conclusion chapter follows that sums up the revenue productivity issues discussed including the evaluation of SARA reforms in general, and a final deduction on SARA reform in Malawi within the confines of the studies' limitations.

CHAPTER 1

Evaluating the Semi-Autonomous Revenue Authority Reform Model: A New Quantitative Panel Approach

Chapter Summary

Over the last three decades, many countries in developing Africa and Latin America have reformed their tax administrations away from centralized bureaucracy, establishing a semi-independent tax collection agency formally known as a Semi-Autonomous Revenue Authority (SARA), to operate efficiently and improve tax revenue collections.

To date, assessments have shown mixed results particularly for individual countries. None has yet submitted a definitive conclusion whether the SARA model has in general improved revenue performance of tax systems and been successful in achieving its prime objective.

By drawing pre and post reform samples, a panel analysis of twenty-one countries shows that in general, in the years following the reform, real tax collections were 13 to 28 percent more responsive to changes in real GDP. The most gains were by SARAs implemented in later years most of which are consequently in sub-Saharan Africa. On the other hand, statistical tests show that estimates from a panel of Latin American countries are not statistically different, suggesting there exist elements significant enough that hindered the success of the reform in that region.

Keywords: Semi-Autonomous Revenue Authority, tax reform, tax administration, developing countries

JEL codes: H20, H43, H83

1.1 Introduction

In most countries, tax administration is traditionally the mandate of line departments within central government's Ministry of Finance (MOF). Following failed reforms within existing central government structures, the mid-1980s and the next three decades saw a new wave of tax reform emerge that spread rapidly over more than 30 developing nations of Africa and Latin America. The reform saw establishments of Semi-Autonomous tax collection entities dubbed Revenue Authorities (RAs), Autonomous Revenue Authorities (ARAs) or more commonly, Semi-Autonomous Revenue Authorities (SARAs) in public finance literature. Put simply, the reform transfers all tax administration functions from the MOF to the SARA with constitutional provisions to operate independently of government to some degree. This legally granted autonomy particularly serves to deter political interference in day-to-day operations. Though their autonomy does not necessarily match that of a central bank, they are still in principle meant to be quite independent of the financing and personnel rules that govern the public sector in general (Fjelstad & Moore 2009). For example, its managers can recruit expatriates, and retain quality staff by paying remuneration above civil service pay scales.

In general, SARAs established share significant features in autonomy, management and organization and depict a similar operational framework. In practice however, there is some variation, and their success is further contingent on country specific conditions. In addition, tax revenue collections are also dependent on other exogenous factors such as government policies and macroeconomic conditions. For these reasons it is incredibly difficult to measure the contribution of tax administration to particular outcomes of the tax system. Empirical evaluations are thus scant leaving a notable gap in literature. Lately however, to address this knowledge gap studies are beginning to use innovative quantitative techniques to draw some

credible conclusions.[6] This chapter adds to these studies by proposing another quantitative methodology that deduces whether SARAs have been successful in improving tax revenue performance.

The rest of the chapter is organized as follows; Section 1.2 presents the research background and discusses principal arguments that have been made in favour of establishing a SARA. The section proceeds to outline the principal characteristics, and the associated pros and cons or possible issues of contention. Research objectives are then stated. Section 1.3 offers a review of literature including theoretical and empirical. Section 1.4 explains the methodology and how results would be inferred. Finally, section 1.5 discusses the results, and 1.6 concludes with a summary.

1.2 Research Background

1.2.1 Origins of the Revenue Authority Model

The revenue authority model has its origins in agency theory branching from the New Public Management (NPM) movement. The NPM is generally a management culture that is results oriented, focused on provision of efficient and quality service to the client or citizen with accountability. Agency theory favours the creation of executive agencies which are public organizations used as an instrument in unbundling bureaucracy and creating more flexible and performance oriented public organizations. Caulfield (2002, in Devas, Delay & Hubbard 2001) outline four prominent features of the executive agency form; decentralized management (including limited financial autonomy), task specialization, outputs focused, and performance contracting. The main argument in favour of executive agencies is that they can operate in a private-like form in managing public sector organizations in quest of improved efficiency and

[6] Sarr (2016), a synthetic control approach is the one study worth noting. See also Dom (2017) instrumental variable approach.

effectiveness in conduct and service delivery. In sum, executive agencies and SARAs are similar in that the underlying principles of management have a business-like mentality.

1.2.2 The Rationale for establishing a Semi-Autonomous Revenue Authority

Though there are some country variations, reasons for the adoption of the SARA model in general, were (political) interference, tax evasion, public sector corruption, high compliance costs, and inefficiency, which had all led to dissatisfactory revenue collections amid soaring expenditure needs and fiscal deficits.

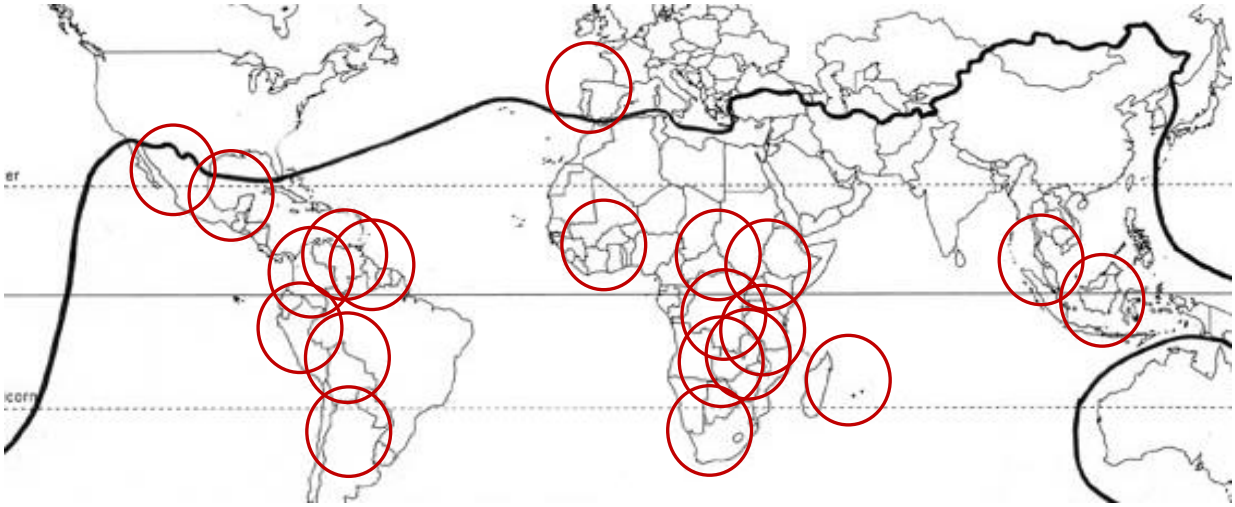
Alternative tax administration models do exist. However, given that contemporary Africa's technologies in communication, transportation, and record keeping, are better developed than in premodern states but not as developed as contemporary developed states, Kiser and Sacks (2009) argue that centralized and partially privatized SARAs are a more appropriate organizational structure for tax administration in Africa than either complete decentralization and privatization, or centralized bureaucracy.

Becker and Stigler (1974, in Kiser & Sacks 2001) had long ago also asserted that one of the limitations of centralized bureaucracy, is that when monitoring is ineffective and sanctions are weak, corruption of various forms will be high, ceteris paribus. Such has proven to be the experience in Africa and Latin America. With such deep-seated problems, in many cases efforts to reform within the ministry of finance had failed to generate notable or sustainable improvements (Mann 2004).

Nevertheless, review of literature shows that the ultimate objective of all main stakeholders in establishing a SARA was to increase tax revenues. Devas et al. (2001) argued that the creation of the revenue authority model works best when the financial position of a country is dire, and the civil service pay scale offers little reward to those with the necessary skills. Clearly, SARAs

have generally been established in regions of poor economies with relatively dire fiscal stress, where governments were especially eager to improve their tax collection mechanisms.

Figure 1.1: SARA establishment world wide[7]



SARAs are mainly found in sub-Saharan Africa (SSA) and Latin America, the two regions of the world that suffered from low and declining incomes in the 1980s and 1990s in particular. The first attempts at SARA reform in these two regions ─ Ghana and Peru ─ were both in situations of acute fiscal crisis, with government revenues reduced to about 6% of GDP in both cases (Fjelstad & Moore 2009). Singapore and Malaysia are exceptions to the typical profile

[7] In Africa, Uganda (1991), Zambia (1994), Kenya (1995), South Africa (1996), Tanzania (1996), Rwanda (2000), Malawi (2000), Zimbabwe (2001), Ethiopia (2002), Sierra Leone (2002), Lesotho (2003), Botswana (2004), Gambia (2005), Mauritius (2005), Mozambique (2007), Burundi (2009), Ghana (2009), Seychelles (2009), Swaziland (2011), Namibia (2017).
In Latin America and Caribbean, Peru (1988), Argentina (1988), Bolivia (1988), Colombia (1991), Venezuela (1994), Mexico (1997), Guatemala (1999) and Guyana (1999), Jamaica (2011), Barbados (2014).
In Europe, Spain (1991).
In Asia, Singapore (1992), Malaysia (1994)

not only in the geographical sense. In Singapore, tax administration is generally viewed as efficient with tax gap estimated to be less than 10 percent.[8] In Malaysia the civil service is highly regarded. It appears that in these countries perhaps the motivation for the reforms was supported by the desire to improve taxpayer services and thus the overall business environment (Manasan 2003).

Within sub-Saharan Africa (SSA), SARAs are also mainly found in countries most directly influenced by international agencies. The UK's Department for International Development (DfID), the World Bank, and the IMF in particular have an interest in government fiscal health for global stability, including in ensuring that previous loans can be repaid, and new ones taken. Consequently, as donors they also advocate decentralization and privatization as a way to decrease government corruption that often wastes their investments (Kiser & Sacks 2001). On the other hand, government has an incentive to comply to signal to external supporters especially budget supporters and aid partners seriousness and a willingness to adopt an iconic idea and reform agendas (Taliercio 2004). Further, establishing a SARA was a substantial organizational change that could be used to mitigate resistance within ministries and as a vehicle to introduce and facilitate more specific changes in tax administration (Kidd & Crandall 2006).

Overall, there was a general consensus among international organizations and leaders of Africa and Latin American States regarding the causes of poor performance. First, tax administration staff remuneration was much too low relative the private sector. Second, bureaucratic civil service regulations were much too rigid to modify remuneration to performance based and

[8] Tax gap is the difference between total amounts of taxes owed to the government and the amount they actually receive. Late tax payments, as well as overstating deductions and understating incomes can widen the tax gap.

incentivize work; too rigid to dismiss officials for poor performance or corruption, and too rigid to expand the scope of possible reforms.

There was need for autonomy, particularly in personnel management, administration and financing. Autonomy would facilitate employment of competent and more qualified staff by offering higher than civil service remuneration packages as well as the will to dismiss on own terms. It would also facilitate de-politicization of tax administration limiting interference in day to day operations (Fjelstad & Moore 2009). These changes would in turn attack and reduce ingrained corruption, and thus improve the credibility and public perception of taxation in particular and the government in general. Further, an administrative shift from a reactive and bureaucratic culture to a proactive and professional one centred on work ethic would reduce hostility. What was needed was such an organization, with power to hire and fire, independently set remuneration and reform its procedures for maximum efficiency; SARAs were seen to be able to do exactly that (Devas, Delay and Hubbard 2001, Manasan 2003, Man 2004, Taliercio 2004).

Furthermore, financing that is independent of the normal national budgeting process would also permit long term planning beyond meeting recurrent expenditure but for investment in the authority's capacity and equipment (Mann 2004). Overall, these changes would foster efficiency, and resulting improvements in taxpayer services would also reduce compliance costs. SARAs that have been established have taken some variations of these aspects. The following section alludes to this and discusses the main facets of established authorities.

1.2.3 The Principle Issues and Characteristics of Established SARAs

As stated, the overarching rationale for transferring the tax collection function from the Ministry of Finance to a SARA is to enhance tax revenue performance amidst rising public expenditure needs, and to attack deep-rooted corruption. To do this, SARAs are designed such

that its functions may be insulated from undue political interference. They are thus conferred semi-autonomous legal status and the resulting agency shapes within the following characteristics.

1.2.3.1 The Legal Form and Autonomy

There can be many variations of the legal form that then determines its autonomy. It should be noted that though the first executive agencies were modelled on the central bank, SARAs are not meant to be as autonomous. Mann (2004) categorizes at least three legal forms:

1. A large degree of autonomy as a decentralized institution with separate legal character and complete autonomy regarding financial, personnel, administrative, and procurement systems (e.g. Ecuador, Guatemala, and Peru).
2. A corporate body with perpetual succession and also a large degree of autonomy (e.g. Kenya, Tanzania, Uganda, Zambia).
3. A de-concentrated service with no separate legal character (e.g. Argentina, Mexico, South Africa).

Though it might even be arguable to label the third variation a SARA, in all cases the new agency is granted in law, some autonomy from central executive power.

1.2.3.2 Leadership and Governance

The SARA is led by a chief executive, head, or commissioner general who is answerable to a board. Particularly in SSA, the President or Minister of Finance is involved in almost every case of appointment. While almost every SARA board includes a private sector representative, in every case he or she is chosen by government rather than by any independent organization (Kidd & Crandall 2006).

Similarly, in Ethiopia, South Africa, Tanzania and Zambia, the chief executive is appointed by government alone, and in Botswana, Kenya, Lesotho, Rwanda, Uganda and Zimbabwe, he or

she is jointly appointed by the government and the supervisory/management board. Only in Mauritius does the board alone have sole formal power of appointment (Fjelstad & Moore 2009).

In other cases, chief executives appointed to run SARAs in Africa have been expatriates or nationals believed not to be deeply embedded in local politics or networks of corruption. Fjelstad and Moore (2009) however note that such appointments are made and terminated very much at the will of Presidents. This means close relations between the chief executive and head of state are the norm, which implies informal power relations can significantly if not completely override formal arrangements designed to ensure autonomy.

In addition, the SARA-MOF relationship is often of contention. The MOF is in charge of establishing tax policy, but with SARA input. Frequently, the tax policy analysis unit in the SARA is better, however the Minister often tries to interfere in SARA policies, and the resolutions often depend on personalities (Mann 2004). Separation of responsibilities is important, however defining and maintaining separation must be a challenge.

1.2.3.3 Personnel Management

In Uganda in 1989, with average public official salaries at 20 percent of the corresponding salary in the private sector, higher quality staff tended to leave while those who stayed tended to take bribes (Fjelstad 2005). The personnel systems in SARAs are established autonomously outside the framework of the regular civil service system. Fjelstad and Moore (2009) report that in some cases remuneration is at levels with comparable jobs in the private sector. This is important for the recruitment and retainment of competent personnel that would not be easily outwitted by their counterparts in tax consultancies and corporate legal departments.

In a minority of cases however, the human resource policy and salary scales of SARAs fall within the civil service and/or must meet ministerial (of finance) approval (Mann 2004).

1.2.3.4 Financing and Accountability Mechanisms

Arrangements in financing also vary from strongly autonomous to discretional. In Peru and Guatemala, direct deposits of a given percentage of revenue collections are made into a special SARA account. In Ecuador, this is periodic as a given percentage of revenue collections released periodically by the MOF. In Mexico, South Africa, Tanzania, and Uganda, the mechanism is legislative in the form of annual budget appropriations. In Kenya, appropriations are given as a percentage of estimated collections plus the difference between actual and estimated revenues (Mann 2004).

The mechanisms for accountability also range from directly reporting to the legislature, to reporting to the MOF, the SARAs Board of Directors, and/or the national comptroller's office. Mann (2004) further notes a critical concern; while SARA organizational charts include an internal audit unit; most lack an internal anticorruption investigation unit and a unit to investigate external fiscal fraud by tax payers. Studies have shown that part of the SARA evolution is increased self-assessment, and that as a SARA matures, corruption is inevitable. These functions are thus important.

These features do show that the variation in institutional and perhaps operational arrangements of SARAs could potentially be quite wide, nevertheless the general similarities in management, autonomy, and organizational framework are alike enough that conducting a broad evaluation would not be futile.

Though these features are deliberate to enhance revenue performance, it is worth noting that they do pose risks some of which have led to arguments against SARAs. Most common is the higher cost argument. For example, between 1991 and 2002 Uganda Revenue Authority (URA) expanded staff by 50 percent, higher salaries and more officials led to unusually high collection costs that soared from 2.8 to 5.3 percent of revenues collected over the same period

(Therkildsen 2003, in Kiser & Sacks 2009). However, it is possible that higher salaries may be offset by weeding out incompetent and/or corrupt employees. The second drawback relates to impact on the wider civil service stemming from such issues as jealousy and reluctance to cooperate as SARA staff work with MOF, courts, police etc. Third, civil service rules and regulations protect public resources and the public from abuse, greater autonomy and power over personnel and finance can result in corruption, as was the case with Uganda Revenue Authority when president Museveni publicly called it 'a den of thieves' (Muwanga 2009).

1.2.4 Research Problem and Objectives

Studies that have carried out analyses of SARAs conclude that mere establishment offers no guarantee of success. This is no surprise considering the possible variation in the institutional arrangement discussed and the potential for informal settings to erode formal arrangements. In general, most studies find mixed results and/or fail to conclude whether SARAs have improved tax revenue performance or have failed to live up to their expectations (Mann 2004, Manasan 2003, Taliercio 2004a, 2001). Others downright find no evidence or sign of success (Dom 2017, Fjelstad & Moore 2009, Kidd & Crandall 2006).

Encompassing all literature, the general consensus however is that SARAs have definitely increased tax revenue collections. The problem however, is that even real tax collections, without a base cannot be used as a unit of analysis to evaluate the reform; a natural upward trend is expected.

Most assessments thus resort to GDP for the base and analyse movements in the tax-to-GDP ratio, the standard unit of gauging performance. However, this unit often varies considerably over time such that gauging a long-term trend can be difficult perhaps even misleading. For example, when a SARA was established in Peru in 1988, the ratio rose from 9 percent in 1987

to 15 percent in 1997. In other countries, the improvement was more modest. In Venezuela, a SARA was established in 1994, the ratio increased 3 points from 14 percent in 1993 to 17 percent in 1997. In Colombia, a SARA was established in 1991 and the ratio went up from 10 percent in 1990 to 13 percent in 1997. In South Africa, a SARA was established in 1996, and the ratio rose 2 points from 24 percent in 1996 to 26 percent in 1999 (Manasan 2003).

However, in some countries the creation of a SARA seemed to have had no tangible impact on the tax-to-GDP ratio, for example in Malaysia, following a SARA established in 1994, the ratio was fairly stable at 17 percent of GDP since 1993. Yet still, in other countries, the ratio declined despite creation of a SARA. In Rwanda, a SARA was established in 2000, the ratio rose from 9.8 percent in 1997 to 10.1 percent in 1998 and dropped to 9.3 percent in 2000. In Tanzania, a SARA was established in 1996, the ratio rose from 11 percent in 1995 to 12 percent in 1996 but declined since then reaching 10 percent in 1998 (Manasan 2003).[9]

This leaves quite an unclear picture but is only the tip of the extremely difficult problem researchers face in attempts to quantify the contribution the SARA reform makes to revenue mobilization. What is needed, is a unit that can measure how tax revenue changes (or responds) when the tax base changes. Such a measure would estimate the long run responsiveness of tax revenue whether the tax-to-GDP ratio is as low as 10 percent – considered a poor performance, or as high as 30 percent – considered a good performance. Whether a country has a low or high tax-to-GDP ratio, a one-to-one or proportionate response of a tax revenue to changes in its base indicates good performance given the current tax effort and size of the tax base. The overall objective of this study was to identify such a unit of analysis and use it to estimate and

[9]Annex 1.2 shows seven cases that illustrate the challenge in using trends in tax-to-GDP ratio to deduce whether overall the SARA reform model has improved the revenue performance of tax systems

compare pre-reform and post-reform revenue performance in developing countries and make general deductions concerning the SARA reform model.

1.3 Literature review

Within the limited literature assessing SARAs and revenue performance, results are mixed leaving the question whether SARAs have generally been effective open ended. Furthermore, most existing literature including those attempting to evaluate the reform have focused on the organizational structure and operational framework other than the revenue performance outcomes of the authorities. We begin with a brief theoretical review of the concept of tax revenue productivity measures before turning to some empirical literature review.

1.3.1 Revenue Performance Measures

Most performance measures assess tax revenue collected in relation to its base. The most common such measure is the total tax revenue share of GDP. For example, the average is 21 percent in sub-Saharan Africa and 33 percent OECD countries (OECD 2018a). What may be seen as low performance is partly a consequence of the features of the economic structure of African states that is largely agrarian, with most producers as small enterprises often lacking accounting and book keeping capabilities, both of which make tax collection difficult.

Tax-to-GDP ratios for developing countries are thus low, however this is not necessarily an indicator of poor performance. A more indicative measure of performance would be to evaluate revenue productivity, that is to estimate how tax revenues change in response to changes in the base or GDP. Ideally, a performing tax system should respond at least proportionately one-to-one, regardless how low or high the tax ratio is. Though difficult to ascertain the portion, this measure of responsiveness can also reflect tax administration efforts.

How taxes grow relative to the base can be decomposed into two. First, tax revenues can 'automatically' grow because the tax base has grown. Second, tax revenues can grow because

tax rates and/or rules have changed, i.e. 'discretionary changes.' Tax administration has the potential to tap into both, but both can also be affected independently of the tax authority presenting the quantitative assessment challenge discussed. Simply put, both automatic and discretionary changes present difficulty in strictly crediting growth in revenue to the SARA or any tax administration. Revenue growth may simply be an automatic response to good economic performance. On the other hand, discretionary changes such as changes in tax rates may simply reflect the fiscal policies of the Ministry of Finance (MOF).

Nevertheless, to gauge this responsiveness, studies many of which assess individual countries, estimate tax buoyancy, which measures the responsiveness of tax revenue to a percent change in GDP.[10] Buoyancy measures the responsiveness encompassing both revenue growth due to base growth, and revenue growth due to discretionary tax changes. A closely related measure is elasticity which estimates responsiveness to base growth alone. There are also other measures variously used in literature mostly as basic indicators of tax revenue performance.[11]

1.3.1 Empirical literature review

Early studies beginning around the year 2000 mostly used qualitative assessments to analyse the organizational structure and operational framework. Lately however, studies are beginning to posit plausible empirical frameworks for quantitative evaluations.

In his re-examination of SARAs in SSA, Dom (2017) found that SARAs had a consistently positive effect on direct taxes, and on taxes on goods and services, but a negative effect on trade taxes. His research however showed that when you control for revenue dynamics there actually is little statistical evidence for a relationship between SARAs and total tax revenues in SSA. He further found that corruption was unaffected by SARAs. His paper basically cast

[10] Omondi et.al (2014), Mawia and Nzomoi (2013), Chipeta (2009), Kusi (1998), Osoro (1993)

[11] For a comprehensive list on revenue performance measures, see Mann (2004)

doubt on any prior studies that suggested a positive association between SARAs and revenue performance.

The synthetic control technique employed by Sarr (2016) generates a counterfactual country that behaves as if it was not under reform intervention. Out of twenty SARAs, only five, Argentina, Bolivia, Guyana, Malawi and South Africa, sustainably performed better than their synthetic controls. For some countries like Zambia, the impact seems to have been briefly positive before becoming negative the rest of the period suggesting SARAs have been unsustainable in some cases. Some results were ambiguous, and for other countries, the method had failed to build counterfactual revenue trends similar to those of the treated countries limiting the comprehensiveness of the study.

As contributions to ongoing discussions, these two studies represent recent credible attempts to analyse SARAs and revenue performance quantitatively. In some earlier studies, Fjelstad and Moore (2009) noted that some cases of recovery were special cases, such as South Africa from the apartheid regime, and Uganda and Rwanda from civil war. In such cases, it can be argued, public revenues would have increased anyway. It is thus difficult to gauge to what extent SARAs accelerated or amplified the process.

Taliercio (2004b) also found mixed results when he investigated Peru, Mexico, Venezuela, Kenya, Uganda, and South Africa. However, he highlighted that revenue performance improved where SARAs had a higher degree of autonomy and where the autonomy was sustained. His earlier studies of the experiences of Bolivia, Mexico, Peru and Venezuela had shown quite the opposite when autonomous features are undermined or eliminated by government.

Mann's (2004) more encompassing comparative study concludes that, in general the initial years of SARAs witness genuine progress toward achievement of goals. Though progress is

never linear the trend line is upward. However, the trend is non-linearly sustained and soon, stagnation sets in, and backsliding takes over necessitating further reforms. Though Mann (2004) does no empirical assessment of how SARAs relate to revenue performance, he still does give some comprehensive recommendations regarding the structure and governance of SARAs and strongly advocates for maximum autonomy.

Fjelstad and Moore's (2009) analysis had similarly found that total revenues increase steeply for some years, and then with small variations, they seem to plateau at some proportion of GDP. Kiser and Sacks (2009) studying Uganda asserted that it had been successful initially; a portion of the increase in the revenue proportion of GDP was clearly a product of increases in administrative efficiency, but little progress ensued thereafter such that its tax ratio 13.6 percent in 2004 was way below the SSA average of 20 percent. Corruption also begun to rise post reform; in a 1998 survey, 43 percent of firms said they had paid bribes to the authority's officials (Gauthier & Reinikka 2001, in Kiser & Sacks 2009). The determinants of the declining performance were the gradual erosion internally of SARA features as well as external in the form of increasing political interference.

In the case of South Africa, which is highly regarded as a model case, scholars have cited many factors as contributing to the increasing efficiency of the tax administration; technology improvements, dealing quickly and effectively with officials taking bribes and other forms of corruption, recruiting more staff with corporate backgrounds, and using negative publicity to embarrass and deter tax evaders (Taliercio 2004b). Kiser and Sacks (2009) suggest that increasing the autonomy of South Africa Revenue Services (SARS) could produce additional improvements in administrative efficiency.

Kidd and Crandall (2006) on the other hand devoted a part of their paper to discuss the challenge in data collection to effectively carry out an econometric evaluation of SARA reform.

They thus concluded that while there are various subjective perceptions among researchers and country officials, there is yet to be an objective study evaluating the SARA governance model.

This paper joins current research to develop an analytical model that would produce quantifiable results. It attempts to yield results that can be used to speak of SARAs in general while noting that results from country specific studies may certainly vary. Thus, in no way is this study a definitive assertion of whether the model should be implemented or not, but rather a contribution to emerging quantitative approaches and ongoing discussion.

1.4 Empirical Methodology and Data

1.4.1 Methodology

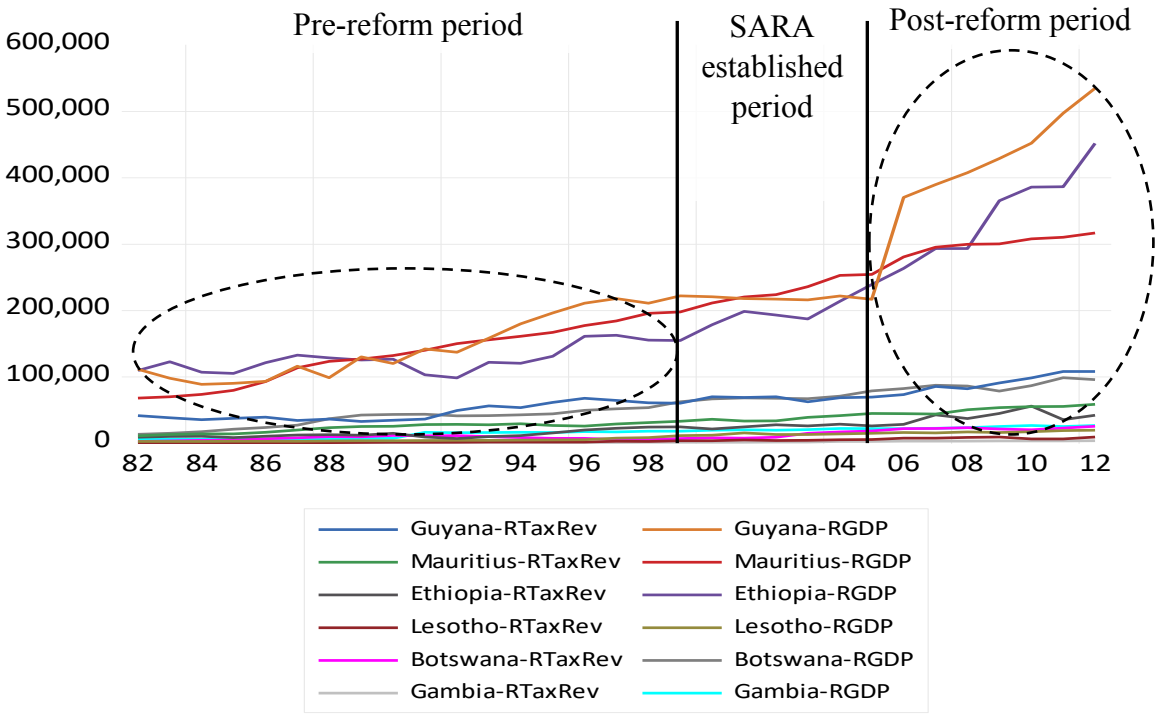
To evaluate whether SARA tax administration reform has improved tax revenue productivity some basis of comparison ought to be identified or created. One approach would be to select pre and post reform tax administration characteristics or performance indicators for a mere comparison. However, this would tell us little overall and in the long run. The alternative would be to utilize a data-driven statistical and/or econometric approach. Emerging studies follow the latter with some innovation to overcome previously identified analysis limitations. Dom (2017) included a lagged dependent variable to capture dynamic effects, as well as an instrumental variable approach. Sarr (2016) used observed characteristics of countries, to construct the counterfactual country with a counterfactual revenue performance whose trend was then compared to the treated country in the post treatment period.

This study follows the data-driven approaches. To measure revenue performance, a balanced panel regression is used to estimate tax buoyancy of countries with SARAs. Tax buoyancy (β_1 in equation 1) measures the responsiveness of tax revenue to changes in the tax base; in this case, how real total tax revenue collections respond to changes in real GDP.

$$Log(RTaxRev)_{it} = \boldsymbol{\alpha}_0 + \beta_1 Log(RGDP)_{it} + \boldsymbol{\varepsilon_{it}} \quad \ldots (1)$$

To enable the comparison, each panel consists of two samples; the first with the countries in their pre-reform years, the second with the same countries in their post reform years. In literature, the year a SARA was established often refers to the year the Act of parliament or legislation establishing the SARA was passed. As Mann (2004) noted, there are cases where gaps exist between the legal establishment and the start of operations. To be clear, in this study the year of establishment is used to refer to and is synonymous with the year the SARA begun operations unless specified otherwise. This guided our sampling method to ensure post reform samples are the years in which the SARA was actually operational. Figure 1.2 illustrates this sampling method supposing we were assessing 6 countries that established a semi-autonomous revenue authority in any of the years between 2000 and 2005.

Figure 1.2 Pre and post reform analysis sampling method



At least 10 years of operation on either side of the reform was required to be counted in a panel. 10 years was determined as a reasonable time, moreover in Mann's (2004) description of the evolution of SARAs, 10 years has generally been seen as the number of years within which a

SARA is firmly enough established. 21 countries from which various panels are drawn, fit this 10-year criteria.

Pre and post reform buoyancy coefficients were estimated from the pre and post reform samples respectively and tested for statistical difference. In this case we have two coefficients estimated from two samples of different size. To test for statistical difference, we utilized a form of the *z*-test used to investigate the significance of the difference between the means of two populations when variances are known and unequal. Drawing on the work of Clogg et.al (1995), in large samples, the significance of the difference between the coefficients can be assessed with the statistic;

$$z = \frac{\widehat{\beta}_1 - \widehat{\beta}_2}{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^{\frac{1}{2}}} \quad \text{or} \quad z = \frac{\widehat{\beta}_1 - \widehat{\beta}_2}{\left(s_{e_1}^2 + s_{e_2}^2\right)^{\frac{1}{2}}}$$ (where s is standard deviation, and s_e is standard error)

which follows a standard unit normal under the null hypothesis of equality of the two coefficients. The statistic is computed assuming the samples are independent in which case the standard error of the difference is the square root of the sum of the two squared standard errors (Clogg et.al 1995). The test is accurate if the groups are normally distributed. If not, the test may be regarded as approximate (Kanji 1999).

With the exception of the Latin America panel, the pair estimates in all cases were statistically different. Annex 1.5 shows the results.

1.4.2 Data

The full data consisted of a panel of 30 countries, from which 21 fitting the 10-year criteria were sampled to make a balanced panel covering the period 1980 to 2014.[12] The outcome variable real total tax revenue was constructed using the tax-to-GDP ratio obtained from the

[12] See annex 1.1 for countries sampled and countries not sampled

International Centre for Tax and Development's Government Revenue Dataset (ICTD GRD) version November 2017 (ICTD/UNU-WIDER 2017). The coverage, scope and consistency of this dataset outperform the available alternatives such that some prior research on taxation and development has been reassessed (Prichard 2016). The dataset records central and general government's annual tax revenue data for various individual tax categories. Because in some countries, SARAs are not responsible for local government tax administration, in this study we focused on central government total tax revenue (excluding social contributions and natural resource revenue). The GDP series were obtained from WDI (2017) for consistency, and together with the GRD tax-to-GDP ratios, total tax revenue series in local currency units were computed. The consumer price index (CPI) to transform variables into real data was obtained from WDI (2017), where unavailable the Federal Reserve Economic Data (Federal Bank of St. Louis 2018) and other secondary literature were consulted.

1.4.3 Sampling

From within the 21-country panel, samples were then drawn depending on the period in which a SARA was operationally established. Three samples are drawn in this regard. The third sample was then re-estimated omitting some countries that may bias the result. A fourth and fifth sample were then drawn to test and compare the experience of Latin America and sub-Saharan Africa respectively. Thus, in total, buoyancy coefficients of 6 pair samples; panel A, B, C1, C2, D and E were estimated.

1.4.4 Estimation

Knowing that panel cross-sections may exhibit non-stationarity the first step for each sample was to conduct a panel unit root test. Recent literature suggests that panel-based unit root tests have higher power than unit root tests based on individual time series. We conducted Levin, Lin and Chu (LLC, 2002) and Fischer-type tests using Augmented Dickey-Fuller (ADF) tests

(Maddala & Wu 1999).[13] If the two variables in the regression were integrated to the same order, a Pedroni residual cointegration test was performed.[14]

An ARDL approach to testing for cointegration as proposed by Pesaran and Shin (1995) and error correction model (ECM) were then used to re-check or confirm a cointegrating relationship.[15] If the error correction term in the ECM is negative and significant, we rejected any hypothesis of no cointegrating relationship, and proceeded to estimate a dynamic ordinary least squares (DOLS) and fixed effects (FE) model. This was the case in all 6 of the pre-reform samples and 2 of the post reform samples. In the other 4 post reform samples, real tax revenue and real GDP series were stationary in levels, and thus a least squares FE model was estimated.

1.4.5 Dynamic OLS model

Given the equation;

$$Y_t = \alpha + \theta X_t + z_t \quad (2)$$

If X_t and Y_t are cointegrated, then the OLS estimator θ is consistent. However, in general the OLS estimator has a non-normal distribution, and inferences based on the *t*-statistic can be misleading even when computed using Heteroskedastic and Autocorrelation Consistent (HAC) standard errors. Noting these negatives, new ways to estimate the cointegrating coefficient have been developed. One such estimator of θ is the dynamic OLS (DOLS) estimator (Stock and Watson 1993).

[13] See annex 1.3 for LLC and Fischer-type ADF unit root test results

[14] See annex 1.4 for Pedroni residual cointegration test results

[15] See annex 1.4 for ARDL and ECM approach to testing for cointegration results

The DOLS estimator is based on a modified version of equation (2) that includes past, present, and future values of the change in X_t.

$$Y_t = \beta_0 + \theta X_t + \sum_{j=-p}^{p} \delta_j \Delta X_{t-j} + u_t \quad (3)$$

In this equation, the regressors are $X_t, \Delta X_{t+p}, \ldots, \Delta Xt\text{-}p$. The DOLS estimator of θ is the OLS estimator of θ in the equation (3). If X_t and Y_t are cointegrated, then the DOLS estimator is efficient in large samples. Moreover, statistical inferences about θ and δ's based on HAC standard errors are valid as the *t*-statistics have a standard normal distribution in large samples.

If X_t is strictly exogenous, i.e. uncorrelated with the error term, then θ in equation (3) would be the long-run cumulative multiplier, that is the long run effect of a change in X on Y. If X_t is not strictly exogenous this interpretation does not hold. Nevertheless, since X_t and Y_t are cointegrated and have a common stochastic trend, the DOLS estimator is consistent even if X_t is endogenous. For these reasons, equations where a cointegrating relationship was evident, the DOLS coefficient was estimated.

1.4.6 Least Squares Fixed Effects model

Fixed effects regression is a method for controlling for omitted variables in panel data when the omitted variables vary across entities (in this case countries) but do not change over time. Consider the model;

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 Z_i + u_{it} \quad (4)$$

where Z_i is an unobserved variable that varies from one country to another but does not change over time. We want to estimate β_1, the effect of a change in GDP *X* on tax revenue *Y* holding constant the unobserved country characteristics *Z*. Because Z_i varies from one country to the

next but is constant over time, equation (4) can be interpreted as having *n* intercepts, and thus if we specify; $\alpha_i = \beta_0 + \beta_2 Z_i$ equation (4) becomes

$$Y_{it} = \beta_1 X_{it} + \alpha_i + u_{it} \quad (5)$$

Equation (5) is the fixed effects model in which $\alpha_1,\ldots, \alpha_n$ are treated as unknown intercepts to be estimated, one for each country. When using the FE model, we assume that unobserved factors within the individual country may impact or bias the explanatory or dependent variable and we need to control for this. Unlike the random effects model, this model has *n* different intercepts, one for each country, which absorb the influences of all omitted variables that differ from one country to the next. In other words, the fixed effects α_1 capture all unobservable time invariant differences across the countries. Put simply, it removes the effect of time invariant country characteristics so that buoyancy or responsiveness is measured as the net effect of GDP on tax revenue.

1.5 Results

1.5.1 Panel A – SARA established 1994-1999, EA9

The first panel A consists of countries that were the Early Adopters (EA) of the reform establishing a SARA between 1994 and 1999. 9 countries across Latin America, Africa and Malaysia in Asia fit this profile. One reason for this sample is to maintain a minimal gap (5 years) in between the pair samples to minimize the effects generational differences such as the impact of technology and ICT may have on results.

Pre-reform period	Sample: SARA established 1994 - 1999	Post-reform period
1980 – 1993 126 Obs. 9 countries by 14yrs	Venezuela 94, Mexico 97, Guatemala 99, Ecuador 99, Zambia 94, Kenya 95, South Africa 96, Tanzania 96, Malaysia 96	1999 – 2014 144 Obs. 9 countries by 16yrs

Table 1.5.1: Panel A – Dynamic OLS & Least Squares FE Estimates

Pre-reform sample			Post-reform sample			Buoyancy shift
DOLS (Obs.117)			DOLS (Obs. 127)			DOLS
LogRGDP	1.015*	[0.0309]	LogRGDP	1.217*	[0.0628]	+0.202$^{\Delta}$
LR Variance	0.01765		LR Variance	0.01773		[0.0699]
LS (FE) (Obs. 126)			LS (FE) (Obs. 144)			LS (FE)
LOGRGDP	1.019*	[0.0212]	LogRGDP	1.163*	[0.0375]	+0.144$^{\Delta}$
C	-2.279	[0.3558]	C	-4.761*	[0.6364]	[0.0431]
F-Stat	3170.53*		F-Stat	23219.61*		

* Reject null at 1%, ** at 5%. Standard errors in [ ] parentheses
$^{\Delta}$ Difference is statistically significant at 1%

The DOLS and FE models estimate post reform buoyancy was higher by 0.202 and 0.144 percentage points respectively for every 1 percent increase in real GDP indicating that overall, holding other country specific factors constant, real total tax collections were more responsive to real GDP in the years post reform. This suggests the reform had a positive impact on the rate at which real tax collections respond to real GDP growth, i.e. tax revenue productivity.

1.5.2 Panel B – SARA established 2000 - 2005, NC10

Panel B is a sample of 10 countries in Africa and Latin America that implemented the reform later around the turn of the New Century (NC) between 2000 and 2005. It can be expected that these will have had a learning curve. This sample enables us to test if any post reform performance improvements had an edge over the early adopters. This sample also maintains a minimal gap of 5 years between the pair of samples.

Pre-reform period	Sample: SARA established 2000 - 2005	Post-reform period
1980 – 1999 200 Obs. 10 countries by 20yrs	Guyana 00, Rwanda 00, Malawi 00, Zimbabwe 01, Ethiopia 02, Sierra Leone 02, Lesotho 03, Botswana 04, Gambia 05, Mauritius 05	2005 – 2014 100 Obs. 10 countries by 10yrs

Table 1.5.2: Panel B – NC10 Dynamic OLS & Least Squares FE Estimates

Pre-reform sample			Post-reform sample			Buoyancy shift
DOLS (Obs.186)			DOLS			DOLS
LogRGDP	0.904*	[0.0581]		-		-
LR Variance	0.0928					
LS (FE) (Obs. 200)			LS (FE) (Obs. 100)			LS (FE)
LOGRGDP	0.908*	[0.0346]	LogRGDP	1.193*	[0.0263]	+0.285$^{\Delta}$
C	-0.6804	[0.4269]	C	-4.197*	[0.3234]	[0.0435]
F-Stat	2695.106*		F-Stat	982.334*		

* Reject null at 1%. Standard errors in [ ] parentheses
$^{\Delta}$ Difference is statistically significant at 1%

Comparatively, the least squares fixed effects estimator in this panel shows that the improvement in revenue performance following the reform was better for countries that implemented the SARA reform later around the turn of the new century. This is expected as later SARAs could learn from others experience. Particularly in SSA, the South Africa Revenues Service has been the go-to SARA for consultancy, and periodically dispatch their staff to conduct trainings.

The FE model results show that the overall pre-reform buoyancy of these new century SARAs was lower, and the post-reform buoyancy was higher relative to the early adopters, and thus the greater the magnitude of the shift in buoyancy.

1.5.3 Panel C1 – SARA established 1991 - 2005, C1-21

This third sample was made to be broad to encompass as many SARAs as possible in the sample. In accordance with the 10 minimum years of operation condition, 21 countries that established a SARA between 1991 and 2005 was the biggest sample fitting the profile.

We note that this panel would likely be more severely influenced by generational economic differences. Surely economic conditions for all these countries in the 1980s were different to the 2000s such that understanding how economic factors affect tax revenue performance would

be even more important here. Where the generational gap is minimal as is for the pairs in panel A and panel B, we assume a less than significant effect. Nevertheless, we estimate this panel mainly because it captures more SARAs thus broadens the data included.

Pre-reform period	Sample: SARA established 1991 - 2005	Post-reform period
1980 – 1990 231 Obs. 21 countries by 11yrs	Colombia 91, Uganda 91, Zambia 94, Venezuela 94, Kenya 95, South Africa 96, Tanzania 96, Malaysia 96, Mexico 97, Guatemala 99, Ecuador 99, Guyana 00, Rwanda 00, Malawi 00, Zimbabwe 01, Ethiopia 02, Sierra Leone 02, Lesotho 03, Botswana 04, Gambia 05, Mauritius 05	2005 – 2014 210 Obs. 21 countries by 10yrs

Table 1.5.3: Panel C1-21 Dynamic OLS & Least Squares (FE) Estimates

Pre-reform sample			Post-reform sample			Buoyancy shift
DOLS (Obs.210)			DOLS			DOLS
LogRGDP	1.068*	[0.0531]		-		-
LR Variance	0.0312					
LS (FE) (Obs. 231)			LS (FE) (Obs. 210)			LS (FE)
LogRGDP	1.057*	[0.0405]	LogRGDP	1.191*	[0.0194]	+0.134$^{\Delta}$
C	-2.764	[0.5950]	C	-4.771*	[0.2909]	[0.0449]
F-Stat	6929.762*		F-Stat	5018.151*		

* Reject null at 1%. Standard errors in [ ] parentheses
$^{\Delta}$ Difference is statistically significant at 1%

The broad panel had a similar finding of improved revenue performance, though the estimate 0.134 is lower relative to panel A and panel B estimates. Considering the generational gap, the opposite was expected. The post reform estimate was similar to that in panel A and B, but the pre-reform estimate in this broad panel was higher. We suspect this may be due to the inclusion of Zimbabwe which has significantly high real GDP and real tax revenue in the early pre-reform years.

1.5.4 Panel C2-16

This sample draws from the previous panel C1 but omits 5 countries that likely have significantly influential observations. Zimbabwe had periods of economic and currency crises that plummeted its tax ratio including in the period just after the reform was implemented. Uganda experienced civil war between 1981 and 1986, Rwanda suffered civil war and genocide between 1990 and 1993, Sierra Leone 1991 and 2002, and Ethiopia between 1974 and 1991. Except Zimbabwe, all these cases are pre-reform periods and tax performance can be expected to be low. Furthermore, it is almost inevitable that recovery from conflict would result in increased performance whether a SARA is in place or not. This panel was estimated to gauge to what extent these issues may be influential in the overall result.

Pre-reform period	Sample: SARA established 1991 - 2005	Post-reform period
1980 – 1990 176 Obs. 16 countries by 11yrs	Colombia 91, ~~Uganda 91~~, Zambia 94, Venezuela 94, Kenya 95, South Africa 96, Tanzania 96, Malaysia 96, Mexico 97, Guatemala 99, Ecuador 99, Guyana 00, ~~Rwanda 00~~, Malawi 00, ~~Zimbabwe 01,~~ ~~Ethiopia 02~~, ~~Sierra Leone 02,~~ Lesotho 03, Botswana 04, Gambia 05, Mauritius 05	2005 – 2014 160 Obs. 16 countries by 10yrs

Table 1.5.4: Panel C2-16 Dynamic OLS & Least Squares (FE) Estimates

Pre-reform sample			Post-reform sample			Buoyancy shift
DOLS (Obs.160)			DOLS			DOLS
LogRGDP	0.958*	[0.0389]		-		-
LR Variance	0.0136					
LS (FE) (Obs. 176)			LS (FE) (Obs. 160)			LS (FE)
LogRGDP	0.979*	[0.0259]	LogRGDP	1.125*	[0.0579]	+0.146$^{\Delta\Delta}$
C	-1.4902*	[0.3772]	C	-3.7238*	[0.8862]	[0.0634]
F-Stat	28845.21*		F-Stat	15006.89*		

* Reject null at 1%. Standard errors in [ ] parentheses
$^{\Delta\Delta}$Difference is statistically significant at 5%

Ridding panel C of the war conflict and economic turmoil Zimbabwe resulted in a lower pre-reform buoyancy and a lower post-reform buoyancy as expected. The effect of an extremely high-performance Zimbabwe in real terms in pre-reform years was netted out, and the effects of naturally increasing performance in post war periods was netted out, resulting in the drop in both pre and post reform estimates.

Because the drop in the pre-reform estimate was relatively greater, the resulting buoyancy shift was higher than the previous estimate. Thus, holding country specific and other factors constant, overall real tax revenue performance increased by 0.146 percentage points for every 1 percent increase in real GDP following the SARA reform.

1.5.5 Panel D-LA6

These final two panels were constructed to enable a regional comparison between Latin America (LA) and sub-Saharan Africa (SSA). Maintaining the 10 operational years as the basis for inclusion in the sample, a panel of SARAs established between 1991 and 2000 was the biggest with 6 Latin American countries.

Pre-reform period	Sample: SARA established 2000 - 2005	Post-reform period
1980 – 1990 66 Obs. 6 countries by 11yrs	Colombia 91, Venezuela 94, Mexico 97, Guatemala 99, Ecuador 99, Guyana 00	2005 – 2014 90 Obs. 6 countries by 15yrs

Table 1.5.5: Panel D-LA6 Dynamic OLS & Least Squares FE Estimates

Pre-reform sample			Post-reform sample			Buoyancy shift
DOLS (Obs.60)			DOLS (Obs.81)			DOLS
LogRGDP	0.929*	[0.0570]	LogRGDP	0.975*	[0.1021]	+0.046
LR Variance	0.0213		LR Variance	0.0335		[0.1169]
LS (FE) (Obs. 66)			LS (FE) (Obs. 90)			LS (FE)
LogRGDP	0.963*	[0.0362]	LogRGDP	1.032*	[0.0661]	+0.069
C	-1.421**	[0.6088]	C	-2.531**	[1.1013]	[0.0754]
F-Stat	20865.77*		F-Stat	11850.82*		

*reject null at 1%, ** at 5%. Standard errors in [ ] parentheses

Taking a sample of Latin America countries, results suggest a modest improvement in post reform revenue performance that is however not significant for this region. This result suggests that there exist significant elements that hindered the success of the reform. Taliercio (2004b) who conducted field work research at selected SARAs in Africa and Latin America underscored autonomy (or general management autonomy including in procurement, personnel, and financing) as the hinge that accounts for differences in performance outcomes. Simply put, in general, managers with greater autonomy were able to take reforms farther and faster. Furthermore, greater autonomy reduced micromanagement in tax administration matters by MOF and political interference, both of which are associated with positive outcomes. The experience in the region however, generally showed that SARAs' autonomous features were undermined if not eliminated by government itself and were thus less sustainable than expected (Taliercio 2000, 2001).

1.5.6 Panel E-SSA9

In the case of SSA, a panel of SARAs established between 1994 and 2005 gave the biggest sample of 9 countries having excluded the countries that had experienced war conflicts and Zimbabwe.

Pre-reform period	Sample: SARA established 2000 - 2005	Post-reform period
1980 – 1993 126 Obs. 9 countries by 14yrs	Zambia 94, Kenya 95, South Africa 96, Tanzania 96, Malawi 00, Lesotho 03, Botswana 04, Gambia 05, Mauritius 05	2005 – 2014 90 Obs. 9 countries by 10yrs

Table 1.5.6: Panel E-SSA9 Dynamic OLS & Least Squares (FE) Estimates

Pre-reform sample			Post-reform sample			Buoyancy shift
DOLS (Obs.117)			DOLS			DOLS
LogRGDP	0.918*	[0.0589]		-		-
LR Variance	0.0187					
LS (FE) (Obs. 126)			LS (FE) (Obs. 90)			LS (FE)
LogRGDP	0.892*	[0.0448]	LogRGDP	1.265*	[0.0664]	+0.373$^{\Delta}$
C	-0.226	[0.5983]	C	-5.5397*	[0.9615]	[0.0801]
F-Stat	18597.81*		F-Stat	20807.40*		

* Reject null at 1%. Standard errors in [ ] parentheses
$^{\Delta}$ Difference is statistically significant at 1%

Unlike Latin America, the sample of sub-Saharan African countries shows a vast performance increase. In the pre-reform years the FE model estimated an overall tax buoyancy of 0.89, thus real taxes responded less than proportionately to changes in real GDP which is a non-buoyant poor performance record. Following the reform however, the model estimates that overall, a 1 percent increase in real GDP led to a 1.26 percent increase in real tax collections ceteris paribus, representing a 0.37 percentage point increase in real tax revenue productivity.

This suggests that SARAs have been more successful in achieving their purpose in SSA, consequently managers in Kenya and South Africa for example have also enjoyed relatively more and sustained autonomy. The success fits the narrative as significantly more SARAs have been established in the region. Namibia is the latest currently to pass the establishment Act, while the newest country South Sudan is already considering it.

1.6 Summary of Results and Conclusion

Panel	Pre-reform		Post-reform		Buoyancy shift
Panel A-EA9	DOLS	1.015*	DOLS	1.217*	+0.202$^{\Delta}$
SARA est. 1994 – 1999	FE	1.019*	FE	1.163*	+0.144$^{\Delta}$
Panel B-NC10	DOLS	0.904*	DOLS	-	-
SARA est. 2000 – 2005	FE	0.908*	FE	1.193*	+0.285$^{\Delta}$
Panel C1-21	DOLS	1.068*	DOLS	-	-
SARA est. 1991 – 2005	FE	1.057*	FE	1.191*	+0.134$^{\Delta}$
Panel C2-16	DOLS	0.958*	DOLS	-	-
SARA est. 1991 – 2005	FE	0.979*	FE	1.125*	+0.146$^{\Delta\Delta}$
Panel D-LA6	DOLS	0.929*	DOLS	0.975*	+0.046
SARA est. 1991 – 2000	FE	0.963*	FE	1.032*	+0.069
Panel E-SSA9	DOLS	0.918*	DOLS	-	-
SARA est. 1994 – 2005	FE	0.892*	FE	1.265*	+0.373$^{\Delta}$

* Coefficient significant at 1%

$^{\Delta}$ Difference is statistically significant at 1%, $^{\Delta\Delta}$ at 5%

Overall the dynamic OLS and fixed effects models estimate that on average, for every 1 percent increase in real GDP, the resulting increase in real tax revenue collections was between 0.13 to 0.28 percentage points higher in the period following the reform ceteris paribus. Put simply, tax revenue productivity as measured by buoyancy was 13 to 28 percent higher in the post reform period relative to the period prior. The most gains were in SSA (Panel E suggests 37 percent buoyancy improvement), however in LA there was no significant improvement. This result (and all sub-sample panel results) must however be taken with caution. It does not imply the improvement is a result solely due to the reform and tax administration efforts as there are various exogenous variables that affect revenue performance that could significantly differ between the two periods.

Such exogenous elements include macroeconomic growth conditions and economic structural changes. For example, in the post 2000 era Africa grew tremendously that The Economist published ‘Africa Rising’ and ‘Aspiring Africa’ issues in 2011 and 2013 respectively. Per capita income grew 30 percent, investment particularly in infrastructure grew with gross capital formation increasing to 23 percent from 10 percent in 2002, linkages with emerging markets

China, India, Brazil strengthened, domestic demand grew driven by younger urban demographics, 30 percent FDI went to areas other than extractive industries, and health and social indicators were improving.

These trends presented great opportunities for tax collection regardless the administration as tax revenue sources (tax payers and bases) such as those in the booming mobile communication industry certainly grew. This likely also accounts for the high post reform buoyancy estimate for SSA in panel E. It can be argued SARAs would have been the best organizational set up to take advantage of the opportunity presented by this growth trend, however without an adequate analysis of a counterfactual, one cannot make such an assertion with certainty.

Other exogenous factors include tax policy, including tax incentives and exemptions, tax code modifications and changes in tax rates, and trade liberalization among others. How other exogenous factors affect tax revenue performance is explored in chapter 3. Still, we currently do not have a rigorous methodology for evaluating tax administrations that would control for all exogenous variables and measure with precision the marginal impact of SARA reform on revenue collections or other outcome variables. Much needed data particularly in the pre-reform period (such as costs) to create an enormous dataset that would permit a rigorous and exhaustive multivariate analysis of tax administration performance is not available. Nevertheless, based on this analysis of a panel of countries, using the fixed effects estimation that controls for country specific effects, and the sampling methodology, we assert that the improvement in performance is partially a function of the reform and subsequent tax administration efforts. We deduce that in general, ceteris paribus, the reform has been effective at improving total tax revenue productivity.

Optimism is thus warranted to some degree, provided economic conditions are fairly stable, the odds are in favour of improved total tax revenue performance as expected. However, it can

be expected that within the tax structure, the reformed administration may affect the underlying taxes non-uniformly due to the differences in the taxes themselves, their bases, and collection methods. This analysis is thus extended in chapter 2, that utilizes a dynamic model to evaluate various categories of taxes beyond the international classification to gauge changes in the responsiveness of tax revenues to increases in the tax base following implementation of the SARA reform.

CHAPTER 2

Assessing the Responsiveness of Taxes to Changes in Base: A Pre and Post Revenue Authority Reform Analysis of the Malawi Tax System

Chapter summary

The study gauges how responsive tax revenues are to changes in their base by applying Auto-regressive distributed lag (ARDL) estimation to 1979 to 2017 annual time series. The model is further utilized to test whether there was a significant shift in the degree of responsiveness following the implementation of a popular tax administration reform - establishing a tax agency operating semi-autonomous of government.

Results show that among direct taxes, personal income tax is the most responsive in both the short and long run at 0.6 and 1.32 percent respectively for a 1 percent change in real GDP. However, there was no significant change following the reform.

Among indirect taxes, Value added tax leads, with a 0.4 percent short run response, and 1.25 percent in the long run for every 1 percent change in real household final consumption. Excise tax closely follows at 0.99 percent in the long run. In general, the responsiveness of taxes on goods and services altogether increased by 0.99 percentage points following the reform.

For trade taxes, the short run response is not significant, however in the long run Custom duties increase by 0.29 percent for a 1 percent increase in the real total value of imports.

Overall, for the Malawi tax system, total tax revenue immediately responds by 0.46 percent for a 1 percent change in real GDP, and in the long run 0.8 percent. Following the reform, the long run responsiveness increased by 0.16 percentage points.

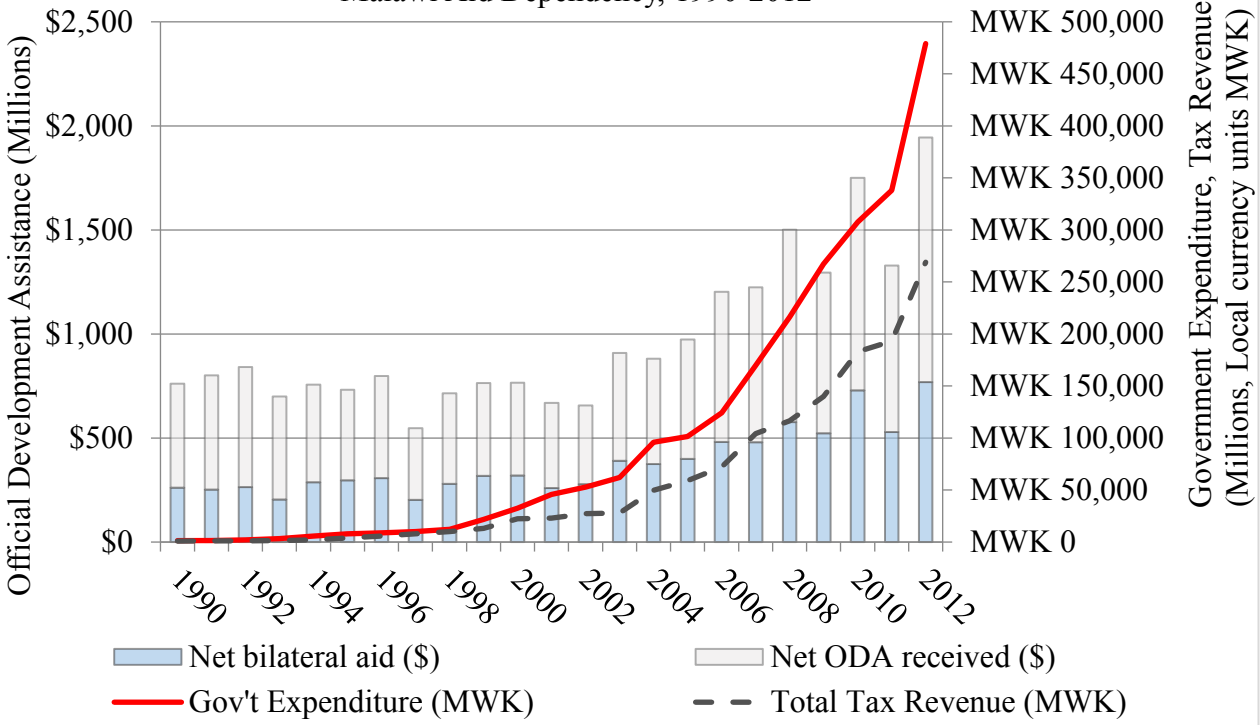
Keywords: ARDL; Semi-Autonomous Revenue Authority; Tax Buoyancy; Tax Reform

JEL codes: H20, H43

2.1 Introduction

Budget deficits have been an evident persistent problem among developing nations. With pressure to sustain development initiatives, it is often the case that expenditure requirements exceed their capacity to raise required revenue. Consequently, as shown in figure 1, over the years the government of Malawi has occasionally resorted to debt financing both domestic and foreign, and a persistent reliance on donor aid.

Figure 2.1: Government Expenditure - Tax Revenue Gap, and Trend in Malawi Aid Dependency, 1990-2012



Source: Aid and ODA data: World Bank WDI October 2015
Revenue and Expenditure data: Malawi Government Annual Economic Reports (Various issues)

Debt financing however, may yield undesirable consequences. For example, persistent and extensive reliance on public borrowing may crowd out private sector investment; the consequential effect may be even worse if the increase in government expenditure is not channelled to the private sector. This has in fact often been the case in Malawi as government has occasionally borrowed to repay maturing debt and not necessarily for productive

investment. This may also have further economic impacts as the rate of return on private equity competes with that in the bond market.

Further, foreign debt financing may adversely affect the external value of local currency since depreciation could occur when foreign currency is sought to repay maturing debt. One consequence would be a worsening balance of payments for a predominantly importing nation that Malawi is.

On the other hand, foreign aid can also be severed as was the case in 1992 (and 2002) due to failure to fulfil political requisites (Chipeta 1998). Similarly, following a plundering of public resources scandal revealed in 2014 all budgetary support was withheld and eventually halted (Government of Malawi 2015).

In view of these associated problems, the likely more dependable policy option for government is to rely on taxation and seek to enhance revenue yielding capacity. Thus, a numerical understanding of how taxes respond to changes in the base is important, as is gauging how recent significant reforms may have affected this responsiveness.

Significance of Research

This study utilises autoregressive distributed lag (ARDL) models to estimate the responsiveness of various categories of taxes in addition to total tax revenue. ARDL models are more reliable in estimating limited or finite time series. Using the technique is a first application in the field not only to estimate the responsiveness of total tax revenue but various categories of taxes as well.

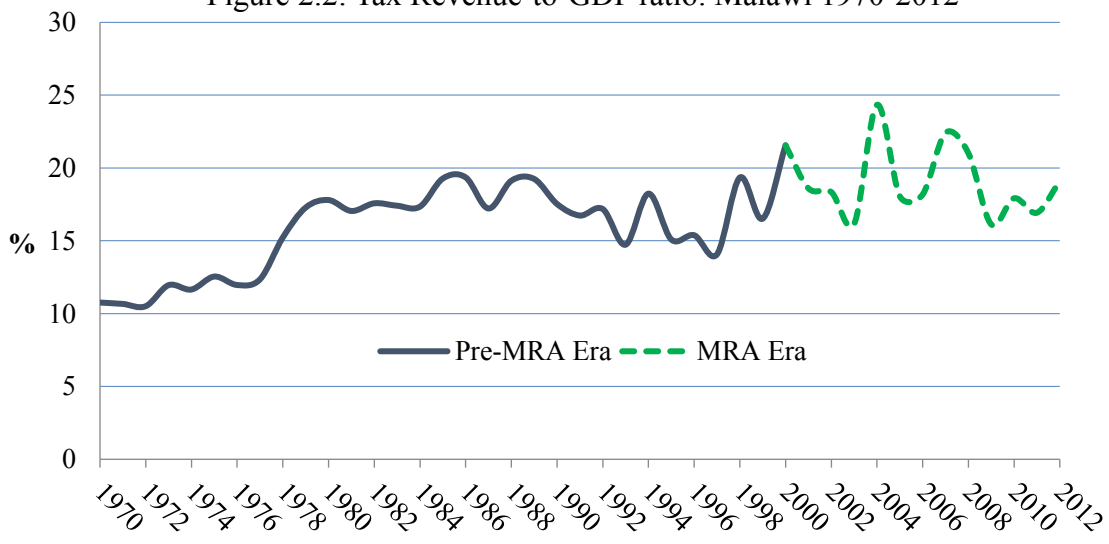
The technique is further applied to test whether there was a significant shift in the responsiveness of taxes following an overhaul in tax administration dubbed Semi-Autonomous

Revenue Authority (SARA) reform that saw the establishment of a tax collection agency; Malawi Revenue Authority (MRA), that operates semi-independent of government.

Various reforms that were implemented early post-independence period, such as those during the 1980s Structural Adjustment Programs (SAPs) had little impact on the tax system (Chipeta 1998, Mkwara 1999). A more recent study by Banda (2006) suggests recent reforms have had a positive impact, though some taxes have not improved. However, there is yet a study that has adequately evaluated the major tax administration reform.

Typically, trends in tax-to-GDP ratios are analysed to gauge tax revenue performance. This gives some indication however it is limited. As observed in figure 2 below, it is difficult to gauge the performance of the tax system following the reform in 2000. It also suggests the coefficient of variation would be higher in the post reform period suggesting the year to year ratio was more inconsistent.

Figure 2.2: Tax Revenue-to-GDP ratio: Malawi 1970-2012



Source: Government of Malawi, Annual Economic Reports (Various issues 1972-2013)

Banda (2006) gave credit to MRA for raising revenue collection. This study follows on to evaluate such credit bearing in mind government's goal to improve revenue collection to help reduce budget deficits and donor dependency in financing the budget (Government of Malawi 2010). This is even more relevant in today's agenda as government operates a 'Zero Aid Budget' as that of 2015/2016 financial year.

Thus, knowledge of the responsiveness of the taxes to bases, and the effectiveness of semi-independent tax administration is essential. It is important to be able to project what additional revenue can be mobilized within the reformed system as the economy and tax bases grow. This would then help to suggest what measures can be adopted to maximize revenue within the system and give insight on whether government's fiscal aspirations of minimizing budget deficits and donor dependency as stated in the second Malawi Growth and Development Strategy can be achieved.

2.2 Overview of Tax Administration: Pre and Post-Reform

2.2.1 Pre-Malawi Revenue Authority Era, 1970-1999

Following colonial independence from British rule in 1964, the newly established constitution made provisions for all taxes to be collected by two departments in the Ministry of Finance namely, the Income Tax Department responsible for pay roll and company taxes, and the Customs and Excise Tax Department responsible for collection of import and excise duties. Tax administration was exclusively by central government.

In the first decade, the economy registered commendable growth resulting in a balanced budget or surplus. Thus, the tax system underwent very few reforms. Nevertheless, the first major reform aimed at broadening the tax base was the introduction of a sales tax called Surtax in 1970/71 financial year. Import duties were also increased to protect domestic industries deemed to be in their infancy (Government of Malawi 1972).

In the late 1970s and early 80s, Malawi experienced macroeconomic shocks from drought, an influx of refugees, and deteriorating terms of trade for major exports. To address adverse effects, the government with assistance from the World Bank embarked on a series of SAPs. Though several tax reforms were implemented, Chipeta (1998) reports that the responsiveness of taxes to economic growth did not improve that much.

From the 1980s, government expenditure soared to meet its development objectives as well as address emerging challenges. Consequently, the revenue-expenditure gap has further widened since. From this period, over 40 percent of government budget was financed by other governments and donor institutions. Revenue generation thus became the main objective of tax reforms.

In the 1990s, major efforts were implemented to simplify the system. Computerization, redesign of forms and documents, and the introduction of a document control system, were completed in 1991. In 1993, employers were given responsibility for verifying PAYE tax assessments, thus relieving the Income Tax Department of this task. Furthermore, the department also went through occasional staff trainings. However, despite these efforts and other reforms, Mkwara (1999) argued they achieved little as shown at the time by a recent move to establish an independent revenue authority.

2.2.2 Malawi Revenue Authority Era, 2000-2012

Following government structural review with assistance from IMF and World Bank, the two tax collecting departments of the Ministry of Finance merged as two divisions in one body called MRA to administer domestic Income taxes and Customs duties. Established and governed by Act 14 of 1998, MRA is a typical SARA, an agency that operates under but autonomous from the Ministry of Finance (MRA 2010). The establishment followed the world trend in tax administration reform where SARAs were established as a perceived means to

improve revenue performance and curb such problems as corruption and political interference by focusing on efficiency enhancing measures and operating semi-independently of government. The authority is mandated to collect, assess and account for tax revenues, promote voluntary compliance, take necessary steps to counteract fraud and evasion, as well as advise fiscal policy. It is headed by a Commissioner General appointed by a board drawn from both the public and private sector (Government of Malawi 1998).

Since inception, enhancing revenue collection has been the primary objective. Major efforts have been made towards modernizing the tax system for simplicity and administrative efficiency. In 2002 Surtax was extended to wholesalers and retailers widening the base from which revenue can be yielded. A third revenue division; Surtax Division was formed under its own commissioner to manage administration of the tax (MRA 2010). This was a move towards modernizing the tax into a fully-fledged VAT.

In 2005, an institutional review process by the Ministry of Finance, the United States Department of Treasury, and the IMF led to the integration of all domestic taxes including Surtax which came to be known as VAT (MRA 2010). MRA thus rescinded to two divisions namely; the domestic taxes division; and the customs division to administer import taxes.

Tax payers were also segmented into large, medium, and small by turnover. In November 2007, MRA established a Large Taxpayer Office (LTO) which improved compliance. These led to a reduction in the cost of administration and misallocation of resources (MRA 2010).

Reforms in the Customs Division included the phase out of pre-shipment inspection in June 2007, thus MRA resumed sole responsibility for the functions of valuation and classification of imported goods (MRA 2010). This led to sustained and improved import revenue (Makawa 2008). MRA also embarked on other measures to automate its systems and procedures and completed installation and updates at all major ports and stations in 2008. MRA (2010) reports

its efforts in tax payer education and compliance campaigns to have been effective, with significant increases in new tax payer registrants. Post SARA reform changes thus seem to have been wide in scope and inclusive, with changes in both the Domestic and Customs divisions to foster efficiency.

It is further worth noting however, that numerous tax changes implemented in both divisions were generally tax liability reducing measures to promote investment and/or growth in various sectors. Between 2008 and 2012, there were increases in investment allowances, removal of taxes on capital gains, and gradual increases in the income tax free bracket. There were reductions in import duties for construction machinery and equipment, goods and materials used by tourism establishments, as well as several goods for manufacturing or development projects (Government of Malawi, Budget Statements 2008-2012). Tariff reductions were also gradually implemented in compliance with SADC and COMESA trade protocols.

In sum, these reforms and changes did contribute towards improved management of the tax system; the authority has indeed improved taxpayer services and enhanced compliance, and tax evasion and fraud have been reduced leading to greater transparency and accountability. The pre-reform era can be characterized as one that generally had some tax reforms that however had little impact on the revenue yielding capacity of the tax system while the post reform era can be characterized as one that focused on modernization and compliance enhancing measures, with numerous changes that improved efficiency, however with some policies that generally reduced tax liability. This study sought to deduce whether the reform and efforts that followed have a long-term effect on the responsiveness of taxes.

2.3 Research Objectives, Hypotheses, and Literature Review

2.3.1 Objectives and Hypotheses

The primary objective of this study was to gauge how taxes respond to changes in their base. Using ARDL estimation, both short and long run responsiveness can be estimated. The secondary objective was to test whether there were any significant changes in responsiveness following the semi-autonomous tax administration reform. Major categories of taxes and total tax revenue would be analysed.

Accordingly, these objectives were specified to two testable null hypotheses:

I. Tax revenues do not respond to changes in base both in the short and long run
II. There is no change in the short and long run responsiveness of tax revenues to changes in base following the MRA reform.

2.3.2 Literature Review

2.3.2.1 Theoretical literature review

There are two channels through which tax revenues can grow or change; they can respond to changes in base, they can also respond to discretionary changes, or both. Therefore, changes in tax revenue in response to changes in tax base can be decomposed into two:

i) When tax revenues grow due to growth in the tax base, this growth is referred as due to the *automatic change.* For example, growth in income tax revenue as new graduates enter employment. In this case the tax revenue changes solely due to a change in the tax base.

ii) Tax revenues can also change due some *discretionary changes* resulting from changes in tax rates, rules or policy, collection and enforcement efforts etc. Thus, for example when income tax revenue grows solely due to an increase in income tax rates, then tax revenue has responded to a discretionary policy change.

In tax revenue productivity literature, the responsiveness of tax revenue to changes in base is measured by both elasticity and buoyancy. However, the crucial difference is that elasticity measures the responsiveness from the automatic change alone, free of discretionary changes (Osoro 1993). It is assumed that the tax system remains unaltered and is thus a hypothetical construct that measures what revenue would have been yielded if the previous years' system including the rates, laws and bases were prevailing this year. A greater than unit elasticity is thus desirable since more revenue can be raised without effecting discretionary changes such as raising tax rates which may be politically unpopular.

On the other hand, buoyancy measures the responsiveness resulting from the combined changes encompassing both the automatic change and the discretionary tax changes. A buoyant tax system is one in which tax revenues increase proportionately more than the base as the base grows. In such a desirable case, the buoyancy is greater than one. A tax buoyancy of 1.4 for example implies that on average, a 1 percent change in tax base would result in a 1.4 percent change in tax revenue collected.

It should be noted that literature does suggest other tax performance measures. Though not exhaustive, Mann (2004) lists twelve indicators for tax administration suitable for evaluating both SARAs and non-SARAs. Tax ratios are often used, with tax/GDP as the most common or standard. However mere use of the ratio which often varies considerably, as is the case for Malawi, makes it difficult to gauge long run implications, likewise following a major reform. Manasan (2003) and Taliercio (2000, 2001) assessing SARAs in other African and Latin America countries also highlight the same.

Other measures include real tax collections, tax gap, indirect and direct taxes as a percentage of total tax revenue, and specific tax productivity indicators such as VAT efficiency ratios and compliance rates. While these are good indicators, Kidd and Crandall (2006) do rightly point

out that some measures would likely tell us very little about how adopting a particular governance structure (in this case a Semi-Autonomous Revenue Authority) might or might not have led to different outcomes. Elasticity or buoyancy are thus better measures to estimate responsiveness, and short and long run changes post reform.

2.3.2.2 Empirical literature review

Osoro (1993), Chipeta (1998), Banda (2006), Murithi and Moyi (2003), Mawia and Nzomoi (2013), as conventional, all used the logarithmic form of the generalised Cobb-Douglas functional form to estimate tax buoyancy, which measures the responsiveness of tax revenue to changes in base due to automatic and discretionary changes as follows:

$$logTaxRev_{kt} = \beta_0 + \beta_k logTaxBase_{kt} + \varepsilon_{kt} \quad \ldots(1)$$

Where, β_k is buoyancy of the kth tax, β_0 is the constant term, and ε_{kt} is the error term at time t.

Osoro (1993) who studied the impact of tax reforms on Tanzania's tax productivity, found that buoyancy coefficients on personal income tax, and consumption sales tax, were less than one, while for company tax and import duty were greater than one. Thus, in Tanzania, personal income tax and consumption tax respond less than proportionately while company tax and import duties respond more than proportionately to changes in their respective bases. Granting generous exemptions and poor tax administration were some key reasons cited why tax reforms failed to improve revenue productivity. A SARA was later established in 1996.

Kusi (1998) who conducted a similar study in Ghana attributed the greater than one elasticities and buoyancies to successive devaluations and de-regulations that permitted growth in international trade and the equivalent tax bases. Measures also led to growth in industrial income. An overhaul of the tax administration system also allowed more taxes to be collected.

Table 1 below summarizes buoyancy estimates of the Malawi tax system from prior studies.

Table 2.1: Comparative Literature on Buoyancy of the Malawi Tax System

	Chipeta		Mkwara	Banda
	1970-1979	1980-1994	1970-1997	1970-2002
Pers. Income tax	1.141	0.987	1.181	0.87
Company tax	1.449	0.496	1.061	1.10
Surtax	1.495	1.082	0.870	0.94
Excise Tax	0.620	0.727	1.013	1.12
Import duty	0.525	0.863	1.180	1.13
Total tax revenue	0.993	0.951	1.102	1.07

Sources: Chipeta (1998), Mkwara (1999), Banda (2006)

From these studies, it is unclear whether the responsiveness of personal and company incomes taxes has improved over the years. It appears the responsiveness of the sales tax Surtax has declined, while that of import duties and total tax revenue has improved.

Though these estimates may give some indication, the coefficients obtained from the conventional estimation of equation (1) given the limited annual time series in each of these studies cast questions on the reliability of the results. ARDL modelling however as employed in this paper overcomes this.

Though Banda (2006) included two years post reform in his analysis, he made no assertions concerning the SARA reform. He noted however, based on increasing buoyancy coefficients, that there had been some improvements perhaps reflecting positive impact of recent reforms.

Sarr (2016) utilizing a synthetic control approach; a method that requires creation of a synthetic country that behaves as one not subjected to an intervention, concluded that the reform had a positive effect on revenue performance in Malawi by 2.87 percentage points per year. His results also showed that there was a two-year lag for the reform to take effect. However, this must have been due to wrongly setting the reform year in his analysis. While the law establishing the reformed tax agency MRA was indeed passed in 1998, operations only begun in February 2000 (MRA 2010).

To evaluate specific reforms, other studies have incorporated dummy variables in time series models. Omondi et.al. (2014) modified the buoyancy equation (1) to include two interactive slope dummies (D_i), to capture the impact of (1) the Tax Modernization Programme (TMP) and (2) Revenue Administration Reform and Modernization Programme (RARMP) respectively, on tax buoyancy in Kenya as follows:

$$logTaxRev_t = \beta_0 + \beta_1 logGDP_t + \theta_1(D_1 * logGDP_t) + \theta_2(D_2 * logGDP_t) + \varepsilon_t \quad \ldots (2)$$

The responsiveness over the period 1963-2010 was a buoyant 1.14. Omondi et.al (2014) also found that TMP reforms and RARMP reforms had a positive impact on the overall tax structure's buoyancy by 21 percent and 46 percent respectively. The buoyant results were consistent with earlier studies by Muriithi and Moyi (2003) who however argued that reforms had a relatively greater impact on elasticity than buoyancy. Nevertheless, Ngari (2000) had earlier found that both elasticity and buoyancy had improved after new tax reforms.

Upender (2008) also employed similar techniques to estimate the degree of differential gross tax buoyancy following tax reforms in India. Equation (1) was modified to include both an intercept and interactive slope dummy (D), taking the value of 1 for post reform period and 0 otherwise, as follows:

$$logTaxRev_t = \beta_0 + \beta_1 logGDP_t + \beta_2 D + \beta_3(D * logGDP_t) + \varepsilon_t \quad \ldots (3)$$

The responsiveness of the India tax system for the period 1951-2005 registered a buoyant 1.23. However, following the reform, the change in responsiveness was estimated as a downward shift in buoyancy by 0.29 percentage points (Upender 2008).

Drawing from this background and reviewed literature, this study sought to estimate the short and long run responsiveness of tax revenues to both automatic and discretionary tax base changes. We utilize ARDL modelling that also overcomes estimation problems associated with

limited time series data. We incorporate dummy variables to test for significant changes in responsiveness following the tax administration reform.

2.4 Methodology, Empirical Model, and Data Variables

2.4.1 Methodology

Ideally, both elasticity and buoyancy should be estimated to gauge what portion of responsiveness is to automatic changes and to discretionary changes. This would also be helpful with the secondary objective in assessing changes in responsiveness following the reform as tax administration efforts are a part of discretionary changes. However, data required to clean tax revenue data to rid it of the effect of discretionary tax measures to estimate elasticity using the known methods; Proportional Adjustment (Prest 1962); Constant Rate Structure (Choudhry 1975, in Ehdaie 1990); and Divisia Index Method (Choudhry 1979), spanning the study period 1979-2017 for Malawi was not available. The Dummy Variable method (Singer 1968) was also not utilized; as Chipeta (1998) argues, its usefulness is limited in estimating tax elasticity where the number of discretionary changes is large relative to the length of the data period.

Moreover, even if the responsiveness due to discretionary changes was isolated, it would be difficult to attribute changes entirely to the reformed institution's administrative efforts as there are other factors such as political directives, and policies implemented by institutions such as the Ministry of Finance, that affect discretionary changes. Changes in tax rates and exemptions are prime examples. This is regardless the fact that MRA advises on fiscal policy and other discretionary measures.

For these reasons, the coefficients estimated in this study are similar to buoyancy coefficients in that they reflect the responsiveness of tax revenues to changes in tax base as a result of both the automatic changes and discretionary measures combined.

4.2 Data Variables

There are three broad categories of taxes; taxes on incomes, profits and capital gains; taxes on goods and services; and taxes on international trade.[16] Each tax category is paired with its equivalent tax base (or proxy) to estimate the responsiveness of each tax to its base as depicted in table 2. The responsiveness of taxes lumped in their broad categories as well as individual or specific taxes was examined.

Table 2.2: Tax Revenue Category and Equivalent Tax Base

% of TTR (Rank)	Tax Revenue Category*		Tax Base Proxy*	Sample & Sources
46% (1)	**Taxes on Incomes, Profits and Capital Gains (TIPCG)**		**(Gross Domestic Product)**	**1983-2017, GRD, AER**
23% (1)	Personal Income Tax (PIT)		(Gross Domestic Product)	1979 – 2016, AER
3% (9)	Company Income Tax (CIT)		(Gross Domestic Product)	1979 – 2016, AER
19% (3)	**Taxes on Goods and Services**		**Household Consumption**	**1983-2017, GRD, WDI**
15% (3)	Domestic VAT (VAT)		Household Consumption	1979 – 2016, AER, WDI
4% (8)	Local Excise Tax (EXCT)		Food, Bev.& Tobacco in Manuf.	1979 – 2016, AER, WDI
36% (2)	**Taxes on International Trade**		**Total Value of Trade**	**1983-2017, GRD, WDI**
16% (2)	Import VAT	Customs duties (CUSDUT)	Total Value of Imports	1979 – 2016, AER, WDI
10% (4)	Import Duty			
9% (6)	Import Excise			
	Total Tax Revenue (TTR)		**Gross Domestic Product**	**1979-2016, AER**

Sources: GRD (Government Revenue Dataset, ICTD/UNU-WIDER 2017), AER (Malawi Annual Economic Reports, 1980-2017), WDI (World Development Indicators 2017).

* CPI for real conversion sourced from WDI 2017

Annex 2.3 contains the major taxes in Malawi and the effective rates in FY2009/10

Individual tax revenue data was obtained from various issues of the Malawi government's Annual Economic Reports. The revenue data for the three broad categories was computed from

[16] Annex 2.1 shows taxes in Malawi and their shares of total revenue.

the tax-to-GDP ratios in the GRD (ICTD/UNU-WIDER 2017). In all cases, data series used were strictly tax revenue series to ensure non-tax revenue is omitted.

Tax base series were mainly obtained from WDI (2017) as was the consumer price index (CPI, base 2010) used to transform data to real terms. Legal bases for PIT and CIT were not available, GDP income was thus used as a proxy base since suitable income aggregates that most closely correspond to the legal base were not found.

2.4.3 Empirical model

Economic theory suggests that there is a long run relationship between the variables under consideration. However, recent developments in econometrics reveal that often, most time series are non-stationary. The non-constant mean and variance they exhibit means that conventional estimation and the resulting spurious regressions would mislead inferences (Studenmund 2000). To overcome non-stationarity, econometric analysis of time series data has increasingly moved towards the issue of cointegration.

In applied time series econometrics, the Granger (1981) and, Engle and Granger (1987), ARDL cointegration technique (Pesaran & Shin 1999) and, Johansen and Juselius (1990) cointegration technique have become the solution to determining the long run relationship between non-stationary series, as well as reparametrizing them to the Error Correction Model (ECM). The ECM result gives the short run dynamics, as well as an indication of a long run relationship among the underlying variables.

Accordingly, the first step was to graph and test each series for a unit root. Augmented Dickey Fuller (ADF) tests showed all series are integrated to the first order (I(1)). A simple OLS was then estimated to enable a CHOW breakpoint test around the reform year 2000 (2002 for VAT).

Rejection of the 'no breaks' null hypothesis was further reason to include reform dummies in the final model.

As none of the variables are I(2), ARDL is applicable and gives realistic and efficient estimates if a long run cointegrating relationship exists. Furthermore, if the data sample size is small as is the case here, the ARDL error correction representation becomes relatively more efficient (Nkoro & Uko 2016).

Since the ARDL model is a dynamic model which may have unrestricted lags, an unrestricted vector autoregression (VAR) was estimated for each series to determine the optimal lag length. All variables were within three lags according to both Schwarz and Akaike, Information Criteria (SIC & AIC), and was thus set as the maximum lag length in all regressions with AIC set as the auto-lag length determination criterion.[17]

Each tax regression was thus specified in general form ARDL (p,q_1,q_2,q_3). Using an example of an ARDL (1,1,0,0), the model is specified, and coefficients interpreted as follows.

$$logY_t = \delta + \theta logY_{t-1} + \phi_0 logX_t + \phi_1 logX_{t-1} + \phi_2 RDV_t + \phi_3 (RDV * logX)_t + \varepsilon_t \quad \ldots(4)$$

Y_t (Tax Revenue) X_t (Tax Base) RDV (Reform Dummy Variable)

This model describes the dynamic effects of a change in the tax base upon current and future values of tax revenue. If the coefficient is significant:

ϕ_0 estimates the immediate response of tax revenue to changes in the tax base ceteris paribus. That is, the short run impact on tax revenue following an increase in the tax base by one percent.

[17] See Annex 2.4 for Unit root and Unrestricted VAR optimal lag selection test results

ϕ_3 estimates the magnitude of change in the immediate responsiveness of the tax in the post reform period i.e. when RDV = 1

Following the estimation of the ARDL, the ARDL long run is estimated also allowing for the bounds test for cointegration. The ARDL long run form computes:

$\frac{\phi_0+\phi_1}{1-\theta}$ which is the long run multiplier. This is the long run effect of a unit change in the tax base. If the tax base increases by one percent, the expected cumulative increase in tax revenue is given by the long run multiplier ceteris paribus.

When RDV = 1, the long run form also computes:

$\frac{\phi_3}{1-\theta}$ which estimates the magnitude of change in the long run multiplier in the post reform period. That is, the change in responsiveness of tax revenues in the long run, to a one percent increase in the base following the reform.

For all regressions excluding the category; taxes on incomes, profits and capital gains, the F-Bounds test for cointegration rejected the 'no levels relationship' null hypothesis. Reparametrized ECMs were then estimated to confirm the long run relationships and results interpreted.[18]

Residual diagnostics and stability tests were then performed. The Breusch-Godfrey Serial Correlation test failed to reject the 'no serial correlation' in all regressions. The Breusch-Pagan-Godfrey heteroskedasticity test detected heteroskedasticity in the total tax revenue regression. The model was thus re-estimated with Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors. The CUSUM of Squares tests showed all the models are stable.[19]

[18] See Annex 2.5 for ARDL long run bounds tests and ECM results

[19] See Annex 2.6 for CUSUM of Squares test results

Accordingly, these regressions enabled the study's hypothesis to be tested; first by estimating the short and long run responsiveness of tax revenues to changes in their base, and second, by testing whether there were significant changes in immediate and long run responsiveness of tax revenues following a major tax administration overhaul.

2.5 Empirical Results

This section presents the ARDL estimation results with some discussion, from individual or specific taxes to the three broad categories, and finally total tax revenue. A summary of results then follows before giving an overall concluding discussion.

2.5.1 Individual tax categories

2.5.1.1 Personal Income Tax

Malawi operates a Pay-As-You-Earn (PAYE) progressive tax structure levied on personal incomes. This tax is deducted at source by the employee and remitted to MRA. For our analysis, the legal base, peoples' incomes, is not available and thus the real value of domestic production GDP was used as a proxy. Since people's incomes are expected to grow as an economy grows, income tax revenues are expected likewise.

Table 2.3 Personal income tax regression results

Dep. Var: LogRPIT	Tax base proxy: LogRGDP			
ARDL (3,2,0,2), 1982 – 2016, Obs. 35 After Adj., Max lags 3 (AIC)			Short run	Long run
$\bar{R}^2$ 0.97, F-Stat 160.0*	LogRGDP	Responsiveness	0.57** [0.236]	1.32* [0.124]
DW 1.97	RDV_LogRGDP	Post-MRA response shift	-0.31 [0.199]	-0.24 [0.134]

* denotes significance at 1%, ** at 5%. [Standard error]

Results show that on average when real GDP grows by 1 percent, there is an immediate or short run response of a 0.57 percent increase in real income tax revenue. The long run response is a

buoyant 1.32 percent. This is good for such an important revenue source that accounts for almost a quarter of total tax revenue.

The results however show that there was no significant change in responsiveness following the reform. This is likely due to the proxy used, it may be unreasonable to expect that income taxes would respond differently to changes in GDP following the reform. The significance of administrative efforts could have been detected if we could measure the responsiveness from the true base; peoples' incomes. MRA (2010) reported that tax modernization programs designed to foster efficiency and enhance compliance resulted in growth of tax payer registrations and year on year income tax revenue collections. Such administrative efforts do directly impact the income tax and base relationship much more than the income tax and GDP relationship.

While the tax structure remained intact for the most part, the same period was also plagued with periodic increases in the zero-rated income bracket. For example, in 2017, a 17 percent increase in the bracket cap translated to a 2.5 percent expected tax revenue forgone (Annual Economic Report 2017). Considering that a substantial population are low income earners, with a suitable base for analysis, it would have been interesting to see how the revenue enhancing effects and tax liability reducing effects generally affected if at all, the responsiveness of income tax to its base.

2.5.1.2 Company Income Tax

Domestic and foreign incorporated firm's profits are levied a 30 to 35 percent corporate income tax. As with PIT for this analysis, corporate profit data spanning the years is not available. Real GDP was thus again used as the proxy tax base. Nevertheless, this analysis enables us to estimate how company tax responds to real GDP growth. The a priori expectation is positive.

Table 2.4 Company income tax regression results

Dep. Var: LogRPIT	Tax base proxy: LogRGDP			
ARDL (1,0,0,1), 1980 - 2016, Obs. 37 After Adj. Max lags 3 (AIC)			Short run	Long run
R̄2 0.89, F-Stat 60.9*	LogRGDP	Responsiveness	0.35***[0.207]	0.42***[0.239]
DW 1.63	RDV_LogRGDP	Post-MRA response shift	0.32 [0.244]	0.47***[0.263]

* denotes significance at 1%, ** at 5%. [Standard error]

This analysis yielded somewhat a surprising result, estimates suggest the significance of the responsiveness of corporate tax to GDP is low and weak. A 1 percent change in real GDP on average leads to a 0.35 percent short run response and 0.42 percent in the long run. This may also suggest the true base, corporate profits, may be quite independent of changes in the economy's GDP. Furthermore, company income tax revenue is a mere 3 percent of total tax revenue. This means, relative to GDP, company tax has a low, perhaps insignificant base. This is plausible considering Malawi is hardly a manufacturing economy with most activity in subsistence agriculture.

In the years post reform, MRA did implement several compliance enhancing measures favourable for companies, major among which was the establishment of the Large Tax-Payer Office. However, the same period was also coupled with government policy directives granting generous tax exemptions to companies in agriculture, tourism, mining and construction sectors. In 2007 for example, first year investment allowances rose from 40 percent to 100 percent, resulting in a 7.5 percent loss in expected company tax revenue (Budget Statement, 2008).

Though real tax revenues grew over the period, perhaps partly due to the reformed institution's efforts, an adequate analysis of changes in responsiveness is only possible given the true or closely corresponding base.

2.5.1.3 Value Added Tax (VAT)

Also known as domestic VAT, this tax ranks third in share, holding a significant 15 percent of total tax revenue. It is the main consumption tax levied at 16.5 percent since 2002 when the surtax (a sales tax) was reformed and extended to wholesalers and retailers. This was to modernize the tax into a fully-fledged VAT. Accordingly in this regression the reform dummy variable VATDV takes the value of one from 2002 onwards. Retailers and service providers with annual turnovers exceeding a minimum threshold are required to register for VAT and levy the tax. In the analysis, household consumption is an appropriate and suitable base to estimate responsiveness.

Table 2.5 Value Added Tax (VAT) regression results

Dep. Var: LogRVAT	Tax base proxy: LogRHHCONS			
ARDL (1,2,0,0), 1981 - 2016, Obs. 36 After Adj. Max lags 3 (AIC)			Short run	Long run
R̄2 0.96, F-Stat 139*	LogRHHCONS	Responsiveness	0.41***[0.231]	1.25* [0.155]
DW 2.08	VATDV_LogRHH...	Post-MRA response shift	0.52** [0.240]	0.51**[0.211]

* denotes significance at 1%, ** at 5%, *** at 10%. [Standard error]

Though significance of the estimate is weak, results show that when real household consumption increases by 1 percent, the expected short run increase in real VAT is by 0.41 percent. In the long run, the response is a buoyant 1.25 percent. This is great from a tax administration perspective, where a more than proportionate increase in real tax collections can be expected from household consumption growth. This implies that VAT is a very reliable tax. Though administrative efforts that impact the base may yield a weak or insignificant short-term response in tax revenue, there is high potential to yield significant returns in tax revenue in the long term.

This is thus a tax that the authority should continue to develop and manage cautiously. The results suggest MRA has perhaps done so, as the model estimates that in the years following

the reform both the short and long run responsiveness increased by 0.52 and 0.51 percentage points respectively.

2.5.1.4 Excise Tax (EXCT)

Also known as local or domestic excise tax, this tax is levied on specific locally manufactured products and services mostly income inelastic leisure goods. The tax ranks 8th of 12 holding a 3.6 percent share of total tax revenue. As the tax is mostly levied on spirits, beer, and cigarettes, the WDI (2017) series food, beverages and tobacco value added in manufacturing (FBTMAN) was used as the closest and most suitable tax base proxy.

Table 2.6 Excise Tax regression results

Dep. Var: LogREXCT	Tax base proxy: LogRFBTMAN			
ARDL (1,2,0,0), 1981 - 2016, Obs. 36 After Adj. Max lags 3 (AIC)			Short run	Long run
R̄2 0.98, F-Stat 253*	LogRFBTMAN	Responsiveness	0.08 [0.121]	1.00* [0.679]
DW 2.20	RDV_LogRFBTM…	Post-MRA response shift	0.11 [0.201]	0.20 [0.352]

* denotes significance at 1%. [Standard error]

Results showed that in the short run, excise taxes do not respond significantly to changes in the value of manufactured food, beverage, and tobacco products. The long run result that is significant however implies a lag in response. Thus, administrative efforts that may impact the base should be expected to produce significant tax yields only in the long term. Nevertheless, on the upside, a one to one responsiveness can be expected. Results also suggest the reform period did not yield any significant changes in responsiveness of this tax.

2.5.1.5 Customs Duties (CUSDUT)

Customs duties comprises of import VAT, duty, and excise. These taxes rank second, fourth, and sixth respectively with a combined 35 percent share of total tax revenue. Since they are all levied on imports, the total value of imports is a suitable base proxy.

Table 7 Customs Duties regression results

Dep. Var: LogCUSDUT	Tax base proxy: LogRTIMP			
ARDL (3,2,0,0), 1982 - 2016, Obs. 35 After Adj. Max lags 3 (AIC)			Short run	Long run
$\bar{R}^2$ 0.88, F-Stat 33.0*	LogRTIMP	Responsiveness	-0.14 [0.160]	0.29** [0.127]
DW 2.13	RDV_LogRTIMP	Post-MRA response shift	0.63* [0.163]	0.64* [0.145]

* denotes significance at 1%, ** at 5%. [Standard error]

Though results suggest that custom duties generally have no immediate response to changes in imports, there was a significant improvement in both the short run and long run responsiveness following the reform.

Nevertheless, a long run response rate of 0.29 percent for every 1 percent increase in the real value of imports is considerably low, and low enough to warrant concern. The Customs Division is reported to face the most serious challenges. While the economy and trade grew, Deputy Commissioner General Kulemeka (2010) acknowledged that Custom duties continued to perform less than expected due to smuggling, corruption, false declaration and undervaluation. More reports indicate that cases have often failed to result in convictions, mainly due to lack of clear evidence further perpetuating the loss of recoverable revenue (MRA 2010).

The low rate is consistent with issues plaguing the division in administration of customs. This suggests taxes on international trade perhaps need relatively more attention from the administrative authority. As a predominantly importing Nation, this may be crucial.

2.5.2 Broad tax categories

The three broad tax categories are standard international classifications that also include lump sums of other taxes, the analysis was thus extended also to enable other researchers in similar studies make country comparisons. Furthermore, this means we can make inferences relating to direct taxes; which are mainly the taxes on incomes, and indirect taxes; which are mainly taxes on goods and services.

2.5.2.1 Taxes on Incomes, Profits, and Capital Gains (TAXIPCG)

The real value of GDP is again used as a proxy as data on the true tax bases; incomes, profits, and capital gains were not available.

Table 2.8 Taxes on Incomes, Profits and Capital Gains regression results

Dep. Var: LogRTAXIPCG	Tax base proxy: LogRGDP			
ARDL (1,2,0,0), 1985 - 2017, Obs. 33 After Adj. Max lags 3 (AIC)			Short run	Long run
$\bar{R}^2$ 0.97, F-Stat 258*	LogRGDP	Responsiveness	0.98* [0.299]	-
DW 1.60	RDV_LogRGDP	Post-MRA response shift	0.25 [0.271]	-

* denotes significance at 1%. [Standard error]

In general, results do show that taxes on income in general have a high short run response rate to changes in real GDP. A significant short run response is a plausible result since these taxes are generally direct taxes often deducted at source.

On the other hand, the analysis yielded no long run inferences as we found no long run cointegrating relationship among the variables.

2.5.2.2 Taxes on Goods and Services (TAXGS)

These are basically consumption taxes levied on goods and services; household consumption is thus a suitable base proxy.

Table 2.9 Taxes on Goods and Services regression results

Dep. Var: LogRTAXGS	Tax base proxy: LogRHHCONS			
ARDL (1,1,1,0), 1984 - 2017, Obs. 34 After Adj. Max lags 3 (AIC)			Short run	Long run
$\bar{R}^2$ 0.98, F-Stat 257*	LogRHHCONS	Responsiveness	0.02 [0.188]	0.72* [0.224]
DW 1.52	RDV_LogRHHCONS	Post-MRA response shift	0.75**[0.294]	0.99* [0.261]

* denotes significance at 1%, ** at 5%. [Standard error]

These results show that in the long run, the responsiveness of indirect taxes on goods and services in general is significant, yielding 0.7 percent for every 1 percent increase in real household consumption. The results also confirm that there was a significant positive change in responsiveness of consumption taxes, in the period following the reform, major among which is VAT.

Indirect taxes are most prone to evasion and fraud; however, the results suggest MRA efforts such as the successful bid to install Point-Of-Sale (POS) electronic fiscal devices in March 2014 are working.

2.5.2.3 Taxes on International Trade (TAXIT)

This category encompasses some export taxes particularly in the early years of the sample. The total value of trade is thus used as the base in this analysis. For many years however, Malawi has continued to have zero-rated export taxes, estimation results were thus expected to be similar to that of the customs duties regression.

Table 2.10 Taxes on International Trade regression results

Dep. Var: LogRTAXIT	Tax base proxy: LogRTRADE			
ARDL (2,1,0,0), 1985 - 2017, Obs. 33 After Adj. Max lags 3 (AIC)			Short run	Long run
$\bar{R}^2$ 0.87, F-Stat 36.4*	LogRTRADE	Responsiveness	-0.46 [0.224]	0.10 [0.240]
DW 2.17	RDV_LogRTRADE	Post-MRA response shift	0.50**[0.207]	0.67**[0.258]

* denotes significance at 1%, ** at 5%. [Standard error]

The result was similar to that of customs duties, confirming the responsiveness of taxes on international trade to changes in the real value of trade is not significant in Malawi. The post reform results suggest the much-needed efforts perhaps are improving the responsiveness.

2.5.3 Total Tax Revenue (TTR)

This assessment of total tax revenue is used to evaluate and make inferences of the tax system as a whole. Following research literature in the field, the total value of goods and services produced in the economy GDP, is a suitable base proxy for estimating the responsiveness of total tax revenue.

Table 2.11 Total Tax Revenue regression results

Dep. Var: LogRTTR	Tax base proxy: LogRGDP			
ARDL (1,1,0,0), 1980 - 2016, Obs. 37 After Adj. Max lags 3 (AIC)			Short run	Long run
$\bar{R}^2$ 0.98, F-Stat 383*	LogRGDP	Responsiveness	0.46* [0.078]	0.79* [0.053]
DW 1.93	RDV_LogRGDP	Post-MRA response shift	0.15***[0.074]	0.16* [0.073]

* denotes significance at 1%, ** at 5%, *** at 10%. [HC1 Standard errors]

The result shows that on average, real total tax revenue can be expected to increase by 0.5 percent for a 1 percent increase in real GDP in the short run. Though barely significant, the results suggest that there was an improvement in this responsiveness by 0.15 percent.

In the long run, the 1 percent increase in real GDP cumulates to a 0.8 percent increase in real tax collections. This non-buoyant response rate indicates there is room to improve the rate to one and beyond. A healthy tax system should yield at least a proportionate increase.

The result further suggests that in the post reform period, the long run response rate increased by 0.16 percent for every 1 percent increase in real GDP. This result suggests that overall, the net effect of automatic and discretionary measures in the post reform period was positive. Though this concurs with Sarr (2016) who found that the semi-autonomous revenue authority

reform had a positive impact on revenue performance in Malawi, this study does not claim that the positive impact post reform was solely due to the reform and subsequent MRA actions alone, as the model does not control for exogenous factors that could have partial effects on the responsiveness.

2.6 Summary of results and conclusion

Table 2.12: Summary of regression estimates

	Short run response		**Long run response**	
	Response rate	Post-MRA response shift	Response rate	Post-MRA response shift
Personal Income tax	0.57**	-0.31	1.32*	-0.24
Company Income tax	0.35**	0.32	0.42***	0.47***
Domestic VAT	0.41***	0.52**	1.25*	0.51**
Domestic Excise	0.08	-0.11	1.00*	0.20
Custom Duties	-0.14	0.63*	0.29**	0.64*
Taxes on Incomes	0.98*	0.25	-	-
Taxes on Goods & Serv.	0.02	0.75*	0.72*	0.99*
Taxes on Intl. trade	-0.46	0.50**	0.10	0.67**
Total Tax Revenue	0.46*	0.15***	0.79*	0.16*

* denotes significance at 1%, ** at 5%, *** at 10%.

The results show that personal income tax is the most responsive (to changes in real GDP) in both the immediate and long run. This is another reason in addition to its 23 percent share in total revenue to note the importance of income tax. As the economy grows authorities can expect increases in revenue in the short run and more than proportionate increases in the long run.

A similar narrative is for VAT which also holds a significant 15 percent share. Increases in domestic household consumption will yield significant increases in revenues in the short run and more than proportionate increases in the long run.

The individual taxes; personal income, VAT, and excise are the most reliable with a one to one or higher responsive rate. Company income tax has a weak response rate to real GDP growth. Customs duties has the weakest and needs significant attention.

Overall, the total tax system needs to improve and achieve proportionate increases to real GDP growth. Prior studies that used nominal data estimated more than proportionate buoyancy coefficients for total tax revenue. How exogenous factors such as the economic structure, fiscal attributes, and other macroeconomic variables such inflation and the exchange rate affect revenue performance is investigated in chapter 3.

It must thus be highlighted, the extent to which we can draw conclusions concerning the secondary objective is limited. To credit the changes in responsiveness fully to MRA administration would be to assume the effect of other exogenous variables remained the same in both periods; too strong an assumption. Chapter 3 thus investigates how major macroeconomic factors and policy variables affect tax revenue collections in Malawi to supplement this analysis and thus inform judgements to make final deductions.

Nevertheless, taking into account the narrative on MRA reform and administrative efforts post establishment, results of prior quantitative studies, and the methodology applied, we ascertain that some portion of the observed results and impacts on real domestic VAT responsivity to real household consumption, real custom duties responsivity to the real total value of imports, and real total tax revenue responsivity to real GDP is due to the SARA reform and subsequent administration. This assertion is however to be taken with a grain of salt; a more cautious

conclusion can and is made after the analysis in the following chapter that explores how other key factors beyond the administration could influence tax revenue performance.

Ultimately, continued efforts to modernize the tax system, and to strengthen institutional capacity to tackle fraud and evasion with special focus on the customs division will be vital to further develop and mature the tax system towards overall buoyant response rates.

CHAPTER 3

Determinants of Tax Revenue Performance in Malawi: Evidence of Direction and Dynamic Inference by ARDL Modelling

Chapter summary

Numerous studies have identified significant relationships between macroeconomic variables and taxes. Noting however that the direction of relationship is not so common between countries, this study sought to ascertain the significance and infer the direction of relationship between these variables, called determinants, and tax revenue collections in Malawi.

Applying Autoregressive distributed lag models to 1980 to 2016 annual time series, we ascertain a negative relationship with the agricultural share, however, we discover a significant positive relationship with the emerging service sector. Domestic debt deters tax revenue collections, however external debt motivates it in the long run. Trade openness and a rising exchange rate both induce tax revenue generation, as does money supply. However official development assistance and the level of inflation seem to have no significant relationship with revenue collections.

Overall, this paper discusses the implications of dynamic short and long run effects of exogenous structural, fiscal attributes and economic policy variables on total tax revenues in Malawi.

Keywords: Determinants of Tax Revenue, ARDL, Malawi

JEL codes: H20

3.1 Introduction

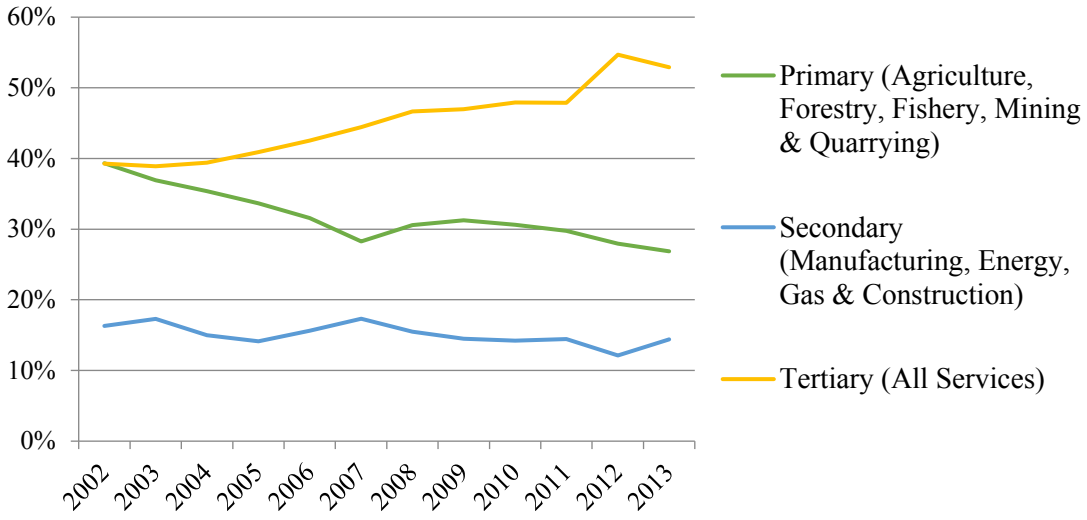
In pursuit of development objectives in health, education and infrastructure, negative fiscal imbalances have persisted for decades as African governments have expanded expenditure at a pace higher than they can raise the required revenue. While governments attempt to reduce expenditures to minimum sustainable levels, raising domestic revenue is the other side of the coin and both need to work if fiscal sustainability is to be achieved. In the latest global development agenda 2030, the importance of domestic resource mobilization has been recognized such that improving the domestic capacity to tax, features as Sustainable Development Goal (SDG) target 17.1 (The World Bank 2018).

The mobilization of tax revenue is an important policy objective particularly if inflationary financing and crowding out of the private sector are to be avoided. The previous chapter suggests that personal income taxes and value added tax (VAT) are the most responsive to GDP and household consumption respectively in Malawi in both the short and long run. However, it is often the case that governments can do little in the short run to change tax structures which may also be politically unpopular, but they can alter other factors that influence tax revenue including but not limited to economic policies such as monetary. Moreover, the previous chapter does show that total tax revenue is quite responsive to GDP growth in both the short and long run.

Though African countries have a low level of development and still heavily agricultural with many informal characteristics, the turn of the new century and recent decade have witnessed some shifts in some sectors of the economy particularly in information and communication technology, and services in general. Growth trends of developing Africa show that agriculture's share of gross domestic product (GDP) has declined, and manufacturing, rather than growing as traditional or classical economic growth theories may have anticipated, has stagnated. In contrast, the services sector is increasing as a share of total employment and GDP (World

Economic Forum Africa Competitiveness Report 2015). Malawi has been no exception to this trend. Figure 1 shows rising services, and declining agriculture and manufacturing sectors.

Figure 3.1: Share of GDP by main sector



Source: Author's computation based on national accounts data from the National Statistical Office (NSO) website (www.nsomalawi.mw), and international standard industrial classification of all economic activities (ISIC), Rev.4, extracted from, http://unstats.un.org/unsd/publication/seriesM/seriesm_4rev4e.pdf

The declining agriculture and manufacturing have been largely offset by an expanding services sector now accounting for over 50 percent of GDP. Considering this gradually reshaping economy and the new global agenda, it is timely to revisit how macroeconomic determinants may affect tax revenue mobilization. For example, in the last five years, the sectors wholesale and retail trade, transportation and storage services, information and communication, and financial and insurance services have grown at an average annual growth rate of 5 percent or more (Authors computation, Annual economic Reports 2013 to 2018). These service sectors are largely in the formal thus taxable sector unlike agriculture.

There are numerous empirical studies that have investigated the determinants of tax revenue in developing countries. Some factors have a common and predictable relationship with tax

revenues, while others have no consensus. Even panel analysis sampling developing countries have yield some different results such that it appears the findings are mixed due to sensitivity to the set of countries and period of analysis. For example, the mining share of the economy was found to have a positive relationship with tax-to-GDP ratio in Leuthold's (1991) 1973 to 1981 panel of 8 sub-Saharan African countries, later Stotsky and WoldeMariam (1997) in their 1990 to 1995 panel analysis of 43 found a negative relationship. Similarly, per capita income was found to be negatively related in the former, but positively related in the later study.

Teera (2002) studying Uganda also found that per capita income was negatively related to the tax ratio, while Gobachew et.al. (2017) found a positive relationship in Ethiopia. For Malawi, there is yet to be a comprehensive study. A brief staff working paper by Masiya et.al (2015) was limited to four explanatory variables likely due to lack of monthly data on vital macroeconomic variables. This paper broadens the scope of determinants by using annual data and an appropriate model for estimating a finite time series, the Auto-Regressive Distributed Lag (ARDL) model.[20]

3.1.1 Malawi Economic Profile and Taxation

Malawi is located in sub-Saharan Africa with an estimated 118,480 square kilometre territory and 16.3 million 2014 population estimate. For decades, Malawi has persisted among 10 least developed economies in the world. In 2010, it was estimated 50.7 percent of the population is below the national poverty line; 72 percent by the international standard of $1.25 a day (World Bank World Development Indicators, 2017). Rapid population growth, low life expectancy, low illiteracy levels, lack of food security, and low productivity are some of the major socio-

[20] ARDL has been applied in finite samples to model demand for energy in New Zealand (Fatai, Oxley, Frank 2003), real exchange rate volatility and US exports (Vita and Abbot 2004), modelling savings behaviour in Malaysia (Tang 2008) etc.

economic development challenges. Table 1 shows the basic economic structure and sector growth rates based on national account figures.

Table 3.1: Industry shares and annual percentage growth rates

	Industry share (% of GDP)		Annual percentage real growth rates (%)				
Industry	2011	2017	2013	2014	2015	2016	2017
Agriculture, forestry, fishing	30.8	28.3	6.2	6.3	-1.0	-0.1	6.3
Mining and quarrying	0.9	0.9	6.9	-4.6	1.1	0.4	1.6
Manufacturing	9.9	9.1	5.6	6.2	3.8	1.3	1.8
Construction	3.0	2.8	2.0	6.1	3.5	3.4	4.8
Transport and storage	2.6	2.8	5.3	5.4	4.3	4.9	6.0
Wholesale and retail trade	15.5	16.0	7.9	5.7	4.9	2.3	5.3
Financial and insurance services	4.9	5.3	3.8	3.3	5.9	5.9	6.7
Information and communication	3.7	4.5	7.5	11.2	8.6	5.0	6.4
Real estate activities	8.2	7.7	2.5	1.6	1.9	3.1	3.9
Gross domestic product (GDP)	100	100	6.3	6.0	3.3	2.7	5.1

Source: Malawi Annual Economic Reports 2015, 2016, 2018

Agriculture, forestry, and fishing account for just under one-third of GDP. Agricultural produce, mainly tobacco and maize, are almost entirely reliant on good rains and favourable climatic conditions. The produce accounts for 90 percent of exports, with tobacco, tea, and cotton leading the pack respectively. It is estimated 80 percent of the labour force is in small holder agriculture, largely subsistence and informal.

The manufacturing industry, accounting for about 10 percent of GDP, is concentrated in agro-industries highly dependent on agricultural input, mainly Tobacco processing. Other agro-industries are mainly confined to food processing ─ tea, sugar, beer production, dairy and flour products among others. This formal sector buying from the informal sector also impairs how the tax system can be administered. On the other hand, non-agro industries rely heavily on

imported raw materials and intermediaries. Thus, foreign exchange and fuel scarcity, and intermittent energy supply are major hurdles for this sector. Furthermore, with mostly old and obsolete technologies, the manufacturing process is simple with little significant value added. These strains on the economy would thus humper domestic revenue mobilization.

Wholesale and retail trade, financial and insurance activities, and information and communication are among the key emerging industries within services. These industries account for about 25 percent of GDP and have been identified as those sectors that will drive growth contingent on performance (Annual Economic Report 2018).

The performance of wholesale and retail is dependent on the overall demand for goods and services, which is largely determined by real wages. Financial and insurance performance is dependent on interest rates, which are very high in Malawi. For example, bank rates and commercial lending rates are as high as 25 and 41 percent respectively (Reserve Bank of Malawi Financial and Economic Review, 2013). Despite this, these sectors provide an opportunity for tax revenue collection owed to tremendous growth in recent years. In fact, government is already tapping on the growth having introduced 10 percent domestic excise tax on mobile phone prepaid vouchers and extended the 16.5 percent VAT to internet services in 2008 and 2013 respectively.

In general, the Malawi economy is characterized by a high dependence on agriculture, and a weak and narrow industrial base. A large subsistence agriculture is difficult to tax, and low per capita incomes all contribute to a low share of tax revenue in GDP, which stands at about 18.5 percent which is below the previous UN standard 20 percent to meet MDGs but above the current 15 percent threshold. The formal sector which is generally easier to tax mainly consists of the public sector including public enterprises. Though a significant part of the emerging sectors is formal, they are relatively small scale.

Faced with the socioeconomic challenges presented, the main objectives that have driven government policy have been to maintain economic stability, promote private sector growth, ensure food security and expand provision of public services and infrastructure. Over the years, solid macroeconomic policies, good governance, improved tax administration and other discretionary measures have improved the tax to GDP ratio, however it is still arguably low. Coupled with soaring expenditures, unsustainable deficits have persisted.

Table 3.2. Revenues, Grants, Expenditures and Budget Deficits in Malawi (% of GDP)

Year	Domestic Revenue	Government Expenditure	Deficit before Grants	Grants	Total Revenue	Deficit after Grants
1985	19.7	28.3	-8.6	2.1	21.8	-6.5
1986	21.1	26.9	-5.8	1.6	22.7	-4.2
1987	19.4	32.0	-12.6	1.6	21.0	-11.0
1988	19.5	20.1	-0.6	2.5	22.0	1.9
1989	19.5	25.5	-6.0	1.8	21.3	-4.2
1990	17.7	21.5	-3.8	0.7	18.4	-3.1
1991	16.4	25.0	-8.7	3.7	20.1	-5.0
1992	18.4	24.0	-5.6	1.0	19.4	-4.6
1993	14.0	17.4	-3.3	1.0	15.0	-2.3
1994	16.8	17.6	-0.8	0.1	16.9	-0.7
1995	14.8	20.1	-5.4	0.1	14.9	-5.2
1996	14.6	16.4	-1.8	0.0	14.6	-1.8
1997	17.3	15.7	1.6	0.3	17.4	1.7
1998	16.2	15.1	1.1	0.3	16.5	1.4
1999	18.4	26.5	-8.1	3.7	22.1	-4.4
2000	18.2	29.7	-11.5	0.0	18.2	-11.5
2001	17.2	30.0	-12.9	10.2	27.4	-2.7
2002	9.8	18.9	-9.1	2.3	12.5	-6.4
2003	12.2	19.9	-7.7	4.5	16.7	-3.1
2004	12.7	25.4	-12.7	5.2	17.9	-7.5
2005	14.6	23.5	-8.9	8.6	23.1	-0.3
2006	13.8	22.8	-9.0	9.3	23.1	0.3
2007	15.2	23.9	-8.7	9.5	24.6	0.7
2008	16.9	27.3	-10.4	4.6	21.5	-5.8
2009	16.1	25.5	-9.4	3.2	19.3	-6.2
2010	22.2	26.6	-4.4	9.4	31.5	4.9
2011	14.3	15.2	-0.9	1.8	16.1	0.9
2012	17.0	27.4	-10.4	8.1	25.1	-2.4
2013	19.0	28.3	-9.3	5.7	24.7	-3.6

Note: Domestic revenue includes non-tax revenue. Source: Ministry of Finance. Ratios computed by Author

In the latest African Economic Outlook, the African Development Bank (2019) now classifies Malawi with a debt-to-GDP ratio of 58 percent as at moderate risk of debt distress.

To address the socioeconomic problems while pursuing fiscal sustainability, government does recognize improving the tax system and raising revenue, in addition to capping expenditure, is a prime agenda. Given the emerging structure of the economy this chapter investigates the structural, as well as fiscal and policy determinants of tax revenue in Malawi.

3.1.2 Determinants of Tax Revenue Performance: Theoretical Justification

Various empirical studies have exploited the determinants of tax performance or effort in both the developed and developing world.[21] Some have been region or group specific; sub-Saharan Africa, Arab Countries, OECD while others have been country specific.[22] The theory surrounding these studies generally categorizes factors affecting tax performance into four; structural, macroeconomic, institutional, and social or demographic factors.

Structural factors largely indicate the level of development or how advanced a country is. Such include the sectoral shares in GDP; agriculture, manufacturing, mining etc., per capita income, trade openness among others. Theory suggests economic structures characterised by a high agricultural share, high debt, aid and ODA received, low per capita incomes and trade openness will have low tax revenue performance, or that these factors will affect tax ratios negatively.

Macroeconomic factors mainly encompass macro-policy variables that can be utilized and/or affected by government actions. These include interest rates, exchange rates and money supply among others.

[21] Tax effort is an index of the ratio between the share of the actual tax revenue collection to the predicted tax revenue (or taxable capacity)

[22] In SSA studies; Ghura (1998), Stotsky and Woldemariam (1997), in Arab countries; Eltony (2002), in OECD; Castro and Camarillo (2014)

Institutional determinants include corruption, political stability, civil rights, law and order. Theory posits that solid institutional arrangements that ensure stability create a conducive environment for tax administration and revenue collection.

The social demographic factors include urbanization, adult literacy, the population structure and human capital development among others. Urbanization suggests a move from the informal to formal sectors, while adult literacy and human capital development indices may indicate the population's general capacity to understand and adhere to the tax system's codes and procedures.

Overall, the structural and socio-demographic factors indicate the level of economic development. The hypothesis is that as countries develop, tax bases develop more than proportionately to growth in national income. This stems ideas from Musgrave (1969, in Musgrave & Musgrave 1984) who argued that limited tax handles might limit tax revenue collection at low levels of income, however these limitations should become less severe as the economy develops.[23] Moreover, even though economic development brings with it increased demand for public expenditure, it should also bring a larger supply of taxable capacity to meet such demands. For example, while urbanization may induce demand for public services, engagement in formal work may also at the same time grow tax revenue collections.

In general, more developed economies also have strong institutions, and thus political stability, civil rights and accountability, law and order thrive. In low income countries, there are several reasons for relatively low tax ratios, however any generalization is difficult given the differences in the political and economic structures across these countries. In sum, many factors that affect tax effort are thus almost entirely related to the level of economic development of

[23] In using the term tax handles, Musgrave appears to be referring to the changing opportunities to levy taxes as well as tax administration costs

the country. Thus, studies conducting a panel assessment should group countries with economic profiles that are not profoundly different. Alternatively, country specific studies may also yield some rich results. Since there are a large number of studies, the next section reviews papers restricted to developing countries, both panel and country specific.

3.2 Empirical literature review

There are numerous empirical studies that have investigated the determinants of tax revenue in developing countries. Some determinants such as GDP per capita, agriculture share, and corruption generally yield common results across studies. However, if we take an aerial view of all literature and the variety of exogenous factors examined, it appears that some findings are mixed even contradictory due to sensitivity to the set of countries and period of analysis. This section thus reviews panel analysis studies and country specific cases.

3.2.1 Panel Analysis Literature

Tanzi (1987) examining a sample of 86 developing countries was among the first early studies to find a positive and significant relationship between tax share in GDP and log per capita income. However, later Leuthold (1991) in analysing 8 African countries over a 9-year period was among the few that found an odd result of a statistically significant negative relationship between tax share and per capita real GDP. The study also found that the tax share is negatively related to the agriculture share but positively related to the trade and mining shares.

Stotsky and WoldeMariam (1997) broadened the data to 43 SSA countries and found a strong inverse relationship with the agricultural share, similarly, the mining share though significance was weaker. Import share had a strong direct relationship, as did exports and manufacturing though significance was weaker. The study concluded countries with a relatively high tax share in GDP also have a relatively high tax effort index.

Ghura (1998) investigated the impact of economic policies and corruption using a panel of 39 SSA countries over 1985 to 1996. He found inflation, used as a proxy for expansionary monetary and fiscal policies, has the largest impact and is negatively related to the tax ratio. Thus, economic policies that emphasize a prudent financial stance coupled with other reforms can be expected to raise revenue. Corruption captured by an index that measures the extent to which bribes are generally expected by government officials was also negatively related. Human capital that proxied the extent of public services provided by the government was positive.

Agbeyegbe et.al (2004) performed a Generalized Method of Moments to examine a panel of 22 SSA countries over the period 1980 to 1996. The study found that trade liberalization is not strongly linked to aggregate tax revenue, one proxy measure however showed a strong link to higher income tax revenue, a result that was also later found by Mahdavi (2008). The study also showed some linkage of currency appreciation and higher inflation to lower tax revenues. The other factors; industrial share, government consumption, and terms of trade were also found to exert positive effects on total tax revenue, but inflation exerts a negative effect.

For agricultural share, a positive effect was found, and it was argued that this may be explained by the influence of exports in providing a tax handle. Mahdavi (2008) examining an unbalanced panel of 43 developing countries over the period 1973 to 2002 also found agriculture share to have a positive relationship. Aid and non-tax revenue were found to have negative effects.

Gupta (2007) used a panel of 105 countries over 25 years to investigate the determinants of tax revenue efforts in developing countries. He found structural variables per capita GDP, agriculture share, and trade openness to be significant and strong determinants of tax revenue performance. Agriculture share was found to have a strong negative and significant relationship with revenue performance such that every one percent increase could reduce revenue

performance by as much as 0.4 percent. Trade openness was found to be significantly positively related; a one percent increase in imports to GDP ratio could increase performance by 0.15 percent. Though with weaker significance, foreign aid was also found to be positively related. Debt on the other hand was found to be negatively related with revenue performance.

In some specifications, institutional factors measured by political and economic stability were found to be significant determinants. However, variables meant to capture government stability, corruption, and law and order were not significant.

Zarra-Nezhad et.al (2016) investigating an 83 developing and emerging country panel also found that trade liberalization boosts tax revenue. Other significant factors included the official exchange rate, urbanization and democracy.

3.2.2 Country Specific Empirical Studies

In an early study Teera (2002) investigating Uganda confirmed the agriculture share to be significant and negatively related to tax revenue. Oddly enough, so was per capita income and imports to GDP ratio the proxy for trade openness. Significant and positive results were found for the manufacture share and foreign aid, but foreign debt was not significant.

In Malawi, Masiya et.al (2015) estimated a 2003 to 2012 monthly time series to investigate how macroeconomic variables affect tax revenue collections to devise a forecasting model. As expected a priori, GDP and broad money supply were positive and strongly significant. Inflation and exchange rate were found to be insignificant. A similar analysis in Nigeria however found that tax revenue is most significantly responsive to exchange rate and inflation rate, in addition to the income level (Saibu & Sinbo 2013). To conclude, Masiya et.al (2015) recommended emphasis on economic policies that boost domestic production as well as for monetary and tax authorities to collaborate as their policy effects intertwine.

Ayenew (2016) performed Johansen maximum likelihood cointegration test on 1974 to 2013 time series on Ethiopia to find that long run GDP per capita, foreign aid, and industrial value-added share in GDP are positive and significant determinants of tax revenue. Inflation was found to have a negative significant effect in both the short and long run. Gobachew et.al (2017) concurred with these results and also found trade openness significantly positive. However foreign direct investment (FDI) was found to be insignificant.

Ikhatua and Ibadin (2019) using ARDL on 1980 to 2015 annual data investigated how sector productivity affects revenue performance in Nigeria. He found that agriculture sector productivity and tourism sector productivity have a positive and significant effect, while manufacturing sector and telecommunications sector productivity has a significant and negative effect. The later result was rather odd, the study called for strict and meticulous enforcement of tax rules and administration procedures. For the other factors, trade openness and human capital development were found to have significant and positive effects. Table 3 provides a summary of the results from the main literature reviewed.

Table 3.3: Summary of results of main literature reviewed

	Panel Analysis				Time series Analysis		
	Leuthold (1991)	Stotsky & WoldeMariam (1997)	Ghura (1998)	Gupta (2007)	Teera (2002)	Saibu & Sinbo (2013)	Gobachew et.al (2017)
Sample	8 SSA,	43 SSA,	39 SSA,	105 LDCs,	Uganda	Nigeria	Ethiopia
Data Period or Years	1973-81	1990-95	1985-96	25 years	1970-00	1970-11	2000-16
Dependent variable	Tax/GDP	Tax/GDP	Tax/GDP	Tax/GDP	Tax/GDP	Tax/GDP	Tax/GDP
Agriculture share	-	-	-	-	-		-
Mining share	+	-					
Manufacture share		Not sig			+		+
Per Capita Income	-	+	+	+	-		+
Trade share	+		+	+		+	+
Imports to GDP		Not sig		+	-		
Exports to GDP		+					
Foreign Aid or Prog.		Not sig		+	+		
Foreign Debt share				-	Not sig	-	
Inflation			-			-	-
Exchange rate						-	
Corruption			-	-			
Government stability				Not sig			
Human Capital Devt.			+				

Sources: See bibliography

To summarize, most studies find that per capita GDP and degree of openness is positively related to revenue performance, but higher agriculture share, and inflation lower it. Foreign aid seems to be generally positive, while foreign debt is negative. Other factors such as mining share have somewhat an ambiguous effect on resource mobilization.

For the majority of determinants then, results suggest that they are indeed sensitive to the set of countries or country and the time period of analysis further justifying this country case. Accordingly, the next section covers the empirical methodology utilized to determine how structural, fiscal attributes, and economic policy variables affect tax revenue performance in Malawi.

3.3 Data and Methodology

To accomplish this objective, all analysis was on 1980 to 2016 annual time series secondary data from WDI (2017). Total Tax Revenue series was obtained from various issues of the Malawi Annual Economic Report since as reported it excludes social security contributions, grants and non-tax revenue. Economic theory and rationale, as well as reviewed studies guided the choice of variables. Accordingly, a model was developed from the premise that total tax revenue is a function of a non-exhaustive set of variables as follows:

TTR = f (GDPPC, NETODA, EXTDEBT, AGRI, MANU, SERVICE, CLAIMSCG, TRADEOP, INFLA, XRATE, BROADM)

3.3.1 Data variables

Tables 3.4 and 3.5 provides a summary of these variables and descriptive statistics.

Table 3.4: Variable description, 1980 – 2016 Annual

Variable	Name	Description	Units
TTR	Total Tax Revenue	Excludes Soc. Sec. Contr. Grants, and Non-tax revenue	LCU
GDPPC	GDP per Capita	A country's output per person	LCU/pers.
NETODA	Net ODA	Net Official Development Assistance	% of GNI
EXTDEBT	External Debt	Total debt owed to foreign creditors	% of GNI
AGRI	Agriculture share	Share of agriculture value added in GDP	% of GDP
MANU	Manufacture share	Share of manufacture value added in GDP	% of GDP
SERVICE	Service sector share	Share of service sector in GDP	% of GDP
CLAIMSCG	Claims on Cent. Gov	Financial Obligations to country's financial institutions	% of GDP
TRADOP	Trade Openness	Value of Imports and Exports over GDP	% of GDP
INFLA	Inflation	Year on year measured by percentage change in CPI	%
XRATE	Exchange rate	Official exchange rate	LCU per $
BROADM	Broad Money	All-inclusive money assets – notes, coins, deposits etc.	LCU

Source: TTR (Malawi Annual Economic Reports various years)

Other variables (World Development Indicators 2017)

Table 3.5: Descriptive statistics

	Min	Max	Mean	Std.dev	Skewness	Kurtosis	Sum.Sq.dev
TTR	166.87	754,910.00	95,335.11	178,536.00	2.34	7.77	1.15E+12
GDPPC	163.08	215,622.50	34,252.40	54,405.66	1.92	5.96	1.07E+11
NETODA	10.02	41.38	19.87	7.42	0.70	3.16	1,983.75
EXTDEBT	14.90	177.50	81.27	47.15	0.24	2.26	80,041.87
AGRI	22.34	44.78	33.98	5.44	0.02	2.21	1,064.50
MANU	9.25	19.05	12.55	2.26	0.66	3.35	184.57
SERVICE	33.14	59.43	47.85	7.89	-0.35	1.83	2,238.34
CLAIMSCG	-0.85	20.40	8.49	5.71	0.45	2.31	1,175.11
TRADOP	41.90	91.38	59.70	10.66	0.99	3.60	4,091.91
INFLA	5.28	83.33	20.01	14.43	2.47	11.11	7,497.89
XRATE	0.81	710.92	105.60	166.43	2.23	7.52	997,128.10
BROADM	191.52	897265.70	120,706.20	229,488.60	2.16	6.67	1.90E+12

Observations N = 37

The mean values attest to the economic profile described. On average the tax share of GDP is under 20 percent. The manufacturing sector has a relative meagre share in GDP 13 percent. Services on aggregate account for almost a 50 percent share further justifying the need to assess how tax revenues relate to this sector and the implications of this growth as an emerging sector. The value of trade at 60 percent of GDP indicates the economy is very open in terms of trade. Finally, the double-digit rate indicates the Malawi economy has been quite the inflationary environment on average. To examine how these factors affect tax revenue collection the following section describes the methodology and empirical model estimated.

3.3.2 Empirical Model and Estimation Procedure

Theory and literature indicate that the relationship between tax revenue and these variables is nothing other than linear. Thus, all research in the field estimated some form of linear or log-linear OLS or GMM model. Likewise, we estimate a log-linear model with the dependent variable TTR, and some exogenous ones transformed by the natural log.

However, given the finite data and to allow some dynamic effects we estimate an auto-regressive distributed lag (ARDL) model. The adoption of ARDL also follows latest implementations such as Ikhatua and Ibadin (2019) in Nigeria. As a dynamic model, it further permits analysis of immediate or short run and long run relationships. ARDL cointegration technique as proposed by Pesaran and Shin (1999) has become the solution to determining the long run relationship between non-stationary series, as well as estimating a reparametrized Error Correction Model (ECM) to confirm long run relationships.

To demonstrate the model, suppose a two explanatory variable case such that ARDL(p,q_1,q_2) specifies the model, where p is the number of lags of the dependent variable, q1 number of lags

of the first explanatory variable and q2 number of lags of second explanatory variable. Suppose an ARDL (1,1,1), then the model can be written;

$$Y_t = \delta + \theta Y_{t-1} + \phi_1 X_{1t} + \gamma_1 X_{1t-1} + \phi_2 X_{2t} + \gamma_2 X_{2t-1} + \varepsilon_t \qquad (1)$$

Given that the ARDL assumptions hold, the short and long run coefficients estimated by this ARDL (1,1,1) model are computed and may be interpreted as follows: [24]

ϕ_1 estimates the immediate or short run (or within period) impact on Y_t following a change in X_{1t} and

ϕ_2 estimates the short run impact on Y_t following a change in X_{2t}, ceteris paribus.

$\frac{\phi_1+\gamma_1}{1-\theta}$ is the long run multiplier for X_1, i.e. the cumulative or long run effect of a unit change in X_1 on Y. Holding other factors constant, if X_1 increases by one unit, the expected cumulative increase in Y is given by the X_1 long run multiplier.

$\frac{\phi_2+\gamma_2}{1-\theta}$ is the long run multiplier for X_2, i.e. the long run effect of a unit change in X_2 on Y. Holding other factors constant, if X_2 increases by one unit, the expected cumulative increase in Y is given by the X_2 long run multiplier.

Extending to *n* number of explanatory variables X_z and n lags, the following is a representation of an ARDL ($p,q_1,q_{2,\ldots,}q_n$) general model:

$$Y_t = \delta + \theta_k \sum_{k=1}^{n} Y_{t-k} + \phi_z \sum_{z=1}^{n} X_{zt} + \gamma_{zi} \sum_{z=1}^{n} \sum_{i=1}^{n} X_{zt-i} + \varepsilon_t \qquad (2)$$

[24] Distributed lag model assumptions

1. X_t is exogenous.
2. The random variables Yt and Xt have a stationary distribution and (Y_t, X_t) and (Y_{t-j}, X_{t-j}) become independent as j gets large.
3. Large outliers are unlikely and
4. There is no perfect multicollinearity

and the long run multiplier for any of the variables X_z is calculated as:

$$\frac{\phi_z + \sum_{z=1}^{n} \sum_{i=1}^{n} \gamma_{zi}}{1 - \sum_{k=1}^{n} \theta_k} \quad (3)$$

Given that the ARDL assumptions hold, then this model appropriately describes the expected value of the dependent variable Y_t given its own history and conditional upon current and lagged values of the explanatory variables X_z.

The ARDL can be estimated as long as none of the variables are integrated to the second order (I(2)). Augmented Dickey Fuller (ADF) unit root tests were performed, results showed the variables are a combination of I(0) and I(1).[25] This further justified the use of ARDL as it is suited to time series estimation given a combination of orders of integration (zero and one). In addition, in a finite sample, the ARDL error correction representation becomes relatively more efficient (Nkoro & Uko 2016).

To determine optimal lag lengths, we estimated an unrestricted vector autoregression (VAR) for each series. All variables were between 0 to 3 lags based on the Akaike Information Criteria (AIC) and the Schwarz Criterion (SC).[26] Auto lag length determination based on the SC was thus set to a maximum of 3 in all regressions.

As a precaution to multicollinearity, a correlation analysis was performed on all the exogenous variables.[27] Some variables were significantly or strongly correlated (±0.7 threshold) and were thus not included in the same regression (further) guiding the specification of the models. Due to the finite data, models were specified to include a limited number of exogenous variables, maximum three. Accordingly, as explanatory variables, specification I had GDP per capita,

[25] See Annex 3.1 for ADF unit root test results

[26] See Annex 3.1 for the lag order selection Unrestricted VAR results

[27] See Annex 3.3 for Correlation Analysis results

Net ODA and Trade openness; specification II had the service sector share, the domestic debt proxy – claims on central government, and inflation; specification III had the agriculture sector share, broad-money supply, and external debt; and specification IV had the manufacturing sector share and official exchange rate.

For each of these, upon estimating the ARDL, the long run form was computed and bounds test for cointegration performed. In all 4 specifications, we rejected the null of no levels relationship among the variables, thus each model was then reparametrized to the ECM.[28] We thus made dynamic inferences using the short run, as well as the long run estimates.

We then proceeded to perform some residual diagnostics. [29] In all specifications we failed to reject the no serial correlation null in the Breusch-Godfrey serial correlation test. However, we rejected the null of homoscedastic residuals in the Breusch-Pagan-Godfrey heteroskedasticity test for specifications I and IV. For these cases, we re-estimated the ARDL using Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors.

The stability of each model was also tested using the CUSUM of squares. [30] The models were stable with the exception of specification IV. The test displayed some slight diversion out of the 5 percent band. Nevertheless, taking an overall account of model selection criteria, we deduced these models as robust and proceeded to interpret the coefficients estimated as presented in the next section.

[28] See Annex 3.2 for Long run bounds test and ECM results

[29] See Annex 3.4 for serial correlation and heteroskedasticity tests

[30] See Annex 3.5 for CUSUM of squares test results

3.4. Empirical Results

This section presents the results from all 4 specifications labelled according to the explanatory variables included. The section that follows presents a summary table using 1 and 5 percent error tolerance levels, and then discusses the result and implications of each exogenous variable.

3.4.1 Specification I: GDP per Capita, Net ODA, and Trade Openness

Table 3.6: Specification I result

Dependent variable: LOGTTR

ARDL 1981 2016, Obs. 36 After.Adj. Max lags: 3 Auto SIC

Selected model ARDL (1,0,0,0)

R^2 0.998, Adj. R^2 0.998, F-Stat 4650.2, Prob (F-stat) 0.0000, DW = 2.26

	Short run		Long run	
LOGGDPPC	0.4491*	[0.1438]	1.1104*	[0.0201]
NETODA	0.0047	[0.0036]	0.0117	[0.0085]
TRADEOP	0.0059**	[0.0022]	0.0145***	[0.0081]

* denotes significance at 1%, ** at 5%, *** at 10%

[HC1 Heteroskedasticity consistent standard error] in parentheses

3.4.2 Specification II: Service sector share, domestic debt, and inflation

Table 3.7: Specification II result

Dependent variable: LOGTTR

ARDL 1983 2016, Obs. 34 After.Adj. Max lags: 3 Auto SIC

Selected model ARDL (3,0,0,1)

R^2 0.998, Adj. R^2 0.998, F-Stat 2962.2, Prob (F-stat) 0.0000, DW = 2.36

	Short run		Long run	
SERVICE	0.0172*	[0.0042]	0.4604*	[0.1080]
CLAIMSCG	-0.0109**	[0.0044]	-0.2909**	[0.1137]
INFLA	0.0016	[0.0016]	0.1681	[0.1002]

* denotes significance at 1%, ** at 5%. [Standard error] in parentheses

3.4.3 Specification III: Agriculture sector share, Broad-money supply, and External debt

Table 3.8: Specification III result

Dependent variable: LOGTTR

ARDL 1981 2016, Obs. 36 After.Adj. Max lags: 3 Auto SIC

Selected model ARDL (1,0,0,1)

R^2 0.998, Adj. R^2 0.998, F-Stat 3827.2, Prob (F-stat) 0.0000, DW = 2.31

	Short run	Long run
AGRIC	-0.0138** [0.0052]	-0.0379*** [0.0192]
LOGBROADM	0.3663* [0.1098]	1.0018* [0.0316]
EXTDEBT	-0.0002 [0.0008]	0.0049** [0.0019]

* denotes significance at 1%, ** at 5%, *** at 10%.

[Standard error] in parentheses

3.4.4 Specification IV: Manufacturing sector share, and Exchange rate

Table 3.9: Specification IV result

Dependent variable: LOGTTR

ARDL 1981 2016, Obs. 36 After.Adj. Max lags: 3 Auto SIC

Selected model ARDL (1,0,0)

R^2 0.997, Adj. R^2 0.997, F-Stat 4778.4, Prob (F-stat) 0.0000, DW = 1.93

	Short run	Long run
MANU	0.7838 [0.0110]	-0.0057 [0.0512]
LOGX_RATE	0.2797* [0.0946]	1.2940* [0.0495]

* denotes significance at 1%.

[HC1 Heteroskedasticity consistent standard error] in parentheses

3.5 Summary of results and discussion

Table 3.10: Summary of results

Dependent Variable: LOGTTR

Sample: 1980 2016

Included observations in ARDL model: 34 - 36

	Short run	Long run
LOGGDPPC	0.4491*	1.1104*
AGRIC	-0.0138**	-0.0379
MANU	0.7838	-0.0057
SERVICE	0.0172*	0.4604*
TRADEOP	0.0059**	0.0145
NETODA	0.0047	0.0117
CLAIMSCG	-0.0109**	-0.2909**
LOGBROADM	0.3663*	1.0018*
EXTDEBT	-0.0002	0.0049**
INFLATION	0.0016	0.1681
LOGX_RATE	0.2797*	1.2940*

* denotes significance at 1%, ** at 5%

The variables investigated can be grouped in three; structural variables GDP per capita, sector shares, and trade openness; fiscal attributes and monetary variables; Net ODA, domestic debt, broad-money supply, and external debt; and finally, macro-indicators and economic policy variables; Inflation, and the official exchange rate. This section discusses these results in the same order, including the rationale for inclusion based on theory and drawing from empirical evidence.

3.5.1 Structural variables

GDP per Capita

Per capita income is a proven suitable proxy or indicator of a countries general level of development. With economic development come increases in human capital development,

literacy, productivity, stronger institutions thus increased accountability and political stability, and other factors such as urbanization. Musgrave (1969, in Musgrave & Musgrave 1984) also argues in general limited tax handles as typically faced by developing countries should become less severe as their economies develop. Per capita income growth may also indicate growing wealth. As wealth increases people's sources of income tends to increase in number (James & Wallshutzky 1995, in Taliercio 2004b).

Similar to prior studies, this analysis affirms the theoretical rationale of a positive association with tax revenue generation. In Malawi a 1 percent increase in per capita GDP can be expected to yield a 0.4 and 1.1 percent increase in total tax revenue in the short run and long run respectively.

The sector shares Agriculture, Manufacturing, and Services

Like in most developing countries, agriculture that holds a substantial share around 30 percent largely consists of subsistence and small-scale non-commercial farming with little to no value addition hence notoriously difficult to tax. In Malawi, if the agriculture share of GDP grows by 1 percentage point, total tax revenue could decrease by 1.38 percent within the same period. Cumulatively, the decline could be as much as 3.79 percent in the long run, however the significance of this long run estimate is weak.

The falling share over the past two decades thus manifests as a relative advantage to current tax administration. It was thus worthwhile to investigate whether this shifting pattern presents as an opportunity for tax revenue collection by examining the other two major sectors.

The share of manufacturing value added in GDP is not a significant predictor of tax revenue in Malawi. The sector has stagnated over the years and is declining. It averaged 16 percent of GDP in the early 90s, now barely 10 percent in the last decade. The manufacturing base is very small and plagued by intermittent power supply. Malawi thus heavily relies on imports. The

relative decline of industry thus has a negligible impact on tax revenue generation. The main tax levied on locally manufactured goods – domestic excise tax – ranks 8th of 12 with a share of about 3.6 percent of total tax revenue.[31]

On the other hand, the service industry has been the fastest growing sector in many African countries over the last two decades. Growth has been occurring at the expense of agriculture and manufacturing absorbing labour and other resources. In Malawi, substantial growth has been driven by the wholesale and retail trade, and the information and communication sub-sectors despite moderately high inflation and interest rates. Growth has further been compounded by increased urbanization increasing labour supply as well as service demand. An increase of one percentage point in the share of services in GDP could yield a 1.72 percent increase in tax revenue in the short run, and by as much as 46 percent cumulatively in the long run.

Unlike the agriculture sector, business and work in this sector is more formal and thus relatively easier to tax. Accounting for about 46 percent of GDP, this sector represents the latest golden goose, taxes levied in this sector properly administered can be expected to yield prolific revenues. This again further shows the advantage to current tax administration to collect substantial revenues.

Trade Openness

As a nation with such a low manufacturing base, imports such as fertilizer and fuel significantly drive production as well as consumption activities. Imports rose from 26 percent of GDP in 2002, to 35 percent in 2015 (WDI 2017). The a priori expectation then was a positive

[31] See Annex 2.1 for the shares of total tax revenue

association between the value of exports and imports as a share of GDP (a proxy for trade openness) and tax revenue.

The model in specification I suggests that trade openness is a significant predictor of tax revenue collection in the short run only. Accordingly, an increase by one percentage point in the share could lead to a 0.59 percent increase in total tax revenue within the same period. Over subsequent periods this could cumulatively be up to 1.45 percent, however the significance is weak.

Nonetheless, this supports trade openness as a positive factor for revenue generation. Malawi has had zero rates on exports since late 80s, we thus note that this positive relationship is driven by imports. With import duties accounting for about 36 percent of total tax revenue, the reported growth in imports should present itself as an opportunity to current tax administration. However as noted in the previous chapter, administering customs currently presents the greatest challenges in Malawi tax administration. Thus, though the import share has grown and a positive relationship with tax revenue is evident, the current administrative authority may have failed to fully take advantage of the growth trend and opportunity presented to collect substantial revenues.

3.5.2 Fiscal Stance and Monetary Variables

Net Official Development Assistance

Net ODA proxies for all aid and grants which are a major source of finance (for development) for the majority of developing countries. Several studies suggest that large amounts of unearned State income from foreign aid (as well as natural resources), reduce government incentives to raise its own revenue, unless reform is part of the package of conditions tied to aid and loans (Brautigam 2000; Brautigum and Knack 2004; Collier 2000, in Kiser and Sacks 2009). Moyo (2009) shares similar concern and calls for an outright end to aid citing the failure of billions

of dollars of development related aid to reduce poverty and increase growth in developing countries. On the other hand, grants and aid may be tied to revenue mobilization and other economic performance targets such that it can motivate collection.

We thus sought to examine whether Malawi succumbs to the moral hazard or not, moreover grants in the 1990s averaged 4.4 percent of total government revenue but soared to an average of 29.6 percent in the 2000s[32]. The analysis yielded a positive relationship suggesting concerns over moral hazard are unwarranted, however both the short run and long run coefficients were not significant.

Domestic and external debt

Soaring public expenditures have created substantial fiscal deficits leading to rising debt in many countries (Tanzi & Blejer 1988). The theoretical rationale and thus expectation would be for debt to induce revenue collections needed to service it. Alternatively, some governments may simply see it as a readily available alternative source of revenue. Furthermore, in some cases, a high debt burden may be detrimental to macroeconomic performance. For example, the release of much needed development funds is often tied to fiscal targets. Unsustainable debt may have macroeconomic ramifications.

In this analysis central government's financial obligations to the country's financial institutions was used as a proxy for domestic debt. This represents the easiest form to access. It appears that in Malawi there is a negative association, suggesting that rising debt disincentivises tax revenue collection. A 1 percentage point increase in the share of central government's financial obligations to the country's financial institutions as a share of GDP may lead to a 1.09 percent fall in revenue in the short run, and by 29 percent cumulatively in the long run.

[32] Author calculation, Annual Economic Reports data

It appears there is a positive relationship between domestic debt and tax revenue collection suggesting it features as an incentive factor. This suggests that in Malawi domestic public debt induces more tax revenue collection.

On the other hand, external debt appears to be a factor that significantly induces tax revenue in the long run cumulatively by 0.49 percent for a one percentage point increase in the debt owed to foreign creditors as a share of GNI.

Broad-Money Supply

Money supply is a monetary policy tool frequently used in Malawi to effect desired economic outcomes such as inflation targets. The relevance of this variable as a useful predictor is thus quite significant.

An increase in money supply is expected to induce economic activity thus the a priori expectation was a positive relationship with tax revenue. From this analysis, broad money appears to be a strong and significant predictor of tax revenue in both the short and long run yielding a 0.36 and 1 percent increase respectively for a 1 percent increase in broad-money supply. Masiya et.al (2015) estimated a 0.2 percent long run change. In all cases the relationship is positive and significant.

3.5.3 Macro-Indicators and Economic Policy Variables

Inflation

Economic theory and rationale point to a negative association, however empirical evidence suggests the causal direction of inflation is not certain. How inflation relates to tax revenue, will likely be the net result of the underlying economic phenomenon that the inflation is indicating. For instance, it may indicate booming economic activity that may even be a result

of expansionary fiscal policy, or it may indicate a rising cost of living which may have long run detrimental effects on revenue. Inflation also implies reducing purchasing power, in some cases that may fuel the informal economy.

In Malawi, the average inflation rate over the period is in double digits, we thus expected to find a significant relationship, however it appears that the inflation rate, measured by year on year percentage changes in the consumer price index, is not a significant predictor of total tax revenue, neither in the short nor long run. This result concurs with Masiya et.al (2015).

Exchange rate

The exchange rate can be expected to influence taxes in two ways. First, exchange rates can affect tax revenue indirectly if the volume of trade is sensitive to and thus changes in response to exchange rate movements, and duties are levied on those exports and imports. In this case the impact on revenues would be contingent on the net balance of the volume changes of exports and imports following the change in exchange rate. In Malawi, imports have consistently risen irrespective of worsening exchange rate.

Second, the exchange rate may affect import duties more directly at the point of currency conversion. As the exchange rate increases (or worsens), duties due would translate into higher revenues collected in local currency units. In Malawi, the exchange rate has consistently trended upwards, and more exponentially in recent years.

By both accounts, the a priori expectation was positive, and indeed on average, a 1 percent increase in the exchange rate leads to a 0.28 percent, and a 1.29 percent increase in total tax

revenue in the short and long run respectively. The result is plausible further considering that custom duties account for about 35 percent of total tax revenues.[33]

3.6 Conclusion

In conclusion, four exogenous factors per capita GDP, service sector value added as a share of GDP, broad-money supply and the official exchange rate are strong positive and significant predictors of total tax revenue in Malawi. The development trend thus has a major impact, including the changing pattern of the economic structural composition with the booming services industry in particular providing substantial revenue opportunities. Likewise, monetary and exchange rate policy have a considerable bearing on total tax revenue.

As expected, and concurring with empirical evidence, we ascertain the negative relationship between the agriculture share and tax revenue, and the positive relationship between trade openness and tax revenue. We find new evidence that domestic debt disincentivises tax revenue collection, but external debt induces it in the long run.

From this analysis, several factors help explain or account for a natural increase in revenue performance in the post millennial period that surely advantaged current tax administration. First, economic growth rates were substantially higher in the later years of the first decade of the post millennial era. The tax system is expected to have responded positively to the associated per capita wealth and consumption increases. Second, the decline in agriculture and boom in services entirely occurred in the post millennial period.[34] Third, was the substantial growth in the level of imports, plus the compounding effect on import duties of a rising exchange rate. It is thus clear, and we deduce that only a fraction of the reported post reform

[33] See Annex 2.1 for the shares of total tax revenue

[34] See figure 1 for the shifting pattern in sector composition in the 2000s

revenue performance gains was at the hand of the subsequent revenue collection efforts. Results point that efforts led to positive results for revenue performance, but the result itself evidently cannot be entirely accredited to the reform and subsequent tax administration efforts. The general conclusions chapter that follows substantiates this conclusion.

GENERAL CONCLUSIONS

The subject matter of this thesis focused on domestic resource mobilization through taxes, specifically on assessing tax system or tax revenue performance, and evaluating a major tax administration reform in developing countries. The central thesis is that typical measures used fail both the former and the later, and thus proposes use of some measure of tax revenue productivity as demonstrated in the preceding chapters.

This chapter gives summary conclusions; first, on tax revenue productivity as a measure of performance; and second, on tax revenue productivity as a tool to evaluate semi-autonomous revenue authority reforms. Stemming from the latter and the two preceding chapters, a third and final section gives a concluding judgement on the impact of the SARA reform and subsequent MRA tax administration on revenue performance.

Tax Revenue Productivity as a Measure of Performance

The introductory chapter demonstrated that use of some measures, typically the share of tax revenue in GDP may be a mere indicator of tax capacity, which of course tends to be low in poor economies as a consequence of large agricultural sectors and other economic constraints. However, weak capacity does not necessarily mean the tax system's performance or revenue performance is poor as has typically been implied. The thesis argued here is that to better gauge performance we should estimate the proportion of change or responsiveness of a tax revenue to changes in its base (or GDP), i.e. tax revenue productivity.

In this case ideally, at least a one to one change would be indicative of good revenue performance even if the current tax ratio or capacity is weak or low. This idea was briefly illustrated in the general introduction that showed high tax capacity OECD countries evident by high tax-to-GDP ratios (even with the exclusion of social security contributions) had weak or less than proportionate tax revenue to GDP responsiveness. At the same time some sub-

Saharan African countries with relatively and/or significantly weaker capacities evidenced by lower tax-to-GDP ratios had more than proportionate responsive rates. Though this reflects that African tax systems have developed relatively more in recent decades unlike OECD systems which matured long before, and thus does not necessarily imply nor mean SSA country systems perform better, it highlights the deficiency of using tax ratios alone and the credibility of the proposition of revenue productivity measures to gauge current performance. One such measure employed is tax buoyancy, which estimates the responsiveness of tax revenue to changes in the tax base, typically as percentage changes.[35]

The primary objective in chapter 2 was to demonstrate this by estimating the responsiveness of various tax categories (including international standard classifications) in Malawi to their bases. Given limited 1979 to 2017 annual time series, an autoregressive distributed lag (ARDL) model was used, which also estimates dynamic responsivity i.e. short run or within period responsiveness, and long run or cumulative responsiveness of taxes to their bases. We found that real personal income tax is the most responsive to real GDP in both the short and long run in Malawi, followed by the consumption tax real VAT in response to real household final consumption. The performance of custom duties, which is a lump sum of import taxes was found to be weak as determined by a low responsive rate. Overall total tax revenue in Malawi, which accounts for about 17 percent of GDP, responds by 0.46 percent and 0.8 percent in the short run and long run respectively to a 1 percent change in real GDP.

This analysis focused on the performance of the tax in relation to its base alone on which the tax is imposed, however tax categories and total tax revenue can be exogenously affected by other factors; structural (or economic) and policy factors, social and demographic factors, and

[35] This sounds like but is not to be confused with tax elasticity, which requires tax revenue series to be 'cleaned' to rid it of the effects of discretionary tax measures and tax code modifications such as changes in tax rates, exemptions etc., to capture the responsiveness of the underlying tax system.

institutional factors among others. An overview of previous empirical studies suggests that the impact of some variables on revenue performance is sensitive to the set of countries and time period of analysis. Consequently, Malawi shows a significant changing pattern of the economic structure beginning around the turn of the new century. This shifting pattern, thesis subject matter, and the desire to fill a literature gap presented Malawi as a timely case to investigate, to affirm and/or discover how some variables, called determinants, exogenously affect tax revenue performance.

Accordingly, in chapter 3 we investigated how structural variables, fiscal stance indicators, and other macroeconomic policy variables relate with total tax revenue generation. Applying ARDL model estimation to 1980 to 2016 annual time series, we affirmed the agriculture share of GDP is significant, and negative for revenue generation. However, the emerging services sector share is positive, and a strong significant predictor, as are per capita GDP, broad-money supply and the official exchange rate. Trade openness, which is significantly driven by soaring imports, also featured as significantly positive in the short run. On the other hand, the evidence presented suggests that domestic debt disincentivises tax revenue collection, but external debt induces it in the long run.

In sum, chapters 2 and 3 thus demonstrated the use of tax revenue productivity as a measure to gauge performance of tax revenue in response to its base and in response to other exogenous factors. Chapter 1 however, using the same concept focused on the other aspect of the thesis; the inadequacy of typical performance indicators to evaluate reforms, and the proposal to employ tax revenue productivity as a unit of analysis.

Tax Revenue Productivity as a Tool to Evaluate SARA Reforms

The major tax administration overhaul to date that has swept across Latin America and sub-Saharan Africa over the last three decades is rooted in a long history back to the immediate

post-colonial periods when tax systems in developing countries modelled on centralized bureaucracies in Western economies were clearly failing. This was primarily due to compromised monitoring caused by poor communication technology, weak transportation infrastructure and record-keeping facilities. Given the weaknesses in monitoring capacity, reforms that combine some form of decentralisation and privatisation were seen to be more viable. Moreover, systems in pre-modern States that shifted residual clamancy to agents (actual tax collectors) had demonstrated some success.

Over the past three decades, over 35 modern States in the developing world have replaced centralized bureaucracies with partially decentralized and partially privatized tax administration agencies dubbed Semi-Autonomous Revenue Authorities (SARAs). The establishment of a SARA comes with high expectations for improved tax revenue performance fostered by the agency's autonomy in general management, human resources, and financing, expected to replace political interference and corruption with efficiency and professionalism.

Studies that suggest SARAs have generally failed to increase tax revenue collections are a minority. However simply looking at tax revenue collections can be grossly misleading. An analysis of the trend in tax-to-GDP ratio as is typically done is better but has yielded inconclusive results. The objective in chapter 1 was thus to devise a suitable quantitative approach to evaluate SARAs and deduce whether in general they have improved tax revenue performance or not.

To that end, we drew pre-reform and post-reform pair-samples from a panel of 21 countries most in sub-Saharan Africa (SSA), and Latin America, and run dynamic OLS and fixed effects model regressions to estimate pairs of pre-reform and post-reform buoyancy coefficients that measure tax revenue productivity. With the exception of the Latin America sub-sample, post reform estimates were statistically different, and relatively higher by between 13 to 28 percent,

with most gains by SARAs established later most of which are consequently in SSA. We thus deduced that in general SARAs have contributed to the improvement of tax revenue performance.

Though this evidence suggests optimism is warranted, true success and impact would grossly depend on individual country circumstances and the nature of the political-economy. For instance, success has proven to be inhibited when the autonomous features of SARAs are undermined say by government. Furthermore, tax revenue performance is exogenously affected by other economic, social and institutional factors many of which are outside the control of tax administration. To deduce on the potential impact SARAs have, such factors would need to be considered.

Chapter 1 uses data that is a panel of countries in addition to a sub-sampling methodology to limit this issue. Furthermore, fixed effects estimation in a panel analysis controls for country specific differences, thus exogenous factors are unlikely to non-uniformly influence the pair samples and thus bias estimates. However, such would not be the case in a single country assessment. To make deductions would thus require further assessment of some key exogenous variables, which was explored in chapter 3.

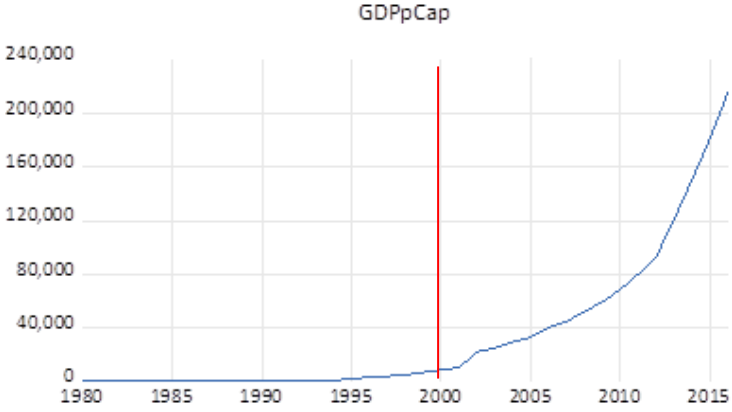
Preceding that further assessment was thus the secondary objective in the preceding chapter 2, which was to evaluate whether there was a significant shift in the responsivity or response rate of tax revenue to changes in its base following the implementation of SARA reform. Assessing a single country case also presented the opportunity to assess for potential impacts on various categories of taxes. Of the six individual tax categories examined, there was a significant positive shift in short run response rate for two taxes; domestic real VAT, and real Custom duties, in response to real household consumption and the real value of imports respectively. In the long run, there was a significant positive shift for real company income tax response rate

to real GDP growth, and again domestic VAT and Custom duties. Total tax revenue and thus the tax system as a whole, improved in both the short run and long run responsiveness by 0.15 and 0.16 percentage points respectively for every 1 percent increase in real GDP in the period following the reform. The magnitude of these shifts however is not necessarily to the credit of the reform and new administration. It is fairly indicative of direction; however, an account of other exogenous variables was necessary to aid deduction, and this was the subject matter of the chapter (3) that followed.

A conclusion on SARA Reform in Malawi and Tax Revenue Performance

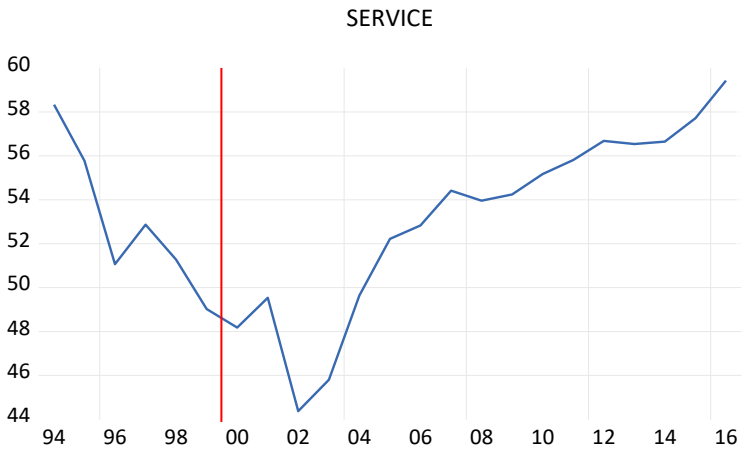
The analysis of the determinants of tax revenue performance in chapter 3 provides evidence that shows that a number of variables are significant exogenous factors. Strong positive determinants include per capita GDP, the share of services in GDP, broad-money supply and the official exchange rate. Other significant revenue enhancing factors include rising trade openness, declining agriculture and reductions in domestic debt.

These factors are significant determinants of total tax revenue collections irrespective of tax administration. A graphical illustration of their movements over the study period and a comparative analysis should thus inform judgement. The more the implied exogenous effects are significantly different between the two periods, the less we can accredit post reform period differences to SARA administration. We thus graphed the variables marking out the year MRA was operationally established 2000.



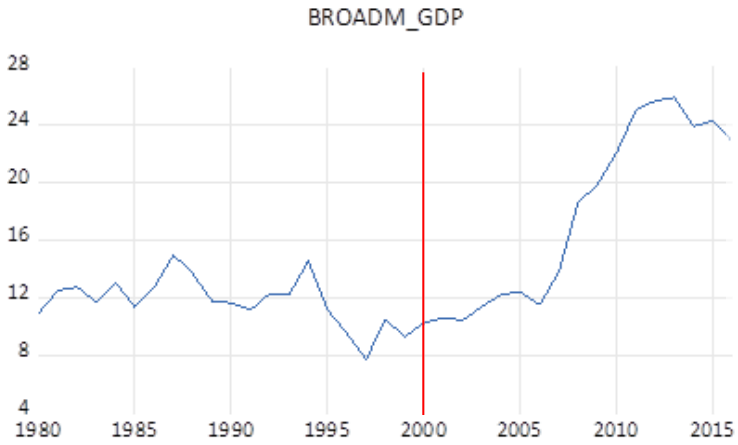
GDP per Capita (LCU/person)

A country's output per person, computed as GDP/Population in year *t*.



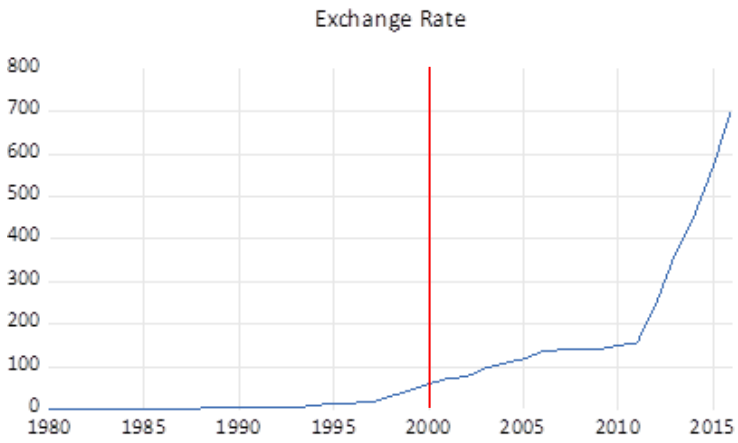
Service share in GDP (%)

The share of the value in service sector in GDP



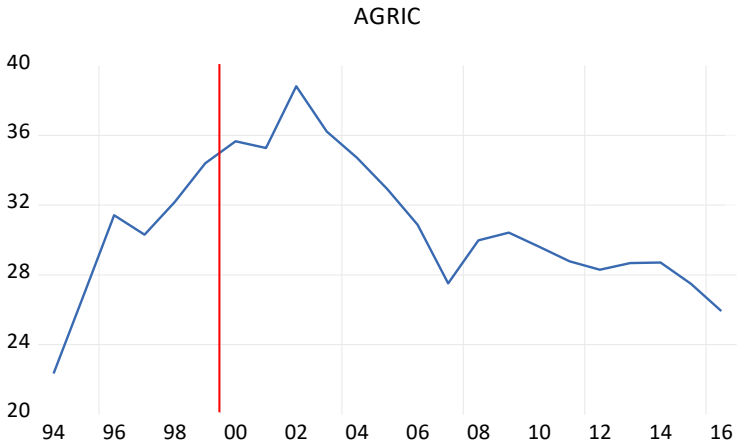
Broad money as a share of GDP (%)

All inclusive money assets including notes, coins, and deposits computed as a share of GDP.



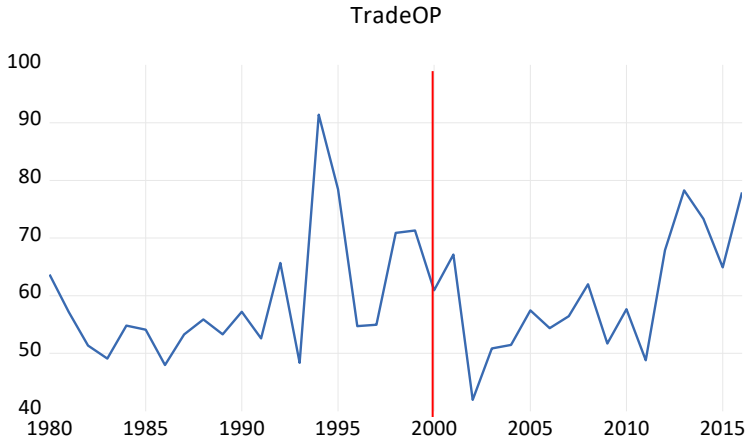
Official exchange rate (LCU per $)

The Kwacha – US dollar official exchange rate



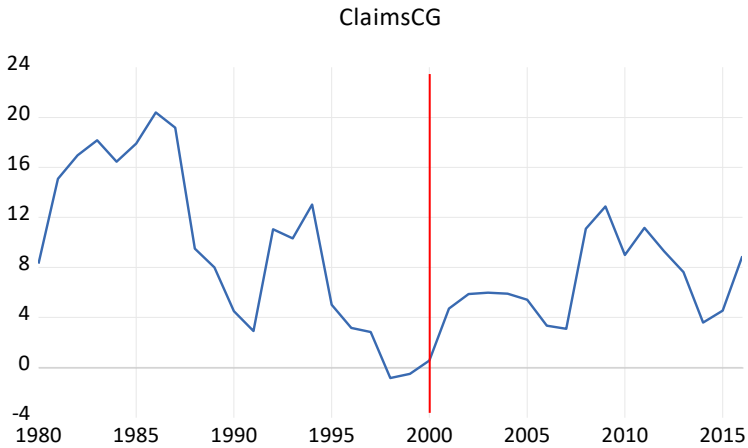
Agriculture share of GDP (%)

The share of agriculture value added in GDP



Value of imports and exports as a share of GDP (%)

Proxy for trade openness



Claims on Central Government (%)

The financial obligations to the country's financial institutions as a share of GDP

The graphical analysis illustrates that the four strong significant determinants grew exponentially by comparison in the post reform period. There are visible significant differences between the two periods such that comparatively, the difference in the exogenous effect is not negligible. The diverging services and agriculture share has already been highlighted. Looking at the trends in trade openness and domestic debt would perhaps fail to yield a conclusive judgement. However, per capita GDP, service share, broad money supply and the exchange rate clearly depict exceptional post year 2000 growth rates that surely compounded tax revenue to increase substantially.

Put simply, there were significantly more revenues available to collect or more value available for tax payers to pay a share in taxes. The question to ask then is whether the reformed agency was significantly better placed or more capable of collecting tax revenue from the increased value and bases. Perhaps yes, considering the rationale for establishment, the organizational set up, and from experiences narrated in case studies. Nevertheless, the empirics here are insufficient to strictly attest to this. At best, they emphasize that within the magnitude of the positive change in performance, the reformed agency only had some part.

The model in chapter 2 estimated that the long run responsiveness of real total tax revenue improved by 0.16 percentage points for every 1 percent increase in real GDP. Considering chapter 3 posits that the exogenous factors are significant, and noting the visible differences between the pre and post reform periods, and thus the implied exogenous effects on revenue generation, we conclude at best, that the significant portion of this increased performance in Malawi, was due to the exogenous effects from the changing patterns of structural and macroeconomic factors that surely biased upwards post reform period tax revenue performance.

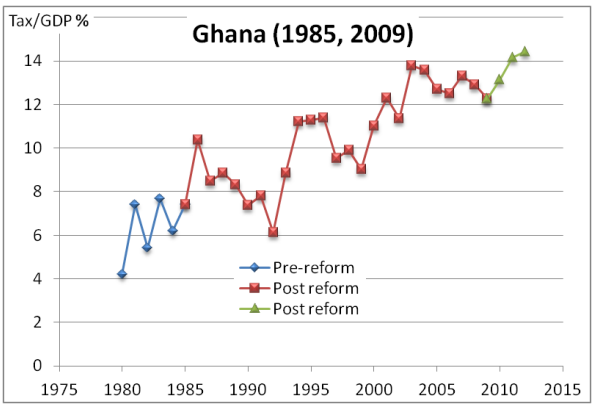
ANNEX 1

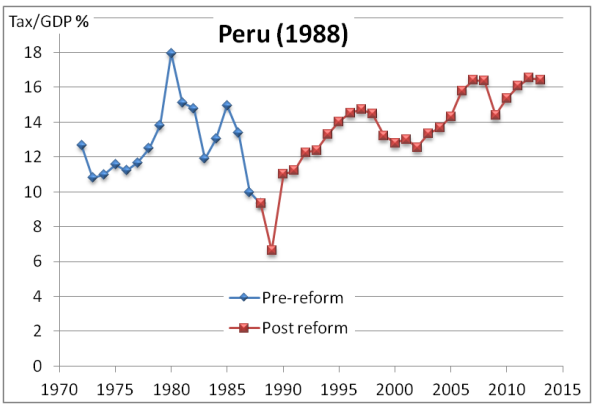
1.1 List of SARAs established (as of 2017)

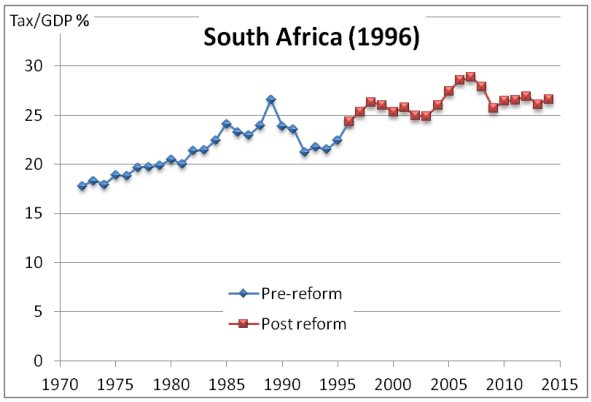
Included in the samples		Not included in the samples	
Country	Year Operational	Country	Year Established
Colombia	1991	Peru	1988
Uganda	1991	Argentina	1988
Venezuela	1994	Singapore	1992
Zambia	1994	Mozambique	2006
Kenya	1995	Ghana	2009
South Africa	1996	Burundi	2009
Tanzania	1996	Seychelles	2009
Malaysia	1996	Jamaica	2011
Mexico	1997	Barbados	2014
Guatemala	1999	Namibia	2017
Ecuador	1999		
Guyana	2000		
Malawi	2000		
Rwanda	2000		
Zimbabwe	2001		
Ethiopia	2002		
Sierra Leone	2002		
Lesotho	2003		
Botswana	2004		
Gambia	2005		
Mauritius	2005		

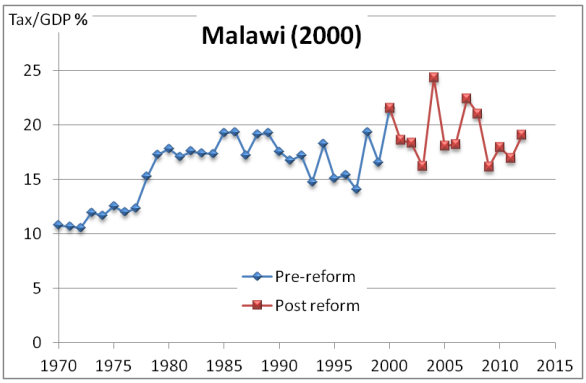
Source: Official SARA websites

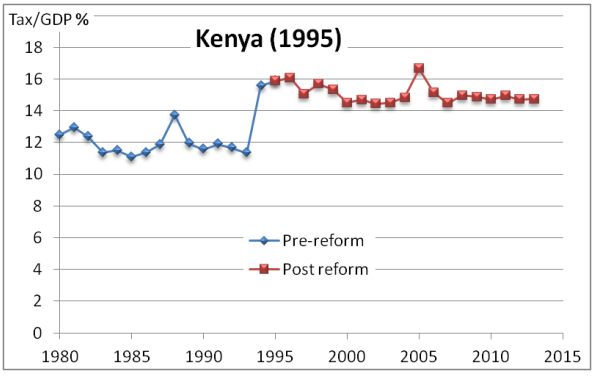
1.2: Pre and post reform revenue performance as measured by tax-to-GDP ratio

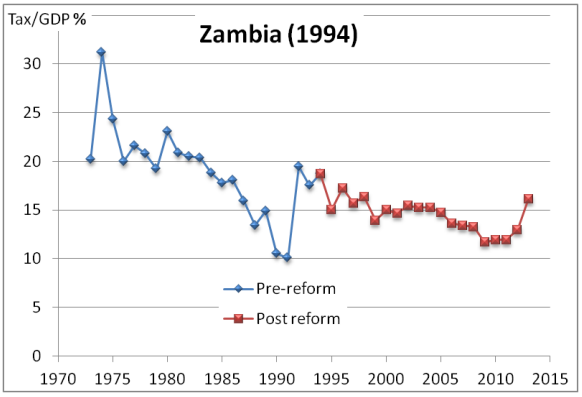


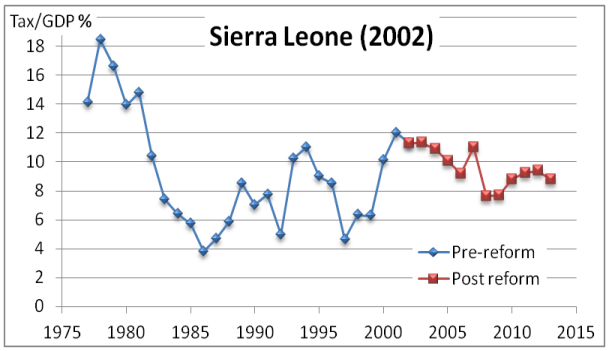












1.3: Panel unit root tests (LL&C *t** and ADF Fischer Chi-square for Common Unit Root (CUR) and Individual Unit Root (IUR) respectively)

Panel A-EA9 Unit Root Test

	Pre-reform sample					Post-reform sample			
	Log(RealTaxRev)		Log(RealGDP)			Log(RealTaxRev)		Log(RealGDP)	
	LL&C *t*	ADF F-Chi	LL&C *t*	ADF F-Chi		LL&C *t*	ADF F-Chi	LL&C *t*	ADF F-Chi
Level	1.389	10.354	2.047	13.351	Level	-0.136	7.332	-2.147	9.067
1st diff.	-6.770*	52.498*	-4.928*	43.109*	1st diff.	-7.478*	83.604*	-20.1*	78.289*
Verdict	I (1)		I (1)		Verdict	I (1)		I (1)	

Panel B-NC10 Unit Root Test

	Pre-reform sample					Post-reform sample			
	Log(RealTaxRev)		Log(RealGDP)			Log(RealTaxRev)		Log(RealGDP)	
	LL&C *t*	ADF F-Chi	LL&C *t*	ADF F-Chi		LL&C *t*	ADF F-Chi	LL&C *t*	ADF F-Chi
Level	1.608	27.008	1.210	17.849	Level	-2.058**	13.214	-1.9**	16.645
1st diff.	-8.875*	93.092*	-7.601*	88.211*	1st diff.	-	-	-	-
Verdict	I (1)		I (1)		Verdict	I (0)		I (0)	

Panel C1-21 Unit Root Test (LL&C *t and ADF Fischer Chi-square for CUR & IUR respectively)**

	Pre-reform sample					Post-reform sample			
	Log(RealTaxRev)		Log(RealGDP)			Log(RealTaxRev)		Log(RealGDP)	
	LL&C *t*	ADF F-Chi	LL&C *t*	ADF F-Chi		LL&C *t*	ADF F-Chi	LL&C *t*	ADF F-Chi
Level	-0.964	44.236	0.347	32.377	Level	-3.231*	30.898	-4.16*	30.951
1st diff.	-13.11*	125.904*	-8.818*	95.756*	1st diff.	-	-	-	-
Verdict	I (1)		I (1)		Verdict	I (0)		I (0)	

Panel C2-16 Unit Root Test (LL&C *t and ADF Fischer Chi-square for CUR & IUR respectively)**

	Pre-reform sample					Post-reform sample			
	Log(RealTaxRev)		Log(RealGDP)			Log(RealTaxRev)		Log(RealGDP)	
	LL&C *t*	ADF F-Chi	LL&C *t*	ADF F-Chi		LL&C *t*	ADF F-Chi	LL&C *t*	ADF F-Chi
Level	0.443	26.717	1.778	18.670	Level	-3.198*	23.995	-4.08*	26.399
1st diff.	-12.51*	104.791*	-7.009*	67.079*	1st diff.	-	-	-	-
Verdict	I (1)		I (1)		Verdict	I (0)		I (0)	

*reject null at 1%

Panel D-LA6 Unit Root Test

	Pre-reform sample					Post-reform sample			
	Log(RealTaxRev)		Log(RealGDP)			Log(RealTaxRev)		Log(RealGDP)	
	LL&C *t*	ADF F-Chi	LL&C *t*	ADF F-Chi		LL&C *t*	ADF F-Chi	LL&C *t*	ADF F-Chi
Level	0.541	11.849	1.941	7.909	Level	-0.522	7.851	1.211	2.684
1st diff.	-6.38*	35.046*	-3.068*	22.352*	1st diff.	-7.333*	50.168*	-4.72*	36.062*
Verdict	I (1)		I (1)		Verdict	I (1)		I (1)	

Panel E-SSA9 Unit Root Test

	Pre-reform sample					Post-reform sample			
	Log(RealTaxRev)		Log(RealGDP)			Log(RealTaxRev)		Log(RealGDP)	
	LL&C *t*	ADF F-Chi	LL&C *t*	ADF F-Chi		LL&C *t*	ADF F-Chi	LL&C *t*	ADF F-Chi
Level	1.928	13.470	-1.358	14.267	Level	-1.934**	11.644	-2.79*	11.169
1st diff.	-8.493*	63.976*	-5.591*	45.367*	1st diff.	-	-	-	-
Verdict	I (1)		I (1)		Verdict	I (0)		I (0)	

*reject null at 1%

1.4: Pedroni Cointegration test results summary and ARDL and ECM tests for cointegration. SIC auto was set as lag determination criteria in the tests

Panel A-EA9

Pre-reform sample Log(RealTaxRev) Log(RealGDP)											Post-reform sample Log(RealTaxRev) Log(RealGDP)										
Panel				Panel Weighted				Group			Panel				Panel Weighted				Group		
v	rho	PP	ADF	v	rho	PP	ADF	rho	PP	ADF	v	rho	PP	ADF	v	rho	PP	ADF	rho	PP	ADF
1.0	-1.4	-2.2	-2.8	0.2	-0.9	-2.1	-2.6	0.4	-1.3	-2.6	2.6	-2.6	-3.2	-4.4	2.2	-2.2	-3.4	-4.9	-0.6	-2.8	-5.1
	**	**	*			**	*			*	*	*	*	*	**	**	*	*		*	*
Verdict				Weak cointegration							Verdict				Strong cointegration						

Panel A-EA9, ARDL (1,1) SIC auto, Dependent Var: DLOG(RTAXREV)

Pre-reform sample (Obs. 117)			Post-reform sample (Obs. 135)		
Long Run Eqn.			Long Run Eqn.		
LOG(RGDP)	1.022*	[0.0454]	LOG(RGDP)	0.894*	[0.0475]
Short Run Eqn.			Short Run Eqn.		
COINT.EQ1	-0.508*	[0.0541]	COINT.EQ1	-0.379*	[0.1187]
DLOG(RGDP)	0.609**	[0.2725]	DLOG(RGDP)	0.771**	[0.3103]
C	-1.182*	[0.1268]	C	-0.090	[0.0776]
Verdict	Cointegration confirmed		Verdict	Cointegration confirmed	

Panel B-NC10

Pre-reform sample Log(RealTaxRev) Log(RealGDP)										
Panel				Panel Weighted				Group		
v	rho	PP	ADF	v	rho	PP	ADF	rho	PP	ADF
1.02	-0.97	-1.52	-1.72	0.78	-2.01	-2.64	-2.99	-0.39	-2.04	-3.14
			**		**	*	*		**	*
Verdict				Weak cointegration						

Panel B-NC10, ARDL (1,1) SIC auto, Dependent Var: DLOG(RTAXREV)

Pre-reform sample (Obs. 190)		
Long Run Eqn.		
LOG(RGDP)	1.002*	[0.0339]
Short Run Eqn.		
COINT.EQ1	-0.322*	[0.0860]
DLOG(RGDP)	0.574**	[0.2317]
C	-0.576*	[0.1609]
Verdict	Cointegration confirmed	

* reject null at 1%, ** at 5%. Standard errors in [ ] parentheses

Panel C1-21

Pre-reform sample Log(RealTaxRev) Log(RealGDP)										
Panel				Panel Weighted				Group		
v	rho	PP	ADF	v	rho	PP	ADF	rho	PP	ADF
0.99	-1.17	-3.27	-3.67	-0.50	-0.81	-4.13	-6.29	1.01	-3.91	-5.60
		*	*			*	*		*	*
Verdict	Weak cointegration									

Panel C1-21, ARDL (1,1) SIC auto, Dependent Var: DLOG(RTAXREV)

Pre-reform sample (Obs. 210)		
Long Run Eqn.		
LOG(RGDP)	1.138*	[0.0349]
Short Run Eqn.		
COINT.EQ1	-0.642*	[0.0745]
DLOG(RGDP)	0.033	[0.1646]
C	-2.481*	[0.2776]
Verdict	Cointegration confirmed	

Panel C2-16

Pre-reform sample Log(RealTaxRev) Log(RealGDP)										
Panel				Panel Weighted				Group		
v	rho	PP	ADF	v	rho	PP	ADF	rho	PP	ADF
0.15	-1.05	-3.86	-5.64	-0.92	-0.50	-3.86	-6.01	1.19	-3.71	-5.68
		*	*			*	*		*	*
Verdict	Weak cointegration									

Panel C2-16, ARDL (1,1) SIC auto, Dependent Var: DLOG(RTAXREV)

Pre-reform sample (Obs. 160)		
Long Run Eqn.		
LOG(RGDP)	1.134*	[0.0402]
Short Run Eqn.		
COINT.EQ1	-0.641*	[0.0931]
DLOG(RGDP)	0.104	[0.2024]
C	-2.343*	[0.3336]
Verdict	Cointegration confirmed	

* reject null at 1%, ** at 5%. Standard errors in [ ] parentheses

Panel D-LA6

Pre-reform sample Log(RealTaxRev) Log(RealGDP)												Post-reform sample Log(RealTaxRev) Log(RealGDP)											
Panel				Panel Weighted				Group				Panel				Panel Weighted				Group			
v	rho	PP	ADF	v	rho	PP	ADF	rho	PP	ADF		v	rho	PP	ADF	v	rho	PP	ADF	rho	PP	ADF	
0.2	-0.9	-2.4	-2.8	-0.1	-1.2	-2.8	-2.8	0.4	-1.7	-1.9		2.9	-0.9	-0.7	-1.9	1.7	-1.2	-1.8	-2.9	0.05	-1.3	-3.3	
		*	*			*	*		**	**		*			**	**		**	*			*	
Verdict				Weak cointegration								Verdict				Weak cointegration							

Panel D-LA6, ARDL (1,1) SIC auto, Dependent Var: DLOG(RTAXREV)

Pre-reform sample (Obs. 60)			Post-reform sample (Obs. 84)		
Long Run Eqn.			Long Run Eqn.		
LOG(RGDP)	0.953*	[0.0419]	LOG(RGDP)	0.623*	[0.0565]
Short Run Eqn.			Short Run Eqn.		
COINT.EQ1	-0.571*	[0.1254]	COINT.EQ1	-0.343*	[0.1267]
DLOG(RGDP)	0.322	[0.4711]	DLOG(RGDP)	1.062*	[0.3835]
C	-0.775*	[0.1730]	C	1.141*	[0.3559]
Verdict	Cointegration confirmed		Verdict	Cointegration confirmed	

Panel E-SSA9

Pre-reform sample Log(RealTaxRev) Log(RealGDP)										
Panel				Panel Weighted				Group		
v	rho	PP	ADF	v	rho	PP	ADF	rho	PP	ADF
1.42	-1.39	-2.52	-3.98	-0.27	-0.53	-2.26	-4.02	0.55	-2.17	-4.25
		*	*			**	*		**	*
Verdict				Weak cointegration						

Panel E-SSA9, ARDL (1,1) SIC auto, Dependent Var: DLOG(RTAXREV)

Pre-reform sample (Obs. 117)		
Long Run Eqn.		
LOG(RGDP)	1.094*	[0.0331]
Short Run Eqn.		
COINT.EQ1	-0.606*	[0.1389]
DLOG(RGDP)	0.198	[0.2113]
C	-2.764*	[0.3907]
Verdict	Cointegration confirmed	

* reject null at 1%, ** at 5%. Standard errors in [ ] parentheses

1.5 The *z*-test for statistical difference between group regression coefficients

Panel		Pre-reform	Post-reform	Difference	Computed *z*-statistic
Panel A-EA9	DOLS	1.015	1.217	+0.202$^{\Delta}$	2.89
SARA est. 1994 – 1999	FE	1.019	1.163	+0.144$^{\Delta}$	3.34
Panel B-NC10					
SARA est. 2000 – 2005	FE	0.908	1.193	+0.285$^{\Delta}$	6.56
Panel C1-21					
SARA est. 1991 – 2005	FE	1.057	1.191	+0.134$^{\Delta}$	2.98
Panel C2-16					
SARA est. 1991 – 2005	FE	0.979	1.125	+0.146$^{\Delta\Delta}$	2.30
Panel D-LA6	DOLS	0.929	0.975	+0.046	0.39
SARA est. 1991 – 2000	FE	0.963	1.032	+0.069	0.92
Panel E-SSA9					
SARA est. 1994 – 2005	FE	0.892	1.265	+0.373$^{\Delta}$	4.66

$^{\Delta}$ Difference is statistically significant at 1%, $^{\Delta\Delta}$ at 5%

Level of significance		*z*-critical
Two sided	One sided	
0.01	0.05	2.58
0.05	0.025	1.96
0.10	0.05	1.64

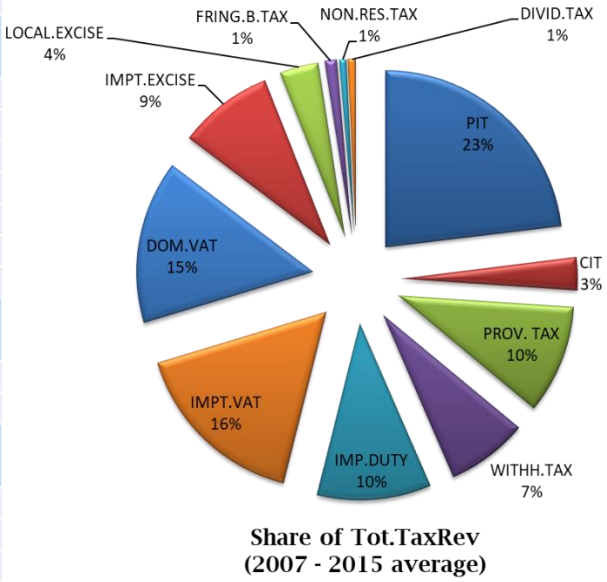
Decision criteria

Reject null if |computed *z*-stat| > *z*-critical

ANNEX 2

2.1 Taxes in Malawi (as of 2016) and share of total (TTR) (2007 – 2015 average)

Taxes in Malawi (as of 2016)		
Tax	Share of TTR	Rank
Taxes on Incomes, Profits And Capital Gains ~ 46%		
Personal Income Tax	23.0%	1
Provisional Tax	10.0%	5
Withholding Tax	7.5%	7
Company Income Tax	2.9%	9
Fringe Benefits Tax	1.1%	10
Dividend Tax	0.7%	11
Non-Resident Tax	0.6%	12
Taxes on Goods and Services ~ 18.5%		
Domestic VAT	14.9%	3
Local Excise Tax	3.6%	8
Taxes on International Trade ~ 35.5%		
Import VAT	16.4%	2
Import Duty	10.4%	4
Import Excise	8.7%	6
Source: MRA (Authors computation, 2007-2015 Average)		
Assessed in this study		



Share of Tot.TaxRev
(2007 - 2015 average)

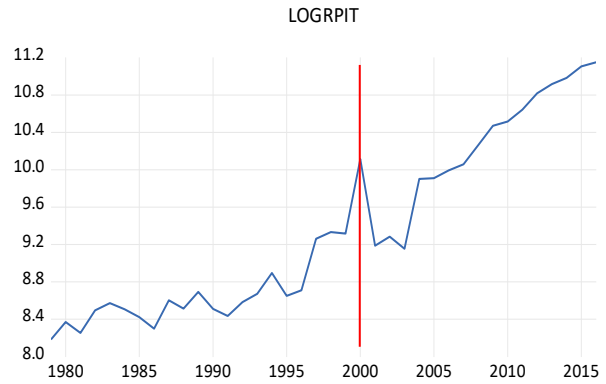
Sources: Government of Malawi Annual Economic Report, various years 1979-2017

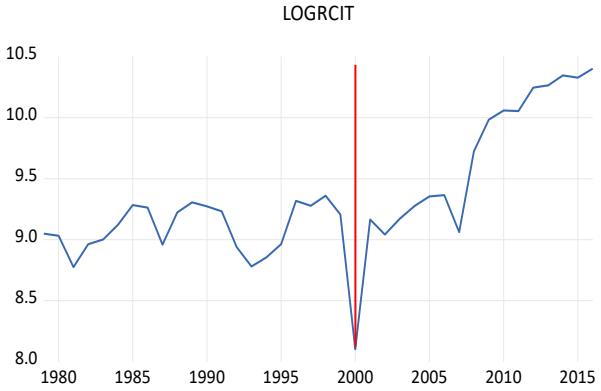
2.2: Selected major taxes 2009/10 FY rates

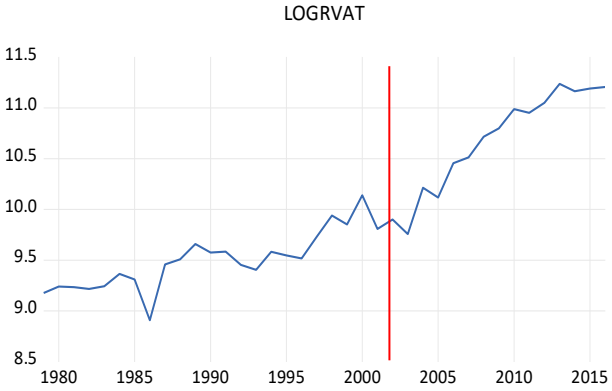
Tax Base	Name of Tax	Description	Applicable rate	Division responsible
Final Income	Corporate	Domestic incorporated	30%	Domestic Taxes Division
		Foreign Incorporated	35%	
	Individual tax (PAYE)	From employment or business		
		First MWK10,000	0%	
		Next MWK3,000	15%	
		Excess over MWK13,000	30%	
	Withholding tax	e.g. Dividends, Rent, Royalties, Contractors	4% to 20%	
	Fringe Benefit	e.g. Motor vehicle, Housing, Utilities, school fees	30%	
Consumption	Domestic VAT	levied on value added created at various stages in production-distribution stages	0% to 16.5% depending on commodity	
International Trade	Customs	e.g. Capital machinery, raw materials, intermediate goods, finished goods	0% to 25% depending on commodity	Customs and Excise Division
	Excise	e.g. Beers, Wine, Cigarettes, Vehicles, Fruit Juices, Tobacco products	0% to 75% depending on commodity	
	Import VAT	levied on value added on specific import goods	0% to 16.5%	

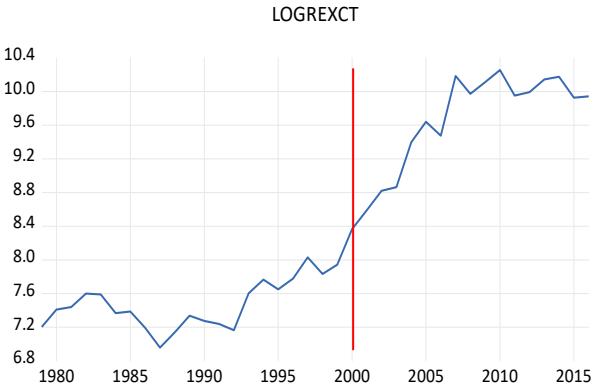
Sources: MRA 2009-2010 tax and duty rates brochures

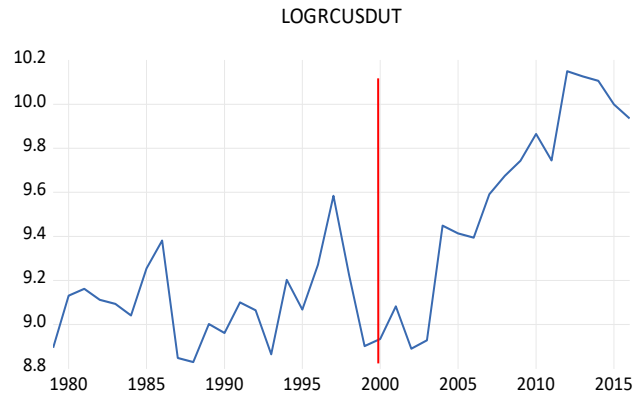
2.3 Graphical representation (log of tax revenues. Vertical mark = reform year)

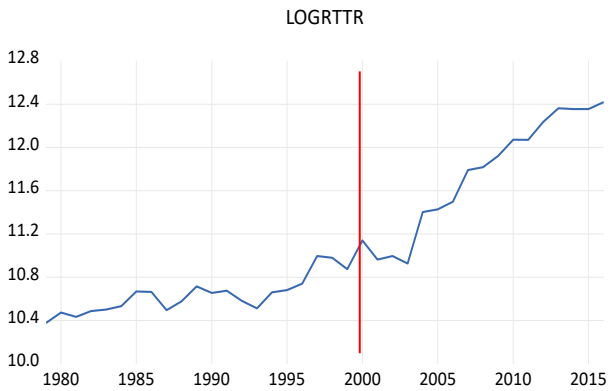


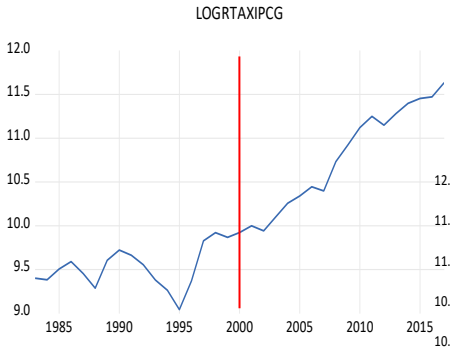


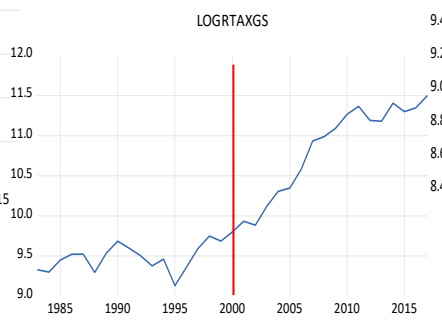


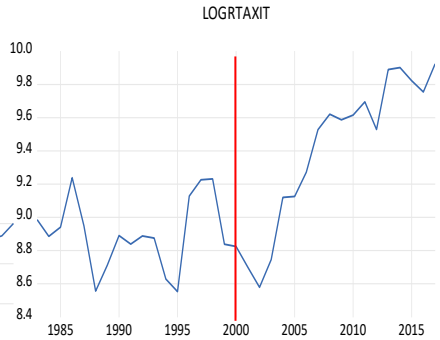












2.4 Unit root tests and unrestricted VAR optimal lag results

VAR Lag Order Selection Criteria **Sample:** 1979 2016			**ADF Stationarity Tests, Max Lag 3 (AIC)** **ADF Critical:** 1% (-3.626), 5% (-2.945), 10% (-2.611)		
Variable	**AIC**	**SIC**	**Levels**	**1st Diff**	**Verdict**
LogRPIT	2	2	0.459	-8.997	I (1)
LogRCIT	2	1	-0.631	-8.230	I (1)
LogRVAT	2	2	0.4998	-9.161	I (1)
LogREXCT	1	1	-0.347	-6.545	I (1)
LogRCUSDUT	3	1	-1.392	-6.241	I (1)
LogRTTR	2	1	1.036	-7.457	I (1)
LogRGDP	1	1	0.429	-7.049	I (1)
LogRHHCONS	1	1	-0.345	-7.462	I (1)
LogRFBTMAN	3	1	-0.965	-6.499	I (1)
LogRTIMP	1	1	-1.392	-6.241	I (1)
Sample: 1983 2017			**ADF Critical:** 1% (-3.646), 5% (-2.954), 10% (-2.615)		
LogRTAXIPCG	3	1	0.793	-4.520	I (1)
LogRTAXGS	1	1	0.254	-7.713	I (1)
LogRTAXIT	1	1	-0.865	-5.284	I (1)
LogRTRADE	3	1	-0.865	-5.284	I (1)

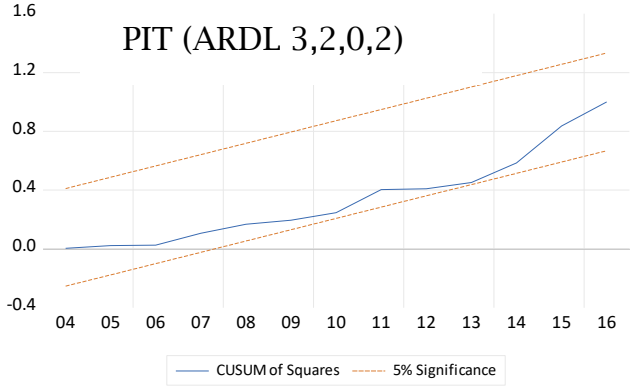
2.5 ARDL long run F-bounds and t-bounds test for Cointegration, and ECM results

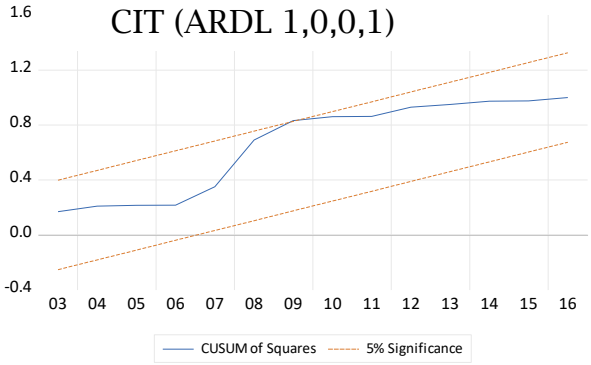
ARDL Long run F-bounds & t-bounds test						**ECM**	**t-bounds test**	
Regression			**F-Stat**	**t-Stat**		**CointEq(-1)**	**t-Stat**	
LogRPIT			8.90*	-5.670*		-1.514* [0.239]	-6.329*	
LogRCIT			11.53*	-6.002*		-0.838* [0.117]	-7.114*	
LogRVAT			8.62*	-5.711*		-1.027* [0.166]	-6.171*	
LogREXCT			7.18*	-4.651*		-0.548* [0.097]	-5.629*	
LogRCUSDUT			8.34*	-5.310*		-0.984* [0.161]	-6.102*	
LogRTTR			8.88*	-5.643*		-0.973* [0.155]	-6.241*	
LogRTAXIPCG			0.87	-1.860		N/A	N/A	
LogRTAXGS			7.55*	-4.82*		-0.757* [0.130]	-5.79*	
LogRTAXIT			6.76*	-4.98*		-0.758* [0.138]	-5.49*	
F Critical	**I (0)**	**I (1)**	**t-critical**	**I (0)**	**I (1)**	**t-critical**	**I (0)**	**I (1)**
10%	2.72	3.77	**10%**	-2.57	-3.46	**10%**	-2.57	-3.46
5%	3.23	4.35	**5%**	-2.86	-3.78	**5%**	-2.86	-3.78
1%	4.29	5.61	**1%**	-3.43	-4.37	**1%**	-3.43	-4.37

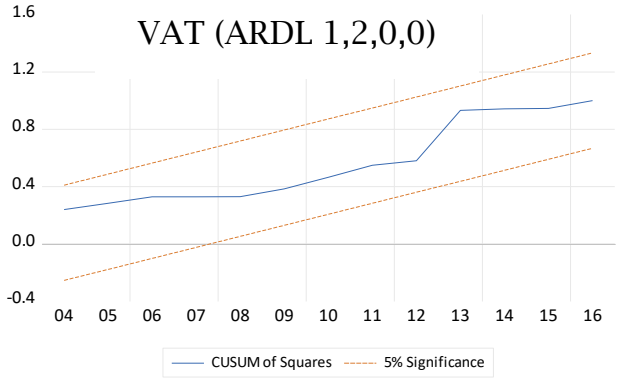
* Denotes significance at 1 %, ** at 5 %, *** at 10 % , to reject null of no levels relationship

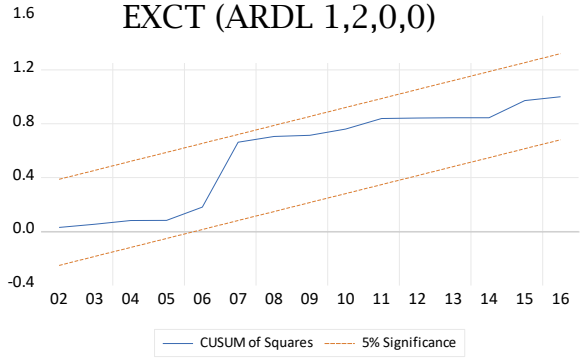
[Standard errors] in parentheses

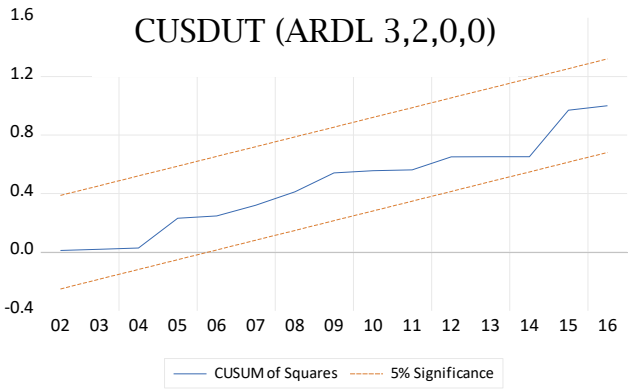
2.6 CUSUM of squares model stability tests

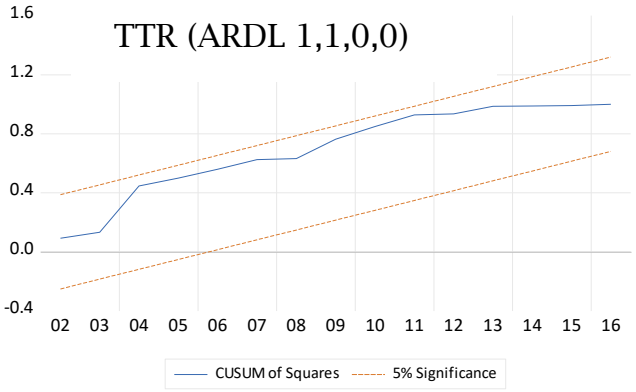


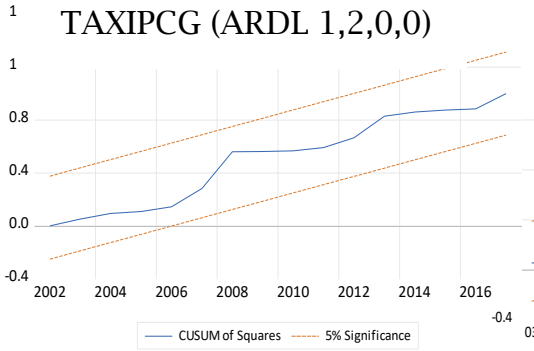


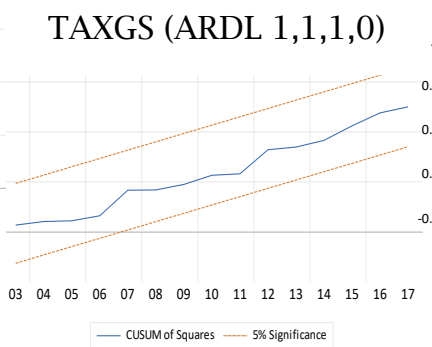


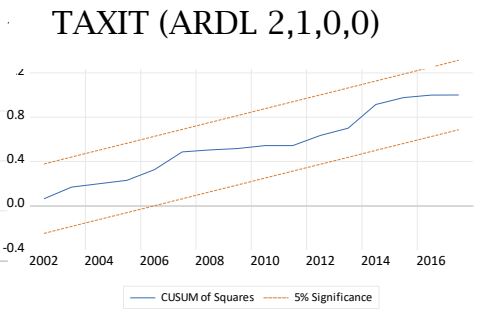












ANNEX 3

3.1 Unrestricted-VAR lag length selection and ADF Unit root tests results

VAR Lag Order Selection Criteria **Sample:** 1980 2016			**ADF Stationarity Tests, Max Lag 3 (SIC)** **ADF Critical:** 1% (-3.626), 5% (-2.945), 10% (-2.611)		
Variable	**AIC**	**SIC**	**Levels**	**1st Diff**	**Integr. Order**
LOGTTR	1	1	0.6880	-5.4661*	I (1)
LOGGDPPC	1	1	0.4272	-5.2102*	I (1)
AGRIC	2	2	-1.4579	-9.4926*	I (1)
MANU	1	1	-1.6813	-7.7184*	I (1)
SERVICE	1	1	-1.6970	-7.0916*	I (1)
TRADEOP	1	0	-3.9993*	-	I (0)
INFLA	3	1	-3.6267*	-	I (0)
LOGBROADM	0	0	1.0712	-5.7983*	I (1)
NETODA	1	1	-2.8679***	-7.6303*	I (1)
CLAIMSCG	1	1	-1.9760	-5.4996*	I (1)
EXTDEBT	1	1	-1.6521	-5.6517*	I (1)
LOGX_RATE	2	2	-0.2372	-4.0062*	I (1)

* Significant at 1 %, *** at 10 %

3.2 ARDL long run F-bounds & t-bounds tests, and Error Correction Model

ARDL Long run F-bounds & t-bounds test						**ECM**	**t-bounds test**	
Regression			**F-Stat**	**t-Stat**		**CointEq(-1)**	**t-Stat**	
Specification I			7.418*	-4.341**		-0.404* [0.071]	-5.705*	
Specification II			11.650*	-2.572		-0.037* [0.005]	-7.210*	
Specification III			8.085*	-3.349***		-0.366* [0.061]	-5.964*	
Specification IV			4.928**	-3.598**		-0.216* [0.055]	-3.963**	
F Critical	**I (0)**	**I (1)**	**t-critical**	**I (0)**	**I (1)**	**t-critical**	**I (0)**	**I (1)**
10%	2.72	3.77	**10%**	-2.57	-3.46	**10%**	-2.57	-3.46
5%	3.23	4.35	**5%**	-2.86	-3.78	**5%**	-2.86	-3.78
1%	4.29	5.61	**1%**	-3.43	-4.37	**1%**	-3.43	-4.37

* Denotes significance at 1 %, ** at 5 %, *** at 10 % , to reject null of no levels relationship

[Standard errors] in parentheses

3.3 Exogenous Variables Correlation test

Covariance Analysis: Ordinary

Sample: 1980 2016

Included observations: 37

Correlation	LOGGDPPC	AGRIC	MANU	SERVICE	NETODA	CLAIMSCG	LOGBROADM	EXTDEBT	TRADEOP	INFLA	LOGX_RATE
LOGGDPPC	1.00000										
AGRIC	-0.67778	1.00000									
MANU	-0.67899	0.43936	1.00000								
SERVICE	0.78004	-0.94174	-0.69092	1.00000							
NETODA	-0.15544	-0.08414	0.52319	-0.10594	1.00000						
CLAIMSCG	-0.48134	0.28916	0.11224	-0.30744	-0.25374	1.00000					
LOGBROADM	0.99437	-0.69252	-0.68028	0.78280	-0.11611	-0.44475	1.00000				
EXTDEBT	-0.49834	0.27111	0.43277	-0.29915	0.57575	-0.11491	-0.51277	1.00000			
TRADEOP	0.24205	-0.63183	-0.13272	0.52816	0.59115	-0.25988	0.28696	0.22979	1.00000		
INFLA	-0.04408	-0.20934	0.10958	0.16799	0.63247	-0.25720	-0.02297	0.57360	0.56228	1.00000	
LOGX_RATE	0.99388	-0.68711	-0.66736	0.79047	-0.08572	-0.51336	0.98794	-0.41148	0.30218	0.02791	1.00000

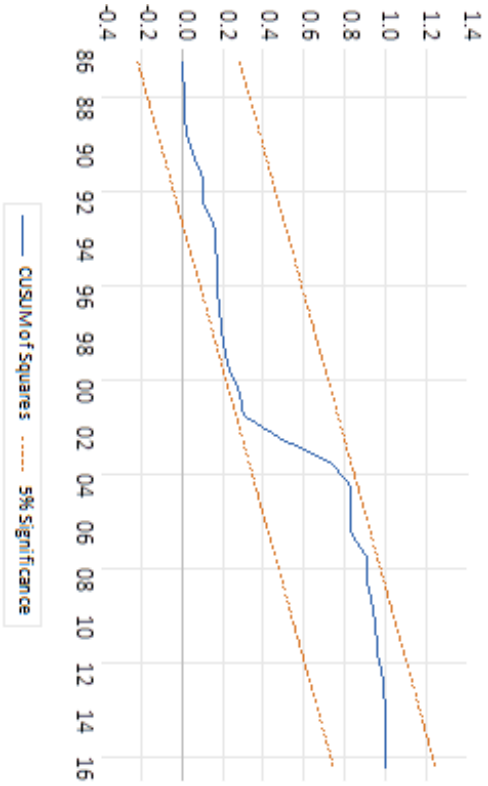
3.4 Breusch-Pagan Serial Correlation & Breusch-Pagan-Godfrey Heteroskedasticity test

Breusch-Pagan Serial Correlation test Null hypothesis: No serial corr. (Up to 2 lags)				Breusch-Pagan-Godfrey Heteroskedasticity test Null hypothesis: Homoskedasticity			
Specification I: GDPPC, NETODA, TRADEOP							
F-Stat	0.640	Prob. F(2,29)	0.535	F-Stat	2.761**	Prob. F(4,31)	0.045
Obs.*R^2	1.522	Prob. Chi-sq(2)	0.467	Obs*R^2	9.457	Prob. Chi-sq(4)	0.051
				Scaled ESS	10.276	Prob. Chi-sq(4)	0.036
Specification II: SERVICE, CLAIMSCG, INFLATION							
F-Stat	1.405	Prob. F(2,24)	0.265	F-Stat	1.326	Prob. F(7,26)	0.278
Obs.*R^2	3.563	Prob. Chi-sq(2)	0.168	Obs*R^2	8.943	Prob. Chi-sq(7)	0.257
				Scaled ESS	7.950	Prob. Chi-sq(7)	0.337
Specification III: AGRIC, BROADM, EXTDEBT							
F-Stat	1.104	Prob. F(2,28)	0.345	F-Stat	0.625	Prob. F(5,30)	0.682
Obs.*R^2	2.632	Prob. Chi-sq(2)	0.268	Obs*R^2	3.397	Prob. Chi-sq(5)	0.639
				Scaled ESS	3.013	Prob. Chi-sq(5)	0.698
Specification IV: MANU, X_RATE							
F-Stat	0.229	Prob. F(2,30)	0.797	F-Stat	5.363*	Prob. F(3,32)	0.004
Obs.*R^2	0.540	Prob. Chi-sq(2)	0.763	Obs*R^2	12.044	Prob. Chi-sq(3)	0.007
				Scaled ESS	11.508	Prob. Chi-sq(3)	0.009

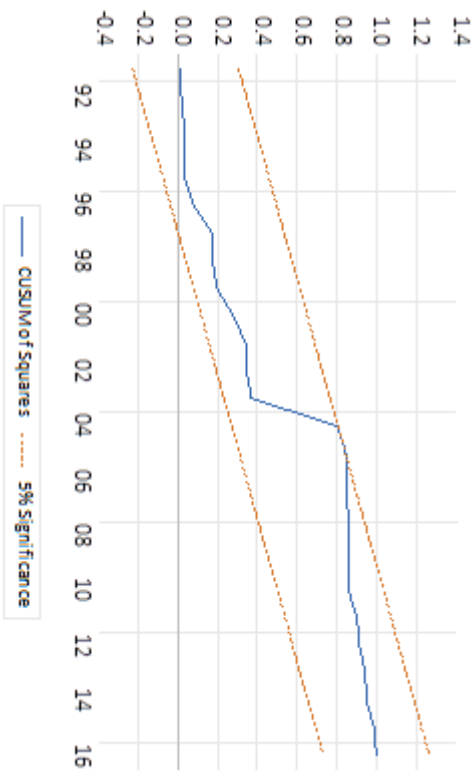
* denotes reject null at 1 %, ** at 5 %

3.5 CUSUM of Squares model stability test

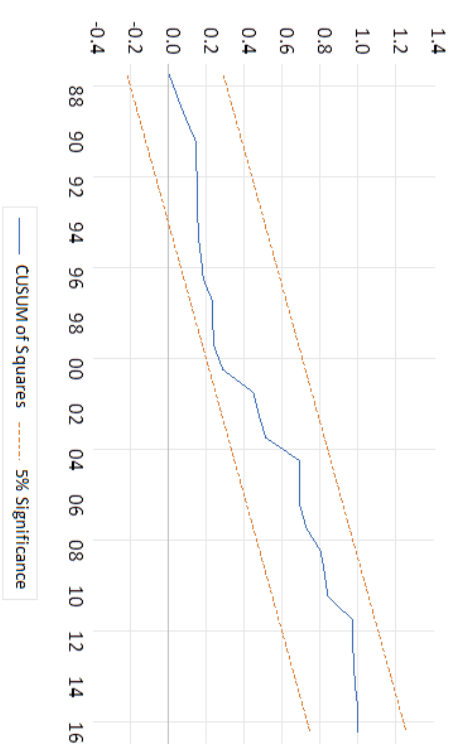
Specification I: GDPPC, NetODA, TRADEOP



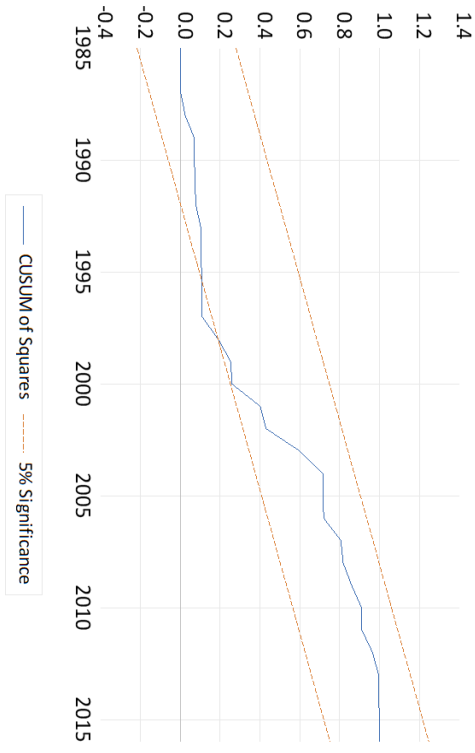
Specification II: Service, ClaimsCG, Inflation



Specification III: Agriculture, BroadM, ExtDebt



Specification IV: Manufacturing, X_Rate



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