Economic growth and tax structure in Zimbabwe: 1984–2009

Juniours Marire

NANGO,
PO Box CY250,
Causeway, Harare, Zimbabwe
E-mail: juniours@gmail.com

Tafirenyika Sunde*

School of Business Management,
Department of Economics,
Polytechnic of Namibia,
Private Bag 13388, Windhoek, Namibia
E-mail: tsunde@polytechnic.edu.na
E-mail: sunde08@gmail.com
*Corresponding author

Abstract: We examine the tax-growth nexus in Zimbabwe using parametric and non-parametric analysis. We use a two-stage estimation procedure that first generates efficiency scores for the country using a Data Envelopment Approach. We use the efficiency scores in the second stage to normalise growth to get a proxy for potential economic growth. Using this potential growth we run a translog model that allows computation of time-varying elasticities of growth to changes in tax policy. The translog model results we got indicate that economic growth is inelastic to tax structure in Zimbabwe. As such, we recommend policies that rely on non-tax stimuli to the economy to buttress growth. We find that the most inefficient years were those punctuated with bad economic governance and droughts.

Keywords: tax; growth; Zimbabwe; translog model; efficiency scores; structural adjustment policy; unit roots; DEA; economic policy; emerging economies.

Reference to this paper should be made as follows: Marire, J. and Sunde, T. (xxxx) 'Economic growth and tax structure in Zimbabwe: 1984–2009', *Int. J. Economic Policy in Emerging Economies*, Vol. x, No. x, pp.xxx–xxx.

Biographical notes: Juniours Marire is a Researcher at the NANGO. He completed his Bachelor of Economics Honours Degree at Midlands State University in 2007 and a Master of Arts in Economics Programme from the University of Malawi in 2011. Just after completing his undergraduate degree he was offered a job as a Teaching Assistant in the Department of Economics at Midlands State University. He has work in progress papers focusing on the determinants of efficiency in SADC countries, the effectiveness of agricultural aid in Zimbabwe and the efficiency of Zimbabwe's health system.

Tafirenyika Sunde is a Senior Lecturer at the Polytechnic of Namibia. He previously worked at the University of Zimbabwe and the Midlands State University as a Teaching Assistant and Lecturer respectively before joining the Polytechnic of Namibia in 2008. He has published several research papers in refereed journals.

1 Introduction

Elementary economic analysis of taxation primarily focuses on the tax burden. Under most situations, the primary burden of a tax is a decrease in economic activity, referred to as deadweight loss. A simple extension of the standard model, allowing for taxes on all goods and activities, implies a reduction in economic activity in every market in the economy, and therefore, taxes would be expected to negatively affect economic growth in an economy. However, that simple analysis ignores a number of other issues. Most importantly, if the government uses the collected tax revenues to fund investment in social goods, especially goods resulting in external benefits (infrastructure, education, agricultural research and extension and public health, for example), the economic growth rate could be positively influenced by taxation. Furthermore, if money is transferred from people with low marginal utilities of income (rich) to people with high marginal utilities of income (poor), while revenues are additionally used to fund public investment, then the economy can gain from this 'double-dividend' of taxation. Therefore, measuring the economic effect of taxation ought to be a simple exercise in determining whether or not the benefits of government expenditures exceed the costs of taxation.

Unfortunately, it is not easy to directly determine the net benefits of taxation and, therefore, to determine whether or not taxes are benevolent. For example, if taxation pushes economic activity underground, we would find that it lowers economic growth when, in fact, it is merely shifting economic activity from the measured economy to the unmeasured economy, that is, we are overstating the negative effects of taxation on economic growth. On the other hand, if many markets are characterised by low elasticities, so that economic activity is not significantly affected, but the government purchases imported goods with the tax revenues, then Gross Domestic Product (GDP) and economic growth will be lower due to the dual leakages, taxation and importation. Therefore, a complete analysis of the economic effects of the fiscus on an economy would examine the impact of expenditure and taxes. The results reported in this paper represent the first stage of research into these issues conducted on the Zimbabwean economy. Rather than comparing the benefits of government expenditure with the costs of taxation, we examine the relationship between taxation and economic growth.

We proceed by investigating Zimbabwean tax policy, the expected effect of those tax policies and relevant research in Section 2. In Section 3, we discuss the analytical framework used to measure the impact of taxes on economic growth. We provide a preliminary analysis of the data, including the control for unobservable economic variables, in Section 4. We also present and discuss the results of the analysis in Section 4, and provide concluding remarks in Section 5.

2 Background

2.1 Economic growth and taxes: a review of the literature

Theoretically and empirically, it has been shown that taxes affect the allocation of resources; and often distort the underlying behaviour of economic agents. Regarding economic growth, taxes influence the labour-leisure trade-off and investment decisions. Due to the importance of labour and capital in determining economic growth it is surprising that the relationship between economic growth and taxes has not featured more prominently in previous researches. In what is now referred to as Harberger's superneutrality conjecture. Harberger (1964) argued that there is a link between tax mix and economic growth. Tax mix, he argued, does not alter labour-leisure trade-off or investment to sufficiently influence economic growth. Hall (1968) developed a savings-consumption model and found that tax changes only led to transitory changes in growth. Hall, who applied a neoclassical growth model, relied on exogenous technical change and population growth, which, by assumption, are not likely to be significantly influenced by the economy's tax structure. More specifically, if exogenous technical progress is the main determinant of economic growth, tax policy can only affect long-run income and not long-run economic growth, primarily because capital accumulation only covers depreciation and population growth in these models.

Models of endogenous growth, however, may provide a theoretical link between economic growth and tax policy. Endogenous growth models allow for continued capital accumulation, beyond depreciation and population growth in the steady-state, for example, capital accumulation depends upon the net return to investment, which is affected by tax policy. For example, Lucas (1990), Jones and Manuelli (1990), King and Robelo (1990) and, more recently, Yamarik (2001) all argue that economic growth is retarded by taxation. Analyses by Pecorino (1993) suggest economic growth could be increased significantly, from 1.53% per annum to 2.56% per annum in the USA if the tax mix were shifted away from income taxes towards non-distortionary consumption taxes. However, Stokey and Robelo (1995) and Mendoza et al. (1997), who also made use of endogenous growth models in their analyses, found negligible negative effects of taxation on economic growth in developed economies. As an example of the small effects, Engen and Skinner (1996) established that a 5% reduction in average tax rates in the USA would likely add 0.25% per year to economic growth. Although the yearly effect is small, accumulation of that quarter percent over 36 years from 1960 implies an overall increase of 7.5% of GDP, approximately $500 billion in 1996 (calculation reported in Engen and Skinner, 1996). The studies differ in that Mendoza et al. (1997) first compute aggregate effective tax rates (for consumption, labour income, capital income) from revenue data and national accounts. Engen and Skinner (1996) do not use such artificially constructed effective tax rates, they rather use marginal tax rates in their cross country studies.

An important feature of these models is the assumption that taxes are returned to consumers, efficiently - an assumption that may not be realistic in developing countries. Although a consensus appears to be emerging regarding the impact of tax policy on economic growth in the developed world, primarily the USA, less analysis has been done in the developing world. However, the research that has been undertaken suggests that the impact of taxation in developing economies is larger than it is in developed economies. Marsden (1990) groups 20 developing countries into high tax and low tax regimes and finds that the low tax group averaged 7.3% growth, but the high tax group only averaged 1.1%. Wang and Yip (1992) show that the structure of taxation is more important than the level of taxation in explaining economic growth in Taiwan from 1954 to 1986. Their empirical estimates show significant and negative impacts of specific taxes on economic growth, but the effect of total taxation is not significant. Kim (1998) compares economic growth and taxation in the US with economic growth and taxation in Korea. According to his analysis, 35% of the difference between USA and Korean economic growth can be explained by differences in the tax structure between the two countries. Kerr and MacDonald (1999) find mixed evidence that the ratio of indirect taxes to direct taxes negatively and significantly affects economic growth in seven Asian economies. On the other hand, Tanzi and Shome (1992) uncover no obvious uniformities between the tax policies of eight Asian economies concluding, "… tax structure may become largely irrelevant when macroeconomic problems become predominant, and the distortions created by the tax system become of a second order magnitude...". Due to the structural problems in African economies and the results of Tanzi and Shome's analysis, we might expect the effects of taxation to be minimal in Africa. Although Africa has received less attention than Asia, Skinner (1987) estimates the effect of taxation in Sub-Saharan Africa over the period 1965 to 1982. He finds that personal and corporate income taxes have a significant and negative effect on economic growth; trade taxes also reduce economic growth, indirectly, in the region, while sales and excise taxes have no significant effect on economic growth. Based upon Skinner's analysis, we tentatively conclude that the tax structure may not be largely irrelevant on the continent, as was implied by Tanzi and Shome. For a number of reasons, the impact of taxation in the developed world is likely to be different from its impact in the developing world, especially in Africa, therefore, taxation in Africa which has received little attention to date, merits further study. Importantly, developing countries do not have the infrastructure to adequately police tax compliance; thus, shifts in tax policies in developing countries, especially increases in income taxes, are likely to push economic activity underground.

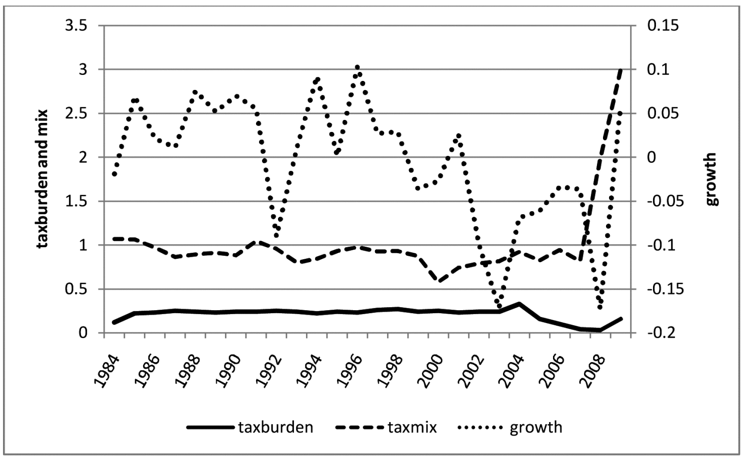
Furthermore, governments in developing countries may not return taxes back to the public in an efficient manner (by not adequately investing in public goods). Skinner (1987) finds that a 5% increase in public investment, financed through taxation, reduces growth by a approximately 0.6% in Sub-Saharan Africa between 1974 and 1982. Governments might be corrupt or otherwise not trustworthy, for example, by squandering resources on white elephants, by changing tax policies in an ad hoc manner, or by taking control of economic resources. McMillan and Masters (2000) develop a model of economic growth and government policy based on time-consistent behaviour showing that government commitment devices improve the incentives for economic agents to invest, beyond subsistence levels, and thus, are likely to improve economic growth. Finally, government agents have the incentive to increase the tax base of taxed activities. In the case of developing countries, which often rely on corporate taxes imposed on large (often state-owned) companies, the tax structure provides incentives to increase the profits of these companies, often to the detriment of competition, which could have significant economic growth effects. Gordon and Wilson (1999) develop a theoretical model showing that incentives within government are likely to be just as important in explaining government behaviour as are incentives in explaining other economic agents behaviour.

We seek to contribute to literature by analysing the efficiency effects of tax policy on economic growth in Zimbabwe. We further seek to establish the deadweight loss that tax policy in Zimbabwe induced on the economy.

2.2 Zimbabwean tax policy and growth: 1984–2009[1]

One outstanding observation from Figure 1 is that real GDP growth has not been associated with tax burden and tax mix between 1984 and 1999. The era beginning 2000 seems to indicate that it has somehow become positively associated with growth although in the same period a significant policy of quasi-fiscal financing of the budget was unleashed. Major spikes in growth reflect the vagaries of climate. In 1984, 1987, 1992, 1995, 2002, 2005 and 2008 there were droughts. The case for the year 2000 coincides with the land reform programme and sanctions imposed on Zimbabwe. Tax mix, which is a ratio of indirect to direct taxes, has been quite stable and sharply rose since 2000. A number of reasons can be cited. Firstly, in 2002 value added tax was introduced. It has been shown that VAT is more revenue productive than sales tax. Secondly, in 2001, Zimbabwe Revenue Authority (ZIMRA) was established. Probably, revenue collection performance and tax administration efficiency improved significantly hence a surge in the tax mix ratio. Thirdly, a wave of de-industrialisation that started since 1999 following the start of the emotive land reform programme meant that the formal economy shrinked and hence the direct tax base. Further, it meant that economic activity shifted from the formal to the informal economy as formal employment fell and retrenched workers resorted to informal and underground activities for sustainable livelihoods. In the same period, in spite of the biting foreign currency constraints, processed food imports rose significantly to fill the gap created by the ailing food processors that were operating below capacity. Therefore, indirect taxes rose through the growth in the trade taxes component against declining direct tax revenue. However, the tax burden also rose significantly since 2003. The imposition of international financial restrictions (de facto sanctions) on Zimbabwe closed all avenues for international finance and as such implied over-reliance on tax policy and printing of money hence a surge in the tax burden.

Figure 1 Real GDP growth rate for Zimbabwe



Source: World Bank: African Development Indicators (2011)

3 Analytical framework

Borrowing from the endogenous economic growth framework and Data Envelopment Analysis (DEA) (Koopmans, 1951; Farrell, 1957), we consider a two-stage procedure to estimate the relationship between fiscal policy and economic growth. The initial stage of the model uses DEA to provide estimates of exogenous factors for which we do not have data, while the second stage uses the first stage estimates to normalise the economic growth rates, yielding unbiased estimates of the relationship between potential economic growth and taxation. Problems of endogeneity are handled by the normalisation of actual GDP by the efficiency score. Branson and Lovell (2001) developed the two-stage procedure, although we modify the second stage estimating equation to take into account Zimbabwean features of the scaling factors and the time series features that are apparent in the data, while also considering a different empirical specification.

3.1 A simple theoretical growth model

Suppose that the Zimbabwean economy is governed by a constant returns to scale production function of the form:

$$Y_t = F(A_t, K_t, N_t). \tag{1}$$

Defining Y_t as GDP, A_t as technology at time t, K_t as stock of capital in the economy at time t, N_t as human capital at time t. Taking the natural log of the production function assuming the production function is Cobb-Douglas, differentiating with respect to time and manipulating slightly yields the following growth equation:

$$y_t = \sigma_a a_t + \sigma_k k_t + \sigma_n n_t \tag{2}$$

Defining $\sigma_a + \sigma_k + \sigma_n = 1$ due to CRS – with sigmas as elasticities of growth to changes in technology, capital and human capital stock. However, we do not formally develop a model of endogenous growth. Because we do not assume exogenous technical progress, we are analysing a model more akin to endogenous than exogenous growth. The lower case letters in equation (2) represent log growth rates of their upper case counterparts, and the subscripts represent the input elasticities for inputs $i = (a, k, l)$. In order to incorporate endogenous growth concepts, we presume that tax policy directly and indirectly affects the growth rates of each of these production inputs, as well as their appropriate elasticities, as suggested by Engen and Skinner (1996). Intuitively, income, business, consumption taxes and user fees alter the incentives to invest in physical and human capital, therefore, they will alter the growth rates of human and physical capital inputs, as well as technical progress. Furthermore, changes in tax policy are also likely to influence the relative cost of physical and human capital, and research and development expenditures; therefore, changes in tax policy are expected to affect the input elasticities for human capital, physical capital and technical progress as well.

We consider, as suggested by Branson and Lovell (2001), two separate measures of tax policy. One is the tax burden, or the ratio of total real tax revenues to real GDP. The other is the tax mix, or the ratio of indirect taxes to direct taxes. Because these tax policies may influence any or all of the variables on the right hand side of equation (2), we will examine economic growth as a function of these two tax policies and other economic growth determinants (represented by the vector *Z*):

$$\text{growth}_t = H(\text{taxburden}_t, \text{taxmix}_t, Z_t) + \xi_t. \tag{3}$$

Defining ξ_t as a stochastic error term with the classical regression assumptions holding. Empirically, equation (3) is difficult to estimate due to the fact that other important factors, as represented by *Z*, cannot be included in the model, because they cannot be observed. If the variables in *Z* were uncorrelated with the tax burden and the tax mix, we could estimate equation (3) without concern for bias. However, the assumption of no correlation between the unobserved variables in *Z*, the tax burden, and the tax mix is absurd. For example, oil shocks, which in the past have led to inflation jitters around the world, and thus increased the demand for gold have positively affected growth in Zimbabwe. Mineral extraction fees and profits taxes, especially for mining companies would also have risen during these time periods. Therefore, it is hard to imagine a case where changes affecting economic growth may not also affect tax collection. One option for dealing with presumed correlation is estimation with the use of instrumental variables; however, finding an instrument that is correlated with *Z* but not with the tax mix or tax burden is difficult. For that reason, it is desirable to find an alternative approach.

3.2 Empirical review

3.2.1 Data envelopment analysis

One approach that lends itself well to the problem of endogeneity, although not parametric, is based on DEA. DEA uses linear programming to search for the best frontier without using statistical techniques in the analysis. Parametric approaches use statistical techniques to estimate parameters. As the name suggests, the technique envelops the data so that observations on the 'edge of the envelope' represent economic frontiers. Once the 'edge of the envelope' has been uncovered, it is possible to determine how far the remaining observations are from the frontier using a simple scaling factor. In our analysis, we are searching for the smallest reciprocal tax burden consistent with the observed growth rate, given all other tax burdens and growth rates observed in the economy over the time horizon. The effect of the model in this scenario is that the scaling factors can be used to normalise production, which in this case is economic growth. Therefore, normalised economic growth is really potential economic growth. If we observe the real GDP growth rate (growth), the ratio of GDP to direct taxes (Y/D), and the ratio of GDP to indirect taxes (Y/I) from 1984 to 2009, we can solve the following linear program:

$$\text{Min}\,\theta^t \text{ with respect to } \theta \text{ and } \lambda$$

Subject to:

$$\theta^t \left(\frac{Y}{D}\right)^p \geq \sum \lambda^t \left(\frac{Y}{D}\right)^t$$

$$\theta^t \left(\frac{Y}{I}\right)^p \geq \sum \lambda^t \left(\frac{Y}{I}\right)^t$$

$$\sum \lambda^t g_y^t \geq g_y^p$$

$$\lambda^t \geq 0 \;\forall\; t \in \{1,\ldots,T\}$$

$$\sum \lambda^t = 1. \qquad (4)$$

The program given by equation (4) is solved $T = 26$ times once for each year in the data because each year is a decision-making unit that has to be evaluated against the rest. For the year denoted with a 'p', the program tries to find the smallest increase in that year's reciprocal indirect and direct tax burden consistent with the constraints.[2] The first two constraints require that the increase in the direct (indirect) tax burden as measured by the reciprocal direct (indirect) tax share of income cannot exceed a linear combination of all other years' tax burdens equivalently measured. The linear program is solved using the reciprocal shares of direct and indirect taxes to real GDP. Both the tax mix and the tax burdens can be recovered from these two reciprocals, for example, the tax mix is the ratio of the reciprocal direct tax share of income to the reciprocal indirect tax share of income:

$$m = \frac{Y/D}{Y/I} = \frac{I}{D}.$$

The third constraint also requires that a linear combination of all other years' growth rates cannot be exceeded by the year 'p' growth rate. λ^t are weights that guarantee a convex combination of the remaining years besides the one being evaluated. The final $T + 1$ constraint forces the linear combinations to be convex and non-negative.

The construction of the problem requires only positive inputs and outputs while resulting in solution values of $\theta^t < 1$ for all years. Given the fact that real growth rates are occasionally negative an alternative specification is analysed. The procedure used based on input reciprocals is invariant to output translations (Lovell and Pastor, 1995); therefore, we take the ratio

$$\frac{Y_t}{Y_{t-1}} \times 100$$

to be a proxy growth rate, which is the equivalence of us adding a constant 1 (one) to each year's growth rate to make it positive and proceed with the analysis. We follow Lovell and Pastor (1995) who argue that such an approach leads to translation invariance.

Regarding interpretation, the resulting θ^t indicates how well the economy performed, despite the current year's direct and indirect tax burden. A more useful interpretation is that it measures the degree to which the economy is performing below the level it ought to be performing given the current fiscal state. For example, a value of unity means that the economy managed its growth rate (the growth rate was not exceeded by a convex combination of other years' growth rates), even though that year's total tax burden was relatively large (not exceeded by a convex combination of any other years' tax burdens). In other words, non-tax influences on economic growth are more favourable, as θ^t approaches unity. The procedure is similar in concept to removing business cycle fluctuations that are, in this case, related to the fiscal situation in the economy. Smaller values represent an economic growth rate and a total tax burden exceeded by a convex combination of other years' growth rates and tax burdens such that economic growth in that year was low despite low tax burdens implying economic conditions were unfavourable in that year.

Following the calculation of all θ^t, the economic growth rate is normalised to correct the data for the relatively favourable and unfavourable economic conditions and other non-tax influences, which affect the business cycle and tax collections. Estimation, using the normalised growth data, follows translog model and controls for potential time-series problems, especially non-stationarity and serial correlation.

3.2.2 Empirical model: translog model

The DEA computes a scaling factor for every year, θ^t, which is normalised on the unit simplex. Although it is not always possible to observe Z^t, it is possible to observe θ^t, which is used as a proxy. Unlike Branson and Lovell (2001), the computed scaling factor is used to filter GDP fluctuations out of the system, so that the second stage equation (5) is used to estimate the tax determinants of potential GDP growth:

$$\left[\frac{1}{\theta_t}\frac{Y_t}{Y_{t-1}}\right] = h(\text{taxburden}_t, \text{taxmix}_t) + w_t \tag{5}$$

$$p\text{growth}_t = h(\text{taxburden}_t, \text{taxmix}_t) + w_t. \tag{6}$$

In specification (5), w_t, represents a stochastic error term and $p\text{growth}_t$ is the growth rate of real potential GDP. The estimated specification (equation (7)) is a translog function of the tax burden and the tax mix.

$$\begin{aligned} p\text{growth}_t =& \alpha_0 + \alpha_1 \text{taxburden}_t + \alpha_2 \text{taxmix}_t + \frac{1}{2}\alpha_3(\text{taxburden}_t)^2 + \frac{1}{2}\alpha_4(\text{taxmix}_t)^2 \\ &+ \alpha_5(\text{taxburden}_t \cdot \text{taxmix}_t) + w_t \end{aligned} \tag{7}$$

The variable *pgrowth* is the normalised growth. A priori we expect $\alpha_1, \alpha_2, \alpha_5 > 0; \alpha_3, \alpha_4 < 0.$ From the translog specification in equation (7), time-varying elasticities for changes in potential growth with respect to changes in the tax burden and the tax mix can be calculated. Those elasticities are:

$$\begin{aligned} \varepsilon^t_{(p\text{growth}_t)\text{taxburden}} &= (\alpha_1 + \alpha_3 \text{taxburden}_t + \alpha_5 \text{taxmix}_t) \cdot \frac{\text{taxburden}_t}{p\text{growth}_t} \\ \varepsilon^t_{(p\text{growth}_t)\text{taxmix}} &= (\alpha_2 + \alpha_4 \text{taxmix}_t + \alpha_5 \text{taxburden}_t) \cdot \frac{\text{taxmix}_t}{p\text{growth}_t}. \end{aligned} \tag{8}$$

4 Empirical results

4.1 DEA results

Since it is difficult to present all the 26 efficiency scores, we have taken era averages without losing the meaning of the results.

In terms of the broad economic eras, Table 1 shows that period 1996–2000 had the best economic performance with an efficiency score of 0.979. The economy was 97.9%

efficient. The year 1996 is regarded as the year of glory for Zimbabwe with a real growth rate of 10.3%. On the other hand, the economy was 97.8% efficient in 2009 although the epochs do not have the same length hence averaging distorts some outcomes. The dollarisation policy and sound economic management explain the efficiency in the relevant eras. However, the economy is still operating below capacity and is still in great need for revitalisation.

Table 1 Results of DEA[3]

Period[4]	*Efficiency* (*theta*)	*Returns to scale*			
		Constant returns	*Variable returns*	*Scale*	*Returns to scale*
1984–1985[5]	0.935	0.626	0.935	0.670	Decreasing
1986–1990[6]	0.970	0.835	0.970	0.862	Decreasing
1991–1995[7]	0.943	0.817	0.943	0.867	Decreasing
1996–2000[8]	0.979	0.895	0.979	0.913	Decreasing
2001–2008[9]	0.871	0.550	0.871	0.617	Decreasing
2009[10]	0.978	0.856	0.978	0.875	Decreasing

Source: Authors' calculations

The 1986–1990 period ranks third with an efficiency of 97%. This era registered positive growth for all the years. The ESAP period ranks fourth with a 94.3%. Of course structural adjustments do not have immediate effects and as such their lagged effects were felt in the 1996–2000 era that we showed to be the most efficient.

The worst era is the 2001–2008 with an efficiency of 87.1%. During this period, the economy stagnated with hyperinflation, deteriorating political and economic governance and economic sanctions. For example, at the peak of the crisis in 2008 economic growth stood at negative 17%. In spite of the largest reciprocal tax burden, non-tax influences were unfavourable. Generally, the economy's efficiency has been coming down over the years. Examples of factors underpinning the decline include drought in 2005, fuel crises, currency crises, sanctions, political impasse in the country, brain drain and hyperinflation among others. Although 2004 ranks among the most efficient years, it had the highest tax burden about 33% of GDP suggesting that non-tax influences were favourable to drive the economy in spite of such a large burden. The years between 2005 and 2008 had a tax burden just below 16% of GDP with the lowest being 3% of GDP in 2008. This is evidence of the shrinkage of the tax base due to deindustrialisation, brain drain and excessive informalisation of the economy (bearing in mind that the informal sector is hard to tax).

We also use the efficiency score to proxy the potential GDP in USD terms and calculate the dead weight loss as the difference between potential and actual growth in each year in the sample period (see Figure 2 and Table 2).

A look at Figure 2 reveals an interesting phenomenon. The efficiency score maps out recessions and booms so accurately for example in 1985, 1987, 1992, 1994, 1999, 2003, 2004 and 2008. Each efficiency score is directly and positively correlated with economic performance.

Figure 2 Actual, potential growth and efficiency score for Zimbabwe: 1984–2009[11]

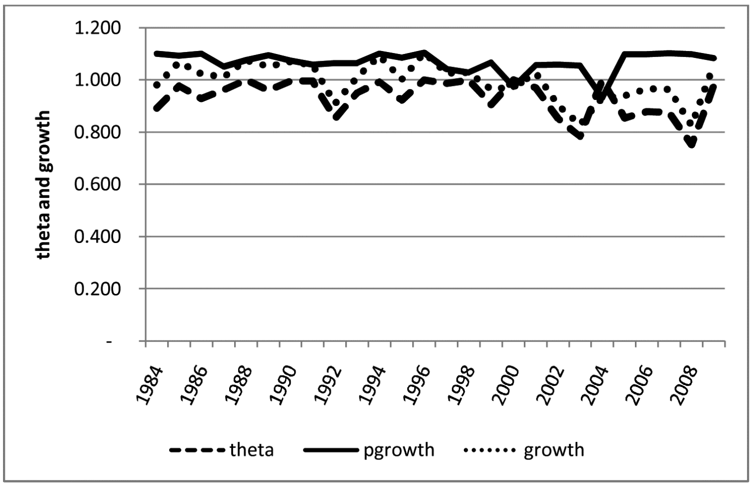


Table 2 Estimated dead weight loss due to inefficiency

Year	*Potential GDP (USD billion) (1)*	*Actual GDP (USD billion) (2)*	*Dead weight loss (USD billion): (1)–(2)*	*Dead weight (% of Actual GDP)*
1984–1985	9.43	8.81	0.62	7.04
1986–1990	26.2	25.4	0.8	3.15
1991–1995	30.9	29.1	1.8	6.19
1996–2000	34.8	34.0	0.8	2.35
2001–2008	44.7	38.9	5.8	14.9
2009	36.9	36.1	0.8	2.22
Total	182.93	172.31	10.62	6.16

Table 2 depicts estimates of potential economic growth and the dead weight loss. Strikingly, the most inefficient era is the crisis period (2001–2008) with a dead weight loss amounting to 15% of actual GDP. The most efficient era is 1996–2000 and 2009, which concede with the after effects of ESAP and continual structural reform under ZIMPREST, and dollarisation efforts under the government of national unity, which was formed in March 2009, respectively. The deadweight loss stands at about 2% of GDP.

The cumulative dead weight loss is approximately 6.2% of actual GDP for the 26 years. However, years under Structural Adjustment Programs 1991–1999 show marked reduction in inefficiency. Thus, the Washington Consensus was not really missing the mark on the overall. If only economic governance endeavoured to improve economic efficiency Zimbabwe would have been completely different from what it is now. There would only probably be need for strategic and long-term aid. The country would not have ambitiously pursued inflationary finance that led to ultimate collapse of the economy. Such resources unlocked by efficiency would free up resources for poverty reduction. Besides, the country would not have incurred the debilitating external debt it accumulated over the years. The poorest performance is not only in the years Zimbabwe had severe droughts such as 1987, 1992, 1995, 2002, 2005 and 2008, but also in years with poor economic governance such as the post 2000 era before dollarisation in 2009. So the popular belief among policy-makers in Zimbabwe that our growth is constrained by adverse climatic conditions is a fallacy.

4.2 Stationarity tests

Given that we are dealing with time series data, it is imperative to analyse the stationarity properties of the data. Table 3 reports the unit root test results based on ADF test procedure. All variables except the residuals of the long run model were found to be non-stationary in levels at 5% significance level or higher.

Table 3 Stationarity tests

Variable	*In levels*			*First difference*	*Second difference*
	Trend and drift	*Drift only*	*None*	*None*	*None*
pgrowth	–2.86	–2.97*	–0.11	–5.37***	
growthy	–3.37*	–2.32	–0.34	–5.94***	
taxburden	–2.4	–2.04	–0.72	–3.09***	
Taxmix	–1.18	0.182	0.966	0.052	–1.995**
Residuals	–3.26*	–2.71*	–2.78***		

***Means significant at 1%, ** at 5% and *at 10% based on ADF critical values.

Table 3 depicts that potential growth (pgrowth), actual growth (growthy), and taxburden are all I(1) at 1% level of significance but taxmix is I(2) at 5% significance level. However, the linear combination of the variables, that is, the residuals are stationary in levels suggesting a possibility of cointegration.

4.3 The Translog model results

We proceed to run a translog model in order to be able to determine time varying elasticities of potential growth to changes in tax policy. The results are reported in Table 4. Our objective is to measure the efficiency effects of tax policy on economic growth and possibly measure the responsiveness of economic growth to tax policy. Table 4 details the translog results.

Modelling actual growth on tax variables produces a weakly significant model and a p-value for the F-statistic equal to 0.065. Only the interactive term is significant at 10% and has a positive influence on economic growth. A 0.1 unit increase in either taxburden or taxmix holding one of the two constant leads to a 1.2 increase in growth.

However, after normalising actual growth by the efficiency score, we get a proxy for potential growth. The translog model for this variable is very significant overall at less than 1%. The explanatory power has more than doubled to 0.84 compared with 0.38 for the actual growth model. We subject the model to a serial correlation test and we find that the model does not suffer from this pathology. The B-G statistic is 0.63 with a p-value of 0.729, which is insignificant and thus failing to reject the null of no serial correlation. Likewise, the White heteroscedasticity test indicates that the model is both not misspecified and does not suffer from heteroscedasticity with a p-value of 0.272 for the Chi-square statistic of 9.58. The null of homoscedasticity is not rejected. The Jarque-Bera test also fails to reject the null of normality of residuals of the model hence classical statistical tests can be applied confidently. However, the sample under study is small but these tests are asymptotic hence the need to interpret results with caution.

Table 4 Translog model results: dependent variable is actual growth and potential growth[12]

Variable	*Model: growth*[13]	*Model: pgrowth*
Intercept	0.906 (0.0001)	0.924 (0.0000)
taxburdentaxmix	1.162* (0.0674)	0.247 (0.163)
taxburden	0.449 (0.719)	0.942** (0.014)
taxmix	0.006 (0.976)	0.194*** (0.0020)
Htaxburdensq[14]	–7.779 (0.139)	–9.00*** (0.0000)
htaxmixsq	–0.087 (0.415)	–0.129*** (0.0003)
R-squared	0.38	0.84
R-squared bar	0.23	0.79
DW	1.58	1.62
F	2.5* (0.065)	20.5*** (0.0000)
Breush-Godfrey serial correlation LM test	1.67 (0.433)	0.63 (0.729)
White heteroscedasticity test	3.86 (0.869)	9.58 (0.296)
Jarque-Bera normality test	5.28* (0.07)	2.600 (0.272)

From the results in Table 4 we see that a 0.1 unit increase in either of taxburden and taxmix holding the other constant raises potential growth by $0.25 \times$ taxburden or $0.25 \times$ taxmix points. On the other hand, a 0.1 unit increase in taxburden raises potential growth by 0.94 points. This implies that in the earlier stages of economic development, a heavier presence of government in the economy is beneficial for purposes of taxing to provide public goods. Similarly, a 0.1 points increase in taxmix in favour of indirect taxes raises potential growth by 0.19. Indirect taxes have been identified to enhance economic efficiency hence the positive impact on growth. Theoretically, the model is consistent: all a priori sign expectations have been met. The results also show that there are diminishing returns to tax policy. As the tax burden increases to higher levels and taxmix likewise, then potential economic growth starts to decline. One of the possible reasons is the pushing of economic activity into the informal sector and increased tax evasion in the formal sector. A repressive fiscal policy is expected to dampen both consumption and investment hence negatively impacting economic growth.

The ability of theta (efficiency) score to capture the effects of non-tax influences on growth should be accorded the prominance it deserves. Before filtering growth for business cycle fluctuations by the theta, the model had very poor explanatory (predictive) power. Once normalised, the explanatory (predictive) power went up significantly. Thus, one can safely exploit the DEA approach to proxy potential economic growth.

4.4 Time varying elasticities

We examine the responsiveness of potential growth to changes in tax structure over the period of study. This is a dynamic concept. We also use the point elasticity measure but this may not capture the dynamism the time varying principle advocates for. Tax policy undergoes several changes year after year and potential growth may respond differently. Table 5 shows that potential growth has been relatively inelastic to changes in tax policy. We also find that in 1984–1985 the growth elasticity to taxburden is –0.071 (0.071% for every 1% increase in tax burden). For the 1986–1990 and 1991–1995 periods the growth elasticity to tax burden is –0.217% for a 1% increase in tax burden. The largest elasticity occurred in the 1996–2000 reaching –0.267. The elasticity to tax burden has been decreasing in the 2000s. Perhaps, a shift by government towards greater recurrent expenditure and less towards social expenditure programs such as education and health that have positive externalities can explain. However, responsiveness of growth to tax mix was fairly constant at about 0.11% for the three periods 1986–1990, 1991–1995 and 1996–2000. The results indicate that a policy shift towards indirect taxes increases growth (although growth is relatively inelastic to tax mix changes). On the other hand, increasing the tax burden would certainly reduce economic growth. However, the tax elasticity to tax burden was slightly positive in 2009 but the tax mix fell to –0.42% suggesting that an over-reliance on indirect taxes as is the current situation in Zimbabwe where indirect taxes account for more than 50% of total revenue collected by government negatively impacts growth.

Table 5 Average time varying elasticities of growth for Zimbabwe with respect to:

Period	*Taxburden using calculus on translog*	*Taxburden using point elasticity*[15]	*Taxmix using calculus on translog*	*Taxmix using point elasticity*
1984–1985	–0.071	–	0.096	–
1986–1990	–0.217	–0.336	0.114	0.433
1991–1995	–0.216	–0.023	0.114	0.099
1996–2000	–0.267	–0.696	0.117	–0.198
2001–2008	–0.158	–0.263	0.081	–0.293
2009	0.035	–0.004	–0.419	–0.036

Source: Authors' calculations

The elasticity of potential growth to tax mix has been fairly negative and between –0.08% and –0.42% for every 1% increase in taxmix. The elasticity to taxmix of economic growth also increased in the 1996–2000 period. In the post dollarisation era, the elasticity of economic growth to tax burden has risen sharply to 0.42% although it is negative. Therefore, there is need to shift away from indirect taxes. However, a policy overemphasising a tax structure in favour of indirect taxes may be counterproductive. The elasticities have been falling in the 2000s, the very period in which tax mix shot up.

The elasticity results calculated using point estimation differ much from the time-varying elasticities calculated using calculus. However, the two results agree that growth is relatively inelastic to tax burden and mix changes. Of course, elasticity to tax burden rose up sharply in the 1996–2000 period to −0.7%. Prior to 1995, growth elasticity to tax mix was positive and became negative since 1996. This method is linear but the translog-based result is non-linear and that makes it approximate reality better.

5 Conclusion

The paper set out to assess the impact of tax policy on growth in Zimbabwe. We find that tax policy negatively influences growth. This finding is surprising given a huge public sector in Zimbabwe that delivers social services to the people. Some of such services have external benefits, which should have rendered tax policy benevolent. We find that a policy in favour of indirect taxation relative to direct taxation is marginally beneficial. We also find that over the sample period the elasticity of growth to changes in tax structure, that is, tax burden and tax mix has been relatively low except during the ZIMPREST period (1996–2000). Our findings agree with the current empirical evidence, for example, Koch et al. (2005) who find a negative relationship between tax structure and growth in South Africa. We compute the dead weight loss in the economy due to inefficiency and get very alarming results. Over the 26-year period of study, the dead weight loss is about 6.2% of actual growth. This is a worrisome performance. We recommend that government should shift away from over-reliance on taxes and probably create a sovereign wealth fund from the vast mineral resources. Such a fund would be used to fund both the development and recurrent budget. The government is certain to gain. A reduction in direct taxes is likely to spur expenditure and so increase indirect tax revenue collection. Further, institutional distortions, poor fiscal governance and other structural impediments have to be handled before efficiency can be attained. We further recommend structural reforms in the economy. However, our results are based on a very small sample and as such they are only preliminary. We suggest that further analysis can be made in the context of optimal tax rates. There is need to know if Zimbabwe is currently overtaxed or not. There is need to unlock the black box by examining the sources of growth and inefficiency in the Zimbabwean economy. Another additional area of research would be to examine the quality of public finance and its impact on economic growth.

References

Branson, J. and Lovell, C.A.K. (2001) 'A growth maximizing tax structure for New Zealand', *International Tax and Public Finance*, Vol. 8, No. 2, pp.129–146.

Engen, E.M. and Skinner, J. (1996) 'Taxation and economic growth', *National Tax Journal*, Vol. 49, No. 4, pp.617–642.

Farrell, M.J. (1957) 'The measurement of productive efficiency', *Journal of the Royal Statistical Society*, Vol. 120, Series A, General Part 3, pp.253–281.

Gordon, R.H. and Wilson, J.D. (1999) *Tax Structure and Government Behaviour: Implications for Tax Policy*, NBER Working Paper No. 7244, p.19.

Hall, R.E. (1968) 'Consumption taxes versus income taxes: implications for economic growth', *Proceedings of the 61st Tax Conference*, San Francisco, CA, pp.125–145.

Harberger, A.C. (1964) 'The measurement of waste', *American Economic Review LIV*, pp.58–76.

Jones, L.E. and Manuelli, R.E. (1990) 'A convex model of equilibrium growth: theory and policy implications', *Journal of Political Economy*, Vol. 98, No. 5.1, pp.1008–1038.

Kerr, I.A. and Macdonald, G.A. (1999) 'Economic growth and taxation mix in selected Asian economies', Paper presented to the *12th World Congress of the International Economic Association*, Buenos Aires, Argentina.

Kim, S.J. (1998) 'Growth effects of taxes in an endogenous growth model: To what extent do taxes affect economic growth?', *Journal of Economic Dynamics and Control*, Vol. 23, No. 1, pp.125–158.

King, R.G. and Rebelo, S. (1990) 'Public policy and economic growth: developing neoclassical implications', *Journal of Political Economy*, Vol. 98, No. 5, part 2, pp.s126–s150.

Koch, S.F., Schoeman, N.J. and Van Tonder, J.J. (2005) 'Economic growth and the structure of taxes in South Africa: 1960–2002', *South African Journal of Economics*, Vol. 73, June, pp.190–210.

Koopmans, T.C. (1951) 'An analysis of production as an efficient combination of activities', *Activity Analysis of Production and Allocation*, Cowles Commission for Research in Economics, Monograph, No. 13, Wiley, New York.

Lovell, C.A.K. and Pastor, J.T. (1995) 'Units invariant and translation invariant DEA models', *Operations Research Letters*, Vol. 18, No. 3, pp.147–151.

Lucas, R.E. (1990) 'Supply side economics: an analytical review', *Oxford Economic Papers*, Vol. 42, No. 2, pp.293–316.

Marsden, K. (1990) 'Taxes and growth', in Bird, R.M. and Oldman, O. (Eds.): *Taxation in Developing Countries*, The Johns Hopkins University Press, Baltimore, MD, USA, pp.620–641.

McMillan, M.S. and Masters, W.A. (2000) *Africa's Growth Trap: A Political-Economy Model of Taxation, R&D, and Investment*, Centre for International Development Working Paper No. 50, p.45.

Mendoza, E.G., Milesi-Firretti, G.M. and Asea, P. (1997) 'On the ineffectiveness of tax policy in altering long-run growth: Harberger's superneutrality conjecture', *Journal of Public Economics*, Vol. 66, pp.99–126.

Pecorino, P. (1993) 'Tax structure and growth in a model with human capital', *Journal of Public Economics*, Vol. 52, No. 2, pp.251–271

Skinner, J. (1987) *Taxation and Output Growth: Evidence from African Countries*, NBER Working Paper No. 2335, p.42.

Stokey, N.L and Robelo, S. (1995) 'Growth effects of flat-rate taxes', *Journal of Political Economy*, Vol. 103, pp.419–450.

Tanzi, V. and Shome, P. (1992) 'The role of taxation in the development of East Asian Economies', in Ito, T. and Krueger, A.O. (Eds.): *The Political Economy of Tax Reform*, The University of Chicago Press, Chicago, IL, USA.

Wang, P. and Yip, C.K. (1992) 'Taxation and economic growth: the Case of Taiwan', *American Journal of Economics and Sociology*, Vol. 51, No. 3, pp.317–331.

Yamarik, S. (2001) 'Nonlinear tax structures and endogenous growth', *The Manchester School*, Vol. 69, No. V, pp.16–30.

Notes

[1]The data we found is complete starting in 1984 hence the choice of the study period. A longer period would have been more informative.

[2]Equivalently, this implies finding the largest increase in that year's non-reciprocal indirect and direct tax burdens.

[3]Detailed DEA results can be obtained from the author.

[4]The grouping is based on major economic eras in Zimbabwe.

[5]Socialist policy era that had heavy government presence.

[6]Socialist policy era that had heavy government presence.

[7]Economic Structural Adjustment Program (ESAP).

[8]Zimbabwe Program for Economic and Social Transformation (ZIMPREST).

[9]Economic crisis years for Zimbabwe.

[10]Dollarisation and economic revival dispensation.

[11]The growth rates are here defined consistently with the definition used in the DEA stage where growth equals Y_t/Y_{t-1} and potential growth is $Y_t/(\theta_t Y_{t-1})$.

[12]*p*-values given in brackets.

[13]*** Means significant at 1%, ** means significant at 5% and * means significant at 10%.

[14]htaxburdensq and htaxmixsq are the squared terms in a translog model.

[15]Point elasticity is calculated as

$$\frac{\Delta p\text{growth}_t}{\Delta \text{taxburden}_t} \cdot \frac{\text{taxburden}_t}{p\text{growth}_t}.$$

The same procedure is used for elasticity to taxmix.