Measuring the Impact of Marginal Tax Rate Reform of the Revenue Base of South Africa Using a Microsimulation Tax Model

Yolandé van Heerden and N.J. Schoeman

ERSA working paper 396

December 2013

Economic Research Southern Africa (ERSA) is a research programme funded by the National Treasury of South Africa.

Measuring the Impact of Marginal Tax Rate Reform on the Revenue Base of South Africa Using a Microsimulation Tax Model

Yolandé van Heerden*and N.J. Schoeman†

December 6, 2013

Abstract

This paper is primarily concerned with the revenue and tax efficiency effects of adjustments to marginal tax rates on individual income as an instrument of possible tax reform. The hypothesis is that changes to marginal rates affect not only the revenue base but also tax efficiency and the optimum level of taxes that supports economic growth. Using an optimal revenue maximising rate (based on Laffer analysis) the elasticity of taxable income is derived with respect to marginal tax rates for each taxable income category. These elasticities are then used to quantify the impact of changes in marginal rates on the revenue base and tax efficiency using a microsimulation (MS) tax model. In this first paper on the research results much attention is paid to the structure of the model and the way in which the data base has been compiled.

The model allows for the dissemination of individual taxpayers by income groups, gender, educational level, age group, etc. Simulations include a scenario with higher marginal rates which is also more progressive (as in the 1998/1999 fiscal year) in which case tax revenue increases but the increase is overshadowed by a more than proportional decrease in tax efficiency as measured by its deadweight loss. On the other hand, a lowering of marginal rates (to bring South Africa's marginal rates more in line with those of its peers) improves tax efficiency but also results in a substantial revenue loss. The estimated optimal individual tax to GDP ratio to maximise economic growth (6.7 per cent) shows a strong response to changes in marginal rates and the results from this research indicate that a lowering of marginal rates would also move the actual ratio closer to its optimum level. Thus, the trade-off between revenue collected and tax efficiency should be carefully monitored when personal income tax reform is being considered.

JEL: H21,H24, H31

Keywords: microsimulation, tax efficiency, optimal tax, tax reform, personal income tax

*PhD student in the Department of Economics, University of Pretoria.

†Professor in Economics, University of Pretoria.

1 Introduction

A vast literature exists arguing the features of an efficient tax regime and tax reform measures to improve on tax efficiency and collection. For example, Hassan (1996) finds that collection is improved with a more simplified and efficient tax system with lower marginal rates and a broader tax base. According to Creedy (2010:140), a broad tax base with few exemptions and low tax rates serves as a 'rule of thumb' for a good tax system. Bird (2008:12) finds that good tax policy in developing countries requires a tax system that minimises efficiency losses.

Adjusting personal income marginal tax rates and income bands is a powerful fiscal policy tool for government to affect the revenue base pending on the proportionality of the tax regime. Obviously the secret is to adjust marginal tax rates until income is maximised and the negative impact on the economy is minimised. From a tax competition point of view it is specifically useful to know how sensitive revenue is to the lowering of taxes but also how tax efficiency responds to such changes. For example, in a study on Finland, Lehmus (2012:3) indicates that in the long run, a one percentage point decrease in the income tax rate, the loss of which is financed through an increase in government debt, improves GDP and employment by around 0.58 and 0.25 per cent, respectively. Feldstein (2011) shows that in the United States a combination of expanding the revenue base and reducing the marginal tax rates actually improves total personal income tax collection. Gwartney (2008:1), indicates that from a supply side perspective relatively high marginal tax rates discourage productivity and encourage early retirement and even tax evasion.

Tax reform over the past 30 years in the Organisation for Economic Cooperation and Development (OECD) countries was featured by lower marginal tax rates and a reduction in the number of income brackets. However, it is important not to compare countries only by their marginal rates but also to look at the threshold levels as well as the number of tax brackets (OECD, 2012:32). The empirical research of Peter, Buttrick & Duncan (2009:11) concludes that the average number of tax brackets for upper-middle, lower-middle and low-income countries should not exceed 4 to 6 brackets making the tax systems simpler to understand and to administrate. It is suggested that the highest marginal rate for PIT is set between 30 per cent and 50 per cent and the lowest rate between 10 per cent and 20 per cent, with a few intermediate tax rates. The highest personal income group's marginal rate should be in line with the company tax rate to avoid tax arbitrage. If the highest PIT rate is lower than the company tax rate, companies will redistribute their profits to wages or give ownership of assets to individuals (Saunders, 2007).

Figure 1 illustrates the maximum and minimum statutory marginal tax rates for 29 high-income countries in 2010 (United States Agency for International Development [USAID], 2011). The average minimum and maximum marginal rates are 15 and 40 per cent, respectively. Looking at 22 upper-middle income countries in Figure 2, the average minimum and maximum marginal rates are between 9 and 29 per cent, respectively (USAID, 2011).

Steenekamp (2012:50) compares marginal tax rates between South Africa and the Southern African Development Community (SADC) countries. He finds that South Africa's 40 per cent maximum marginal rate is higher than the 30 per cent average of SADC countries. A brief overview of the historic development of income tax reform in South Africa since the transformation shows that in 1993/1994, the number of income bands was limited to 9 and individuals were taxed at a minimum and a maximum marginal rate of 17 and 43 per cent, respectively. At the time they were also taxed differently on marital and gender status. In 1995/1996 only the highest marginal rate increased to 45 per cent with the number of income bands stretched to 10 while gender differentiation was discontinued. In the 1997/1998 fiscal year the lowest marginal rate increased to 19 per cent and the income bands decreased to 7. The tax free threshold differentiated between individuals younger than 65 years and older than 65 years while the child rebate was removed. In 1998/1999 the income bands were reduced to 6 and in 2000/2001 the top marginal rate decreased to 42 per cent with a further reduction to 40 per cent in 2002/2003. As from then onwards South Africa's minimum and maximum marginal tax rates have remained on 18 and 40 per cent, respectively which are substantially higher than the average for other upper-middle income countries.

In this paper an attempt is made to identify the impact of an adjustment in marginal tax rates on revenue, efficiency and economic growth. A static microsimulation model is developed from survey data and used to simulate the proposed tax reforms. The choice of marginal rate adjustments is based on international best practice with rates similar to that of South Africa's peers. The results show that such a lowering in rates to levels on par with South Africa's peers offers potential for improved levels of efficiency with the tax burden equal to or even below the optimal tax/GDP ratio from an economic growth point of view. Although this ratio is below the optimal ratio the results suggest that the loss in revenue could be minimised over time through a resultant increase in productivity and economic growth.

The layout of the rest of the paper is as follows: Section 2 explains the data base and the adjustments that had to be made in order to bridge the gaps in published data and the model results are validated against actual published South African Revenue Services (SARS) data. Section 3 explains the structure of the MS model. Section 4 validates the MS model results and Section 5 discusses the simulation exercises reflecting the impact of adjustments in marginal tax rates on individuals (upwards and downwards) on revenue, tax efficiency and economic growth. Section 6 concludes with some policy recommendations.

2 Data and methodology

Data for MS tax models mainly originates from surveys with information on individuals' revenue collection and expenditure patterns. In the case of South Africa, the most representative survey is conducted by the Central Statistics Income and Expenditure Survey (IES) but unfortunately the information shows a high level of versatility. Missing values as a result of non-responses due to refusal, unusable information and disqualified answers are common. In this paper the 2005/2006 IES serves as the primary dataset for the analysis. Income levels are calculated on an individual base with the profile of individuals explained by categorical variables such as gender, age group, education level, population group and settlement. Some of the categorical information is unspecified, but these values cannot be excluded from the dataset because the individuals are included in the weights of the survey and will affect the population total. To improve the data, the problem of unspecified values has been addressed through the imputation technique of Peichl & Schaefer (2009:3). The technique replaces unspecified values in each categorical group by the mean value of the specified values in the categorical groups. Figure 3 reflects the general structure of an MS model.

The gender variable differentiates between males and females, and shows the extent to which each group is represented in the survey. Also, each individual in the household is categorised within a specific population group: African/Black, Coloured, Indian/Asian, and White. Education groups range from no schooling, primary schooling, secondary schooling, to degrees and diplomas. Only qualifications already obtained are included. Diplomas and certificates only count if at least six months of a course has been completed. Age is captured in completed years to the nearest completed number, and categorised in five-year age groups. Settlement is where the dwelling unit is located. Urban areas include cities and towns characterised by higher population densities, economic activity, and infrastructure. Rural areas include farms and traditional areas characterised by low population densities, economic activity, and infrastructure (Statistics South Africa [Stats SA], 2008:1-2).

For the categorical variables in the IES survey containing unspecified data, a frequency table was obtained for each variable to determine the distribution of the unspecified values. When computing values for the unspecified categorical variables the frequency distribution of the original responses remained unchanged. This methodology is available in the SAS program known as RANUNI (uniform random number generator). Briefly, the algorithm is as follows:

In equation 1, R_i is the i^{th} random number, a is the multiplier and c the percentage increase.

$$R_{i+1} = (aR_i + c)(\bmod m)i = 0, 1, 2, ... \tag{1}$$

The RANUNI function then generates a random number using a generator developed by Lehmer (1951) from a uniform (0, m) distribution, and turns it into (0,1) by dividing by m. The number in parentheses is the seed/random number of the random number generator. If the seed is adjusted to a non-zero number, the same random numbers are being generated every time the program is activated (Fan, Felsovalyi, Sivo & Keenan, 2002: 26).

Table 1 shows that prior to imputation, male responses account for 47.1 per cent and female for 52.8 per cent of the total, while non-responses amount to 0.1 per cent of the total population. Using the RANUNI statistical method, an unspecified value is replaced by a female response when the RANUNI is less than 52.8, or alternatively to a male response should the RANUNI be less than 47.1 per cent. It is evident that the female and male distribution before and after the imputation has only deviated slightly between males and females. After imputation, the male ratio only increased from 47.1 to 47.17 per cent and the female ratio from 52.8 per cent to 52.83 per cent.

In Table 1 the racial distribution before imputation is as follows: Africans account for 78.5 per cent, Coloureds 13.6 per cent, Indian/Asian 1.6 per cent and Whites 6.2 per cent of the total population. The non-response number amounts to 0.1 per cent for the total population in the survey. After imputation, the distribution between the racial groups only changes marginally. For example, the ratio for African/Black only increases from 78.5 to 78.6 per cent.

Table 1 shows that before imputation the age group 0 to 14 years accounts for 33 per cent of the population. For age group 15 to 24 years, 25 to 44, 45 to 64 and 65 years and older, the distribution is 21.3, 25.1, 14.5 and 5.8, respectively. The non-response number amounts to 0.23 per cent. Again, the age group distribution after imputation only adjusts marginally. For example, the age group 15 to 24 years increases from 21.34 to 21.38 per cent, while the age group 65 years and older increases from 5.81 to 5.82 per cent.

The distribution of the education categories before and after imputation can be seen in Table 1. The group with no schooling represents 20.7 per cent of the population. Those with primary and secondary schooling (Grade R to Grade 12), represent 73.8 per cent while those with a national diploma only represent 3.6 per cent of the population and those with a degree only 1.3 per cent. After imputation, the distribution between the education groups only changes marginally. For example, the share of the group with no schooling increases from 20.7 to 20.8 per cent, while those with school education increases from 73.8 to 74.2 per cent.

To validate the MS database against the 2005/2006 SARS filer data (Tax Statistics, 2010) a problem with different base years (calendar versus fiscal year) was encountered. Given the fact that the MS model is a tax model, the calendar year survey data had to be re-calculated to fiscal years. The IES data has also been re-weighted to take account of the population change for the fiscal year 2005/2006. The method used is the CALMAR re-weighting program (Sautory, 1993), which recalculates the weights according to control totals, gender, race and age group to match the population totals produced by Stats SA. The population total of the 2005/2006 IES equals the Stats SA midyear population survey of 2006. Therefore, the 2005 midyear population survey is used with the 2006 midyear survey to rework the numbers to the fiscal year 2005/2006. The CALMAR method is also used by Stats SA and the modellers of the EUROMOD and SAMOD models.

3 Structure of the model

The approach followed is to construct a micro-simulation tax model (MS model) - a technique used internationally for the empirical analysis of fiscal policy changes on revenue collection and expenditure, especially health care and retirement as well as other socio-economic expenditures (Buddelmeyer, Creedy & Kalb, 2007:3). It also allows for individual characteristics such as the composition of the taxpaying population in terms of age, gender, income levels, etc. and is especially useful to simulate individual income and expenditure behaviour to policy changes that affect revenue (Citro & Hanushek, 1991:15). This is in contrast to macro models which are structured on an aggregate level without the detail information of individuals/households captured in the micro model (Štěpánková, 2002:36). The model is a static one in which demographic characteristics are not aged.

Figure 4 illustrates how individual tax liability is calculated. Total gross income of individuals (R749 billion) is compared to gross primary income (R1 014 billion[1]) in the production, distribution and accumulation accounts of South Africa (South African Reserve Bank [SARB], 2012). Primary income is adjusted to the fiscal year 2005/2006 and excludes business income of about 7 per cent to account only for households. A factor of 1.35[2] is calculated to up-rate individuals' gross income in the survey.

Tax allowances, deductions and fringe benefits are not accurately recorded in the IES. Thus, the SARS filer data serves as a benchmark based on the principle that it represents the closest proxy to the full tax base of the South African economy on a disaggregated level. The SARS published filer data for allowances and deductions in 2005/2006 (Tax Statistics, 2010) has been used as a proxy to calculate a ratio for allowances, deductions and fringe benefits to be applied to each individual income group. All the allowances, deductions and fringe benefits are then added to taxable income to calculate the gross income per taxable income group (25 disaggregated groups). The total gross income is lower than the primary income obtained from the national accounts, since it only accounts for tax filers and not the total income earned.

The average allowance ratio (φ) is derived from allowances, deductions, fringe benefits ($allow_i$), and gross income (y_i) per taxable income group in equation 2.

$$\varphi = \frac{allow_i}{y_i} \tag{2}$$

Equation 2 is then applied to the SARS filer dataset and the calculated average allowance ratio for each of the six taxable income groups is summarized in Table 2.

These ratios by taxable income group (equation 2) are then applied to each individual IES gross income group in equation 3 to calculate individual allowances ($allow_i$).

$$allow_i = y_i * \varphi \tag{3}$$

Taxable income is then defined as gross income less allowances:

$$tby_i = y_i - allow_i \tag{4}$$

[1] Primary income (2005/2006) = [(1 070*10/12)+(1 190 *2/12)]*93%

[2] Primary income (2005/2006)/ IES gross income= 1 014 billion/749 billion

Due to the lack of tax liability data in the survey, liability is calculated for each individual in the MS model by applying the tax rates and rebates to taxable income for the year of assessment ending 28 February 2006. By deducting rebates from the gross tax liability, net tax liability is derived (National Treasury, 2006).

The tax liability for each individual (i) is calculated in equation 5 by applying the official tax codes to taxable income:

$$pit_i = f(tby_i : \tau_{structure}) \tag{5}$$

The model calculates tax liability given the existing tax codes, which can be adjusted for policy simulation purposes. As mentioned earlier, this procedure is a static method and behavioural changes are not accounted for. However, it allows policy simulations for thresholds, marginal tax rates, allowances, and income bands according to the six income categories.

Finally, the model has been constructed to also measure the changes in tax efficiency related to changes in the tax regime. The point is that an adjustment of tax rates might impact on efficiency thereby affecting tax behaviour and possibly also revenue. Thus, in order to capture the impact of such changes in the tax regime, its impact on efficiency also has to be considered together with its impact on the revenue base. The elasticity of taxable income is used as an indicator to capture revenue and efficiency changes as reflected in changes in deadweight loss. This paper does not allow for an elaborate explanation of the elasticities and the deadweight loss used in this research[3]. Suffice it to say that the inverted Pareto parameter (Atkinson, Piketty, & Saez, 2011:13) has been derived for different income groups with an in-depth analysis of revenue-maximising tax/GDP ratios (Schoeman & Van Heerden, 2009: 29; Scully, 1991:9) which hover around 43 per cent (calculated from macro data). The corresponding taxable income elasticities as derived from the Laffer bound curve (Barlett, 2012:1014) are then calculated. From Figure 5 it can be seen that higher revenue-maximising tax ratios (Laffer bound curve) coincide with lower taxable income elasticity, and a lower revenue-maximising ratio coincides with higher taxable income elasticity. It is therefore assumed that the elasticities are at a direct variance with income.

The elasticities from the Scully (1991:9) model are also used to calculate an optimal growth-maximising tax/GDP ratio of 20.5 per cent for South Africa based on 2005/2006 data. The actual ratio in 2007/2008 was 27.6 per cent; in 2011/2012 it decreased to 24.6 per cent (SARB, 2012). Thus, the tax ratio that maximises growth is substantially lower than the 2011/2012 realised rate. This growth-maximising tax ratio might appear to be on the low side if measured against the revenue required to finance the government's budget. However, the challenge lies in fuelling economic growth that automatically inflates the tax base which means that such a decline in the revenue/GDP ratio might not be too far off the mark. Since 2002 the share of individual tax (PIT) in relation to total tax has been hovering between 30 and 36 per cent (SARB, 2012); therefore,

[3] A more comprehensive description of the methodology is contained in the author's thesis which is to be available soon.

assuming an average of 33 per cent, the optimal PIT/GDP ratio estimated at 33 per cent of 20.5 per cent, or 6.7 per cent.

Figure 6 illustrates the derivation of the deadweight loss using the consumer surplus methodology (Feldstein, 1995:3). The deadweight loss of PIT therefore depends on taxable income and the elasticity of taxable income. The deadweight loss changes with behavioural changes; so if the tax rates increase to raise revenue, they affect the level of the deadweight loss as well.

4 Validation of the MS model results

After simulating tax liability with the MS model, the results are compared to published SARS data, IES, and the Bureau of Market Research of the University of South Africa. Table 3 shows that the MS model's tax liability of R132 billion exceeds the SARS assessed tax liability of R111 billion (the actual amount collected was R125 billion). This is plausible since the MS model accounts for the whole of the South African population and not only for assessed taxpayers. The results for gross income and tax liability are very similar to those of the Bureau of Market Research (2000:17). It should be noted, though, that the MS model only calculates tax liability, which differs from the actual amount collected due to advanced and lagged payments

Table 4 shows the MS model results. Almost half of the population shows unspecified gross income, while approximately 19 million fall under the tax threshold of R35 000. About 1.8 million individuals earn income between R35 000 and R60 000. Those earning less than R60 000 only qualified for the Standard Income on Employees Tax (SITE), and were not liable to file a tax return. The base model results can be validated by comparing the aggregate output to the published SARS data in the Tax Statistics in Table 4. One would not expect identical results but the aim is to show that the MS baseline results are broadly in line with the published data.

5 Tax reform – two scenarios, simulating a more and less progressive marginal tax rate regime

As mentioned previously, the main objective with this analysis is to determine the impact of changes in marginal tax rates on individuals on the revenue base and on tax efficiency. The marginal tax rates for the 2005/2006 fiscal year are used as a base from which changes are implemented. Besides the base scenario, two other scenarios are simulated: one where marginal rates are increased and one where marginal rates are decreased. The three marginal tax rate structures are reported in Table 5. The scenarios are as follows:

Scenario A: This is the base scenario with marginal rates as in the 2005/2006 fiscal year. The marginal rate at the lower end is 18 per cent and 40 per cent at the highest end. It should also be mentioned that these rates have remained unchanged since the 2002/2003 fiscal year.

Scenario B: From the literature it is evident that high income countries' marginal tax rates are higher than those of upper-middle income countries. In order to choose a realistic scenario with higher marginal rates, the rates in South Africa that applied in the financial year 1998/1999 were used in the model. The scenario is useful, since in that year the number of income tax bands was reduced to six from the previous 10, making the comparison that much easier. Marginal rates in this scenario range between 19 and 45 per cent for the lowest and highest income groups, respectively.

Scenario C: This scenario includes lower marginal tax rates. According to the literature discussed, the marginal tax rate for the lower income band should be between 10 and 20 per cent, and the highest marginal tax rate between 30 and 50 per cent, with the number of income tax bands between 4 and 6. Therefore, the scenario reflects a tax regime comparable to those of South Africa's peers, with marginal tax rates starting at 12 per cent and increasing to a maximum of 30 per cent for the highest income group.

6 Impact on the Revenue Base and Tax Efficiency

The results for the base Scenario (A) are given in Table 6, which reflects the number of taxpayers, taxable income, tax assessed, and the deadweight loss per population group for the different income groups. The total deadweight loss amounts to R37.5 billion, with total tax liability at R132.8 billion. Note that tax efficiency decreases (deadweight loss increases) with an increase in taxable income levels. This decrease in efficiency is especially noticeable in the case of the highest income group (54.5 per cent increase in deadweight loss).

Table 6 also shows the results of both more and less progressive marginal tax rate regimes, compared to the base model. In Scenario B the marginal tax rate per income group increases from 18 to 19 per cent, 25 to 30 per cent, 35 to 43 per cent, 38 to 44 per cent, and 40 to 45 per cent, respectively. These increases result in an increase in total revenue, from the previous R132.8 billion to R153.7 billion (an increase of 16 per cent), but with deadweight loss increasing from R37.5 billion to R56.2 billion (an increase of 50 per cent).

The decreased marginal tax rates in Scenario C (from 18 to 12 per cent, 25 to 15 per cent, 30 to 19 per cent, 35 to 23 per cent, 38 to 27 per cent, and 40 to 30 per cent, respectively) imply a loss of about R43 billion (tax liability decreases from R132.8 to R89.9 billion), but also a reduction in the deadweight loss by R21.3 billion. The changes in both revenue and deadweight loss per income group show that income groups are affected differently by changes in marginal taxes. Although those in the highest income group are most affected in absolute terms in both Scenarios B and C as far as tax liability is concerned, the percentage change is different from that of some of the other groups. In the case of Scenario B the tax liability of those in the income group above R300 000 increases by 15 per cent, while their tax efficiency decreases by 38 per cent. In

Scenario C this group's tax liability decreases by 29 per cent and tax efficiency increases by 52 per cent. However, a similar analysis of the income group R130 000 to R180 000 demonstrates that, in the case of Scenario B, their tax liability increases by 18 per cent; but tax efficiency as measured by the inverse of the deadweight loss of tax in this income group decreases by 94 per cent. In Scenario C, with the lower rates, their tax liability decreases by 37 per cent and their deadweight loss by 65 per cent (increase in tax efficiency).

Figure 7 shows that both tax liability and the deadweight loss as a percentage of taxable income increase over all the taxable income groups. With higher marginal tax rates (Scenario B), tax revenue increases, but tax efficiency decreases. Lower marginal tax rates (Scenario C) show a decrease in tax revenue in all income groups, but an increase in efficiency.

Figure 8 shows that in the base scenario the deadweight loss as a percentage of total PIT amounts to 28 per cent but with a more progressive regime it increases to 37 per cent and with a less progressive regime it declines to 16 per cent. Note that Thomas (2007:23) using the elasticity of taxable income with respect to tax rates (0.52), estimates the deadweight loss as a percentage of tax revenue at 15 per cent for New Zealand flatter rate system. For the United States, Robson (2007:15) summarises different studies and the ratio range between 18 per cent and 37 per cent.

As indicated earlier, the optimal growth-maximising tax ratio (PIT/GDP) where economic growth is maximised is estimated at 6.7 per cent. Figure 9 shows that for Scenarios A and B, the PIT/GDP ratios are 8.2 and 9.6, respectively, which are higher than the optimal ratio. With less progressive marginal tax rates (Scenario C) the PIT/GDP ratio declines to 5.6 which is less than the optimal tax ratio and it can be assumed that such a policy reform would stimulate economic growth and thereby expand the revenue base to compensate for the first round loss in revenue.

7 Conclusion

Due to globalisation and the resultant international tax competition a developing country such as South Africa should be mindful of the level of its marginal tax rates. Studies show that countries have embarked on a declining trend in marginal tax rates on personal income. As a general guideline it is suggested that top maximum marginal rates vary between 30 and 50 per cent with minimum rates between 10 and 20 per cent. Currently, the rates for upper-middle income countries average about 9 per cent for the lowest income category to 29 per cent for the highest category (SADC countries 30 per cent). In South Africa the current minimum and maximum marginal rates are 18 and 40 per cent, respectively, which are clearly higher than that of its peers. The result is that in order to align the marginal tax regime in this country to these margins, the future trend will have to be downward. From an efficiency point of view the model clearly shows that increases in marginal rates from the current levels (especially also the higher income groups) will be detrimental to the economy. Also important is that such changes in marginal rates impact more heavily on those in middle income groups (for example the R130 000 to R180 000 income group) which comprises a large cohort of South African employees. Thus, policymakers will have to carefully weigh the trade-off between lower levels of personal tax income and the benefits of increased tax efficiency and economic growth.

References

[1] Atkinson, A.B., Piketty, T. & Saez, E. 2011. Top incomes in the long run of history. *Journal of Economic Literature*, 49(1): 3–71.

[2] Ballard, C.L., Fullerton, D., Shoven, J.B. & Whalley, J. 1985. Introduction to "A general equilibrium model for tax policy evaluation". *A general equilibrium model for tax policy evaluation.* University of Chicago Press.

[3] Barlett, B. 2012. *What is the revenue-maximizing tax rate?* Tax Notes, 134:8. Available at: http://ssrn.com/abstract=2008750 or http://dx.doi.org/10.2139/ssrn.2008750 [Accessed: 2012-07-23].

[4] Bird, R.M. 2008. *Tax Challenges Facing Developing Countries.* International Center for Public Policy (formerly the International Studies Program) Working Paper Series, at AYSPS, GSU paper0802.

[5] Buddelmeyer, H., Creedy, J. & Kalb, G. 2007. *Tax policy - Design and Behavioural Microsimulation Modelling.* Cheltenham, UK and Northampton, MA, USA: Edward Elgar Publishing Limited.

[6] Bureau of Market Research Bundles. 2000. *Personal disposable income in South Africa by population group, income group and district.* Pretoria: University of South Africa, Bureau of Market Research. Research report No 279.

[7] Citro, C.F. & Hanushek A. 1991. *Improving Information for Social Policy Decisions The Uses of Microsimulation Modeling.* Washington, D.C.: National Academy Press.

[8] Creedy, K. & Gemmell, N. 2004. The income elasticity of tax revenue: Estimates for income and consumption taxes in the United Kingdom. *Fiscal Studies* 25(1): 55-77.

[9] Creedy, J. 2010. The elasticity of taxable income: an introduction. *Public Finance and Management,* 10, pp. 556-589.

[10] Fan, X. & Felsővályi, A. 2002. *SAS for Monte Carlo studies: a guide for quantitative research.* SAS Institute [Online] Available from: [Accessed: 2012-05-13].

[11] Feldstein, M. 1995. The effect of marginal tax rates on taxable income: a panel study of the 1986 Tax Reform Act. *Journal of Political Economy,* 103, pp. 551-572.

[12] Feldstein, M. 2011. The Tax Reform Evidence From 1986. *Wall Street Journal.* [Online] Available from: http://www.nber.org/feldstein/wsj10242011.html. [Accessed: 2012-7-14].

[13] Gwartney, J.D. 2008.*Supply-Side Economics. The Concise Encyclopedia of Economics.* David R. Henderson, ed. Liberty Fund, Inc.. Library of Economics and Liberty [Online] Available from: http://www.econlib.org/library/Enc/SupplySideEconomics.html. [Accessed: 2012-7-14].

[14] Hassan, F.M.A. and Bogetic, Z. 1996. Effects of Personal income tax on income distribution: Example from Bulgaria. *Western Economic Association International contemporary Economic Policy.* Volume XIV.

[15] Lehmus, M. 2012. *Distributional and employment effects of labour tax changes: Finnish evidence over the period 1996-2008.* [Online] Available from: https://editorialexpress.com/cgi-bin/conference/download.cgi?db_name=IIPF68&paper_id=135. [Accessed: 2012-10-01].

[16] Lehmer, D.H. 1951. *2nd Symposium on Large-Scale Digital Calculating Machinery*, Cambridge: Harvard University Press.pp.141-146.

[17] National Treasury. 2006. Budget Review. Pretoria: Department of Finance.

[18] OECD. 2012. E*conomic Policy Reforms 2012*: Going for Growth. OECD Publishing, http://dx.doi.org/10.1787/growth-2012-en

[19] Peichl, A. & Schaefer, T. 2009. FiFoSiM - An Integrated Tax Benefit Microsimulation and CGE Model for Germany. *International Journal of Microsimulation,* 2(1):1-15. [Online] Available from: http://www.microsimulation.org/IJM/V2_1/IJM_2_1_1.pdf [Accessed: 2010-03-19].

[20] Peter, K.S., Buttrick, P. and Duncan, D. 2009. *Global Reform of Personal Income Taxation 1981-2005: Evidence from 189 Countries.* [Online] Available from: http://www.econstor.eu/dspace/bitstream/10419/35825/1/605989540.pdf [Accessed: 2012-10-01].

[21] Robson, A. 2007. *No free lunch the cost of taxation.* N*ew Zealand Business Roundtable, Wellington,* New Zealand.

[22] SARB (South African Reserve Bank). *Various issues of the Quarterly Bulletin*, Pretoria.

[23] Saunders, P. 2007. Taxploitation: The case for income tax reform. Published by The Centre for Independent Studies.

[24] Sautory, O. 1993. *La macro CALMAR: Redressement d'um echantillion par calage sur marges, Working paper no F9310*. Institut National de la Statistique et des Etudes Exconomiques.

[25] Schoeman N.J. and Van Heerden; Y. 2009. Finding the optimum level of taxes in South Africa: a balanced budget approach. *South African Journal of Industrial Engineering*. Volume 20 (2) pages 15 -31.

[26] Scully, G.W. 1991. *Tax rates, tax revenues and economic growth.* Policy Report 98. Dallas, TX: National Centre for Policy Analysis.

[27] Statistics South Africa. 2008. *Income and Expenditure of Households 2005/2006: Statistical release P*01001. [Online] Available from: http://www.statssa.gov.za/publications/statsdownload.asp?PPN=P0100&SCH=4108 [Accessed: 2012-01-03].

[28] Statistics South Africa. 2005. *Mid-year population estimates 2005 to 2006: Statistical release P*0302. [Online] Available from: http://www.statssa.gov.za/publications/statspastfuture.asp?PPN=P0302&SCH=4696 [Accessed: 2012-7-14].

[29] Steenekamp, T.J. 2012. The progressivity of personal income tax in South Africa since 1994 and direction for tax reform. *Southern African Business Review*. Volume 16(1) 39-57.

[30] Štěpánková, P. 2002. Using Microsimulation Models for Assessing the Redistribution Function of a Tax-Benefit System. *Finance a úvìr',* 52(1):36-50.

[31] Tax Statistics. 2009. Pretoria. National Treasury and the South African Revenue Service.

[32] Tax Statistics. 2010. Pretoria. National Treasury and the South African Revenue Service.

[33] Thomas, A. 2007. *Taxable income elasticities and the deadweight cost of taxation in New Zealand*. Unpublished paper, Inland Revenue, Wellington.

[34] USAID. 2011. USAID leadership in public Financial management project: collecting taxes full data.

Appendix

Table 1: Gender, Racial, Age, Education distribution

Gender	DBI* %	DAI** %	Racial	DBI %	DAI %	Age (years)	DBI %	DAI %	Level of education	DBI %	DAI %
Male	47.10	47.17	African/Black	78.50	78.60	0 - 14	33.07	33.15	No schooling	20.67	20.81
Female	52.80	52.83	Coloured	13.60	13.64	15 - 24	21.34	21.38	Grade R - 12	73.82	74.21
Unspecified	0.10		Indian/ Asian	1.60	1.56	25 -44	25.11	25.17	NTC/ Diploma	3.63	3.65
Total	100	100	White	6.20	6.20	45 - 64	14.44	14.48	Degree	1.32	1.33
			Unspecified	0.10		> 65	5.82	5.82	Unspecified	0.60	
			Total	100	100	Unspecified	0.23		Total	100	100
						Total	100	100			

***DBI** Distribution before imputation
****DAI** Distribution after imputation

Source: Own calculations

Table 2: Allowance ratio

Taxable income group	Allowance ratio
R0 – R80 000	0.15
R80 001 – R130 000	0.14
R130 001 – R180 000	0.16
R180 001 – R230 000	0.19
R230 001 – R300 000	0.20
R300 001 and above	0.18

Source: Own calculations

Table 3: Comparison of IES, MS model and SARS for the survey year 2005/2006

Database	Gross Income (million)	Taxable Income (million)	Tax Liability (million)
IES Survey data - Total Population	R 841 000	n/a	R 64 700
SARS Tax statistics - 90.2% Assessed filer taxpayers	n/a	R 511 547	R 111 330
MS model - Total Population	R 1 014 408	R 846 961	R 132 832
Bureau of Market Research Bundles Unisa	R 1 166 035		R 156 626

Source: IES (2008:12), Bureau of Market Research Bundles (2000:17); Tax Statistics (2009:15); SARB

Table 4: Comparison of MS model and SARS data by taxable income group

Tax year	**2006 SARS** *[90.2% assessed]*			**Tax year**	**2006 MSM**		
Taxable income group	**Number of taxpayers**	**Taxable income (R million)**	**Tax Assessed (R million)**	**Taxable income group**	**Number of taxpayers**	**Taxable income (R million)**	**Tax Assessed (R million)**
				Unspecified	22 656 489	-	-
				0 - < 35 000	19 231 586	175 223	175 223
0 – 60 000	1 098 979	28 864	947	35 000 – 60 000	1 848 869	85 552	3 546
60 001 – 80 000	475 750	3 586	2 924	60 000 – 80 000	730 648	50 758	4 442
80 001 – 130 000	1 095 553	113 220	15 089	80 000 – 130 000	1 279 451	130 930	17 265
130 001 – 180 000	483 367	74 610	13 387	130 000 – 180 000	655 113	98 507	17 415
180 001 – 230 000	242 473	48 458	10 304	180 000 – 230 000	286 880	57 438	12 188
230 001 – 300 000	224 487	54 276	12 759	230 000 – 300 000	204 966	54 673	13 731
>300 000	297 652	173 427	55 919	>300 000	329 544	193 879	64 244
Total	**3 918 261**	**526 440**	**111 329**		**5 335 470**	**671 738**	**132 832**
% of total	**Number of taxpayers**	**Taxable income (R million)**	**Tax Assessed (R million)**	**% of total**	**Number of taxpayers**	**Taxable income (R million)**	**Tax Assessed (R million)**
0 – 60 000	28%	5%	1%	35 000 – 60 000	35%	13%	3%
60 001 – 80 000	12%	6%	3%	60 000 – 80 000	14%	8%	3%
80 001 – 130 000	28%	22%	14%	80 000 – 130 000	24%	19%	13%
130 001 – 180 000	12%	14%	12%	130 000 – 180 000	12%	15%	13%
180 001 – 230 000	6%	9%	9%	180 000 – 230 000	5%	9%	9%
230 001 – 300 000	6%	10%	11%	230 000 – 300 000	4%	8%	10%
>300 000	8%	33%	50%	>300 000	6%	29%	48%
Total	**100%**	**100%**	**100%**	**Total**	**100%**	**100%**	**100%**

Source: Calculation in SAS 9.2

Table 5: Marginal tax rates

Marginal tax rate	**A: Base**	**B: More progressive**	**C: Less progressive**
0 – 80 000	18%	19%	12%
80 001 – 130 000	25%	30%	15%
130 001 – 180 000	30%	39%	19%
180 001 – 230 000	35%	43%	23%
230 001 – 300 000	38%	44%	27%
> 300 000	40%	45%	30%

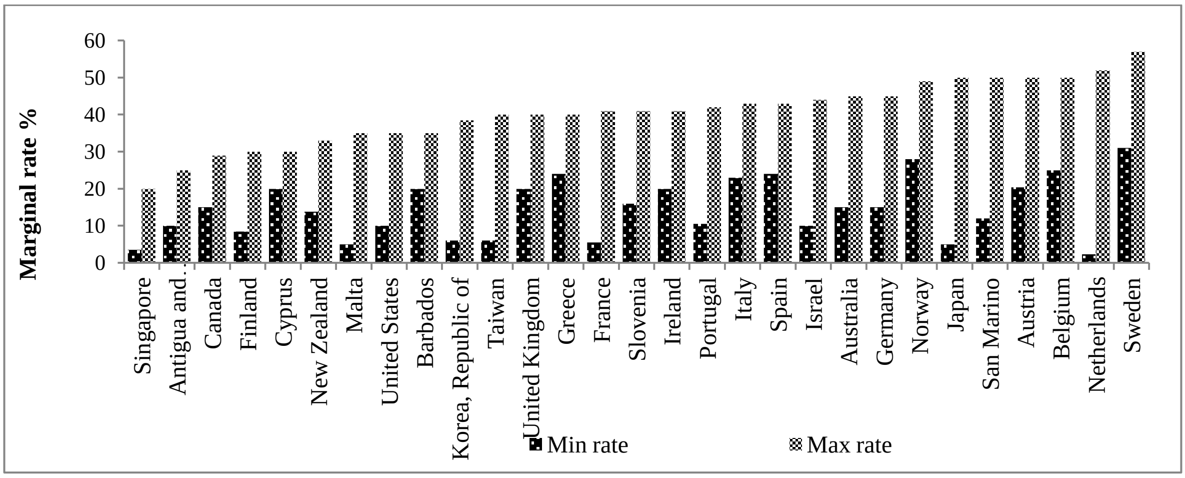
Source: Own calculation

Table 6: Number of taxpayers, taxable income, tax assessed and deadweight loss by population and taxable income group

Taxable income group	Number of taxpayers	Taxable income (R million)	A: Tax paid (R million)	A: DWL (R million)	B: Tax paid (R million)	B: DWL (R million)	C: Tax paid (R million)	C: DWL (R million)	Change Tax B	Change Tax C	Change DWL B	Change DWL C
0 –80 000	2 579 517	136 310	7 988	1 023	8 432	1 154	5 325	424	6%	-33%	13%	-59%
80 001 - 130 000	1 279 451	130 930	17 265	3 328	19 256	5 134	11 034	1 057	12%	-36%	54%	-68%
130 001 - 180 000	655 113	98 507	17 415	4 180	20 544	8 106	10 931	1 449	18%	-37%	94%	-65%
180 001 - 230 000	286 880	57 438	12 188	3 843	14 787	6 614	7 724	1 401	21%	-37%	72%	-64%
230 001 - 300 000	204 966	54 673	13 731	4 711	16 529	6 993	8 972	2 020	20%	-35%	48%	-57%
> 300 000	329 544	193 879	64 244	20 422	74 151	28 196	45 887	9 846	15%	-29%	38%	-52%
Total	5 335 470	671 738	132 832	37 507	153 698	56 198	89 873	16 197	16%	-32%	50%	-57%
Percentage												
0 –80 000	48.35%	20.29%	6.01%	2.73%	5.49%	2.05%	5.93%	2.62%				
80 001 - 130 000	23.98%	20.29%	13.00%	8.87%	12.53%	9.14%	12.28%	6.53%				
130 001 - 180 000	12.28%	20.29%	13.11%	11.14%	13.37%	14.42%	12.16%	8.95%				
180 001 - 230 000	5.38%	20.29%	9.18%	10.25%	9.62%	11.77%	8.59%	8.65%				
230 001 - 300 000	3.84%	20.29%	10.34%	12.56%	10.75%	12.44%	9.98%	12.47%				
> 300 000	6.18%	20.29%	48.36%	54.45%	48.24%	50.17%	51.06%	60.79%				
Total	100%	122%	100%	100%	100%	100%	100%	100%				

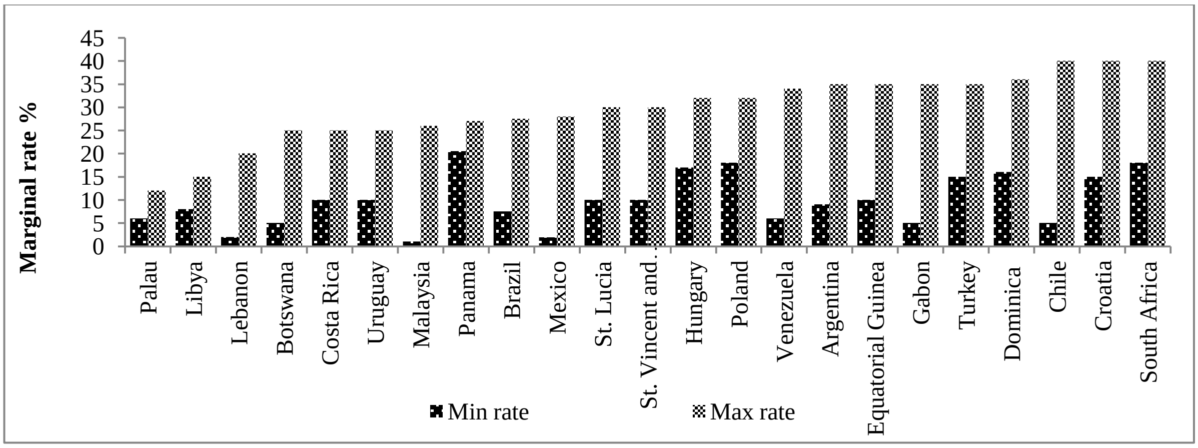
Source: Own calculation

Figure 1: Minimum and maximum marginal tax rates 2010 – High income countries



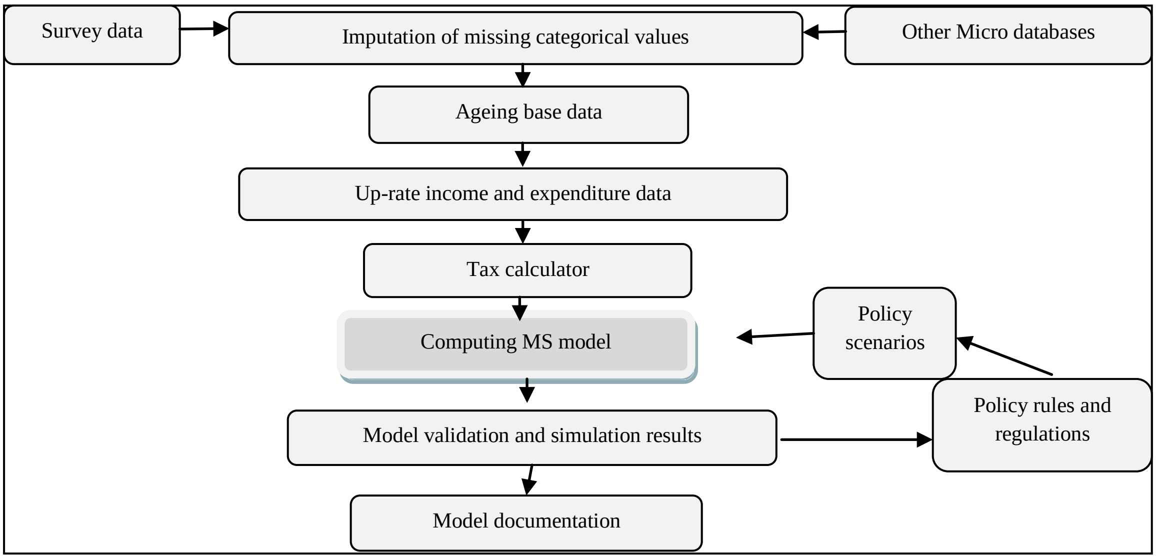
Source: USAID (2011)

Figure 2: Minimum and maximum marginal rates 2010 – Upper-middle income countries



Source: USAID (2011)

Figure 3: Structure of an MS model



Source: Citro *et al*. (1991:2-4)

Figure 4: Calculating individual tax liability

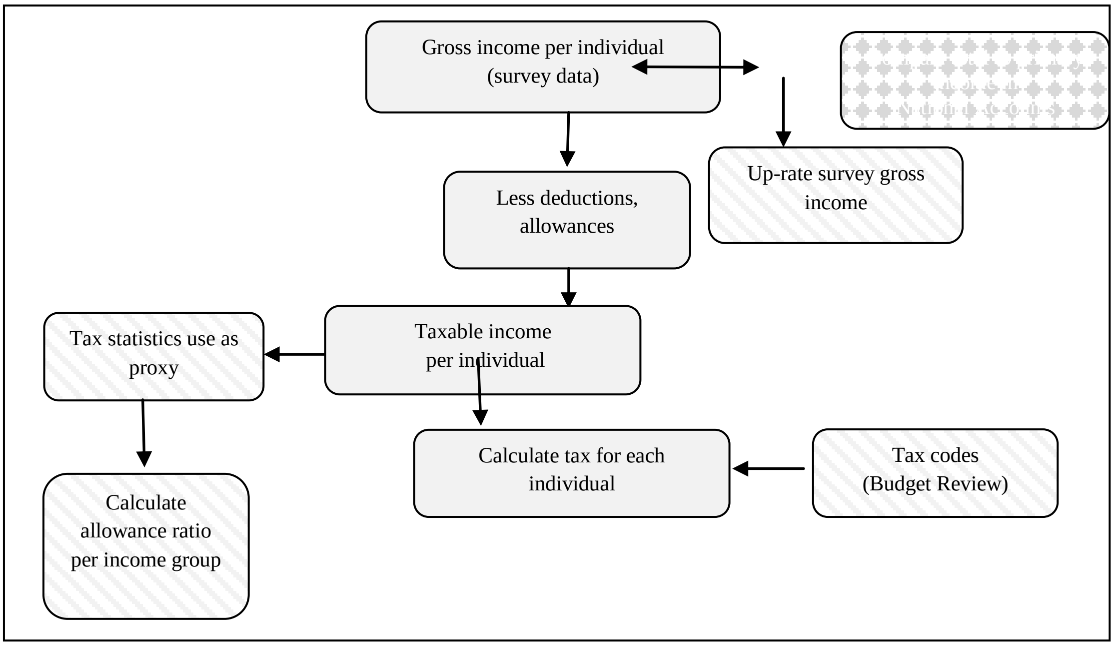
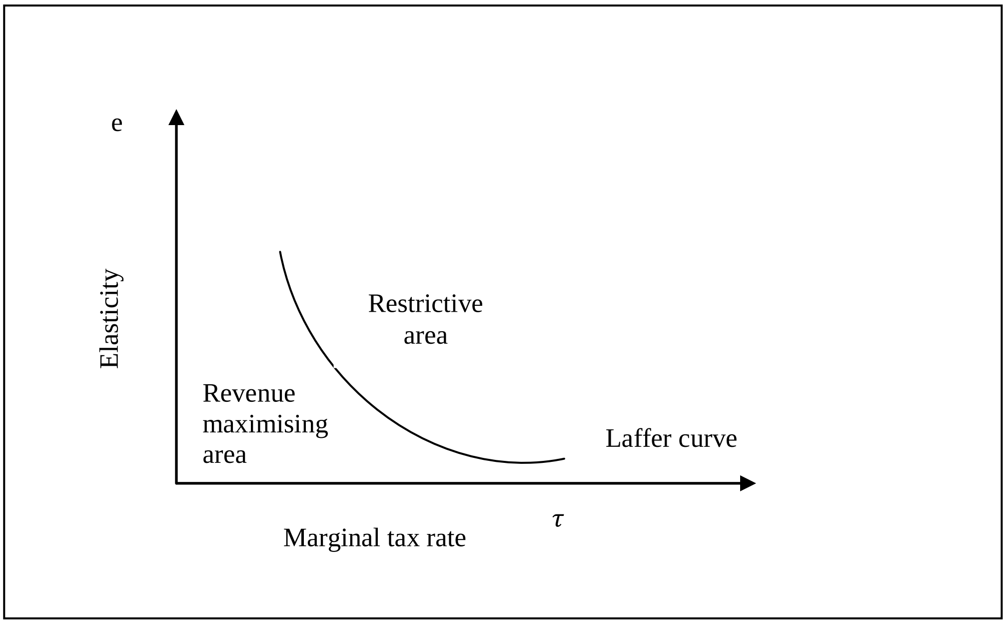
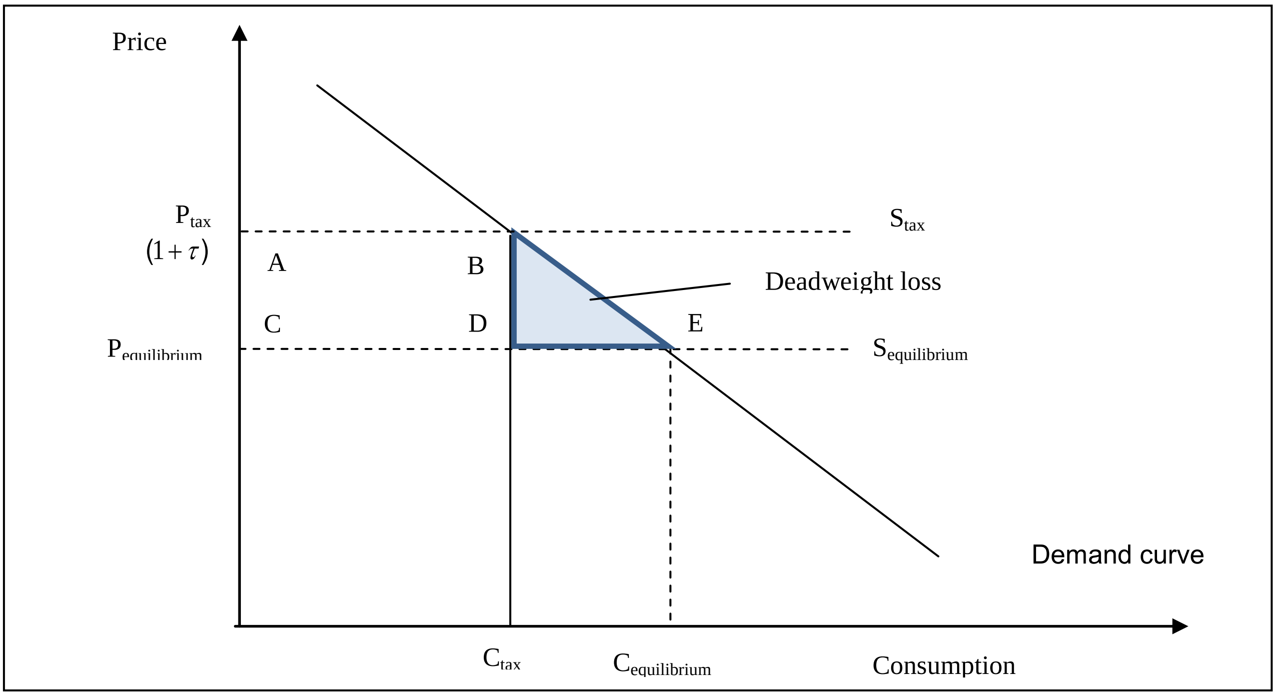


Figure 5: Elasticities and marginal tax rates



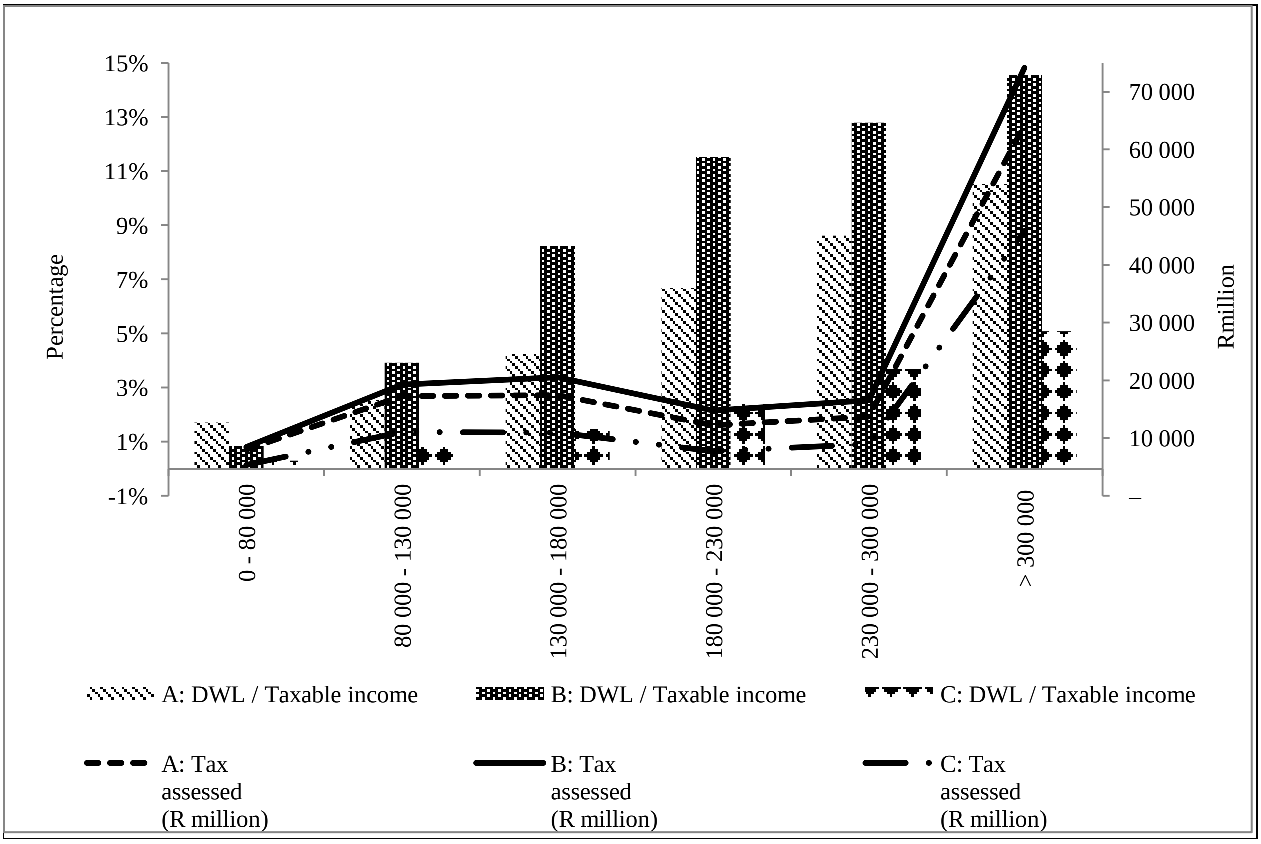
Source: Ballard *et al.* (1985:193)

Figure 6: Deadweight loss area



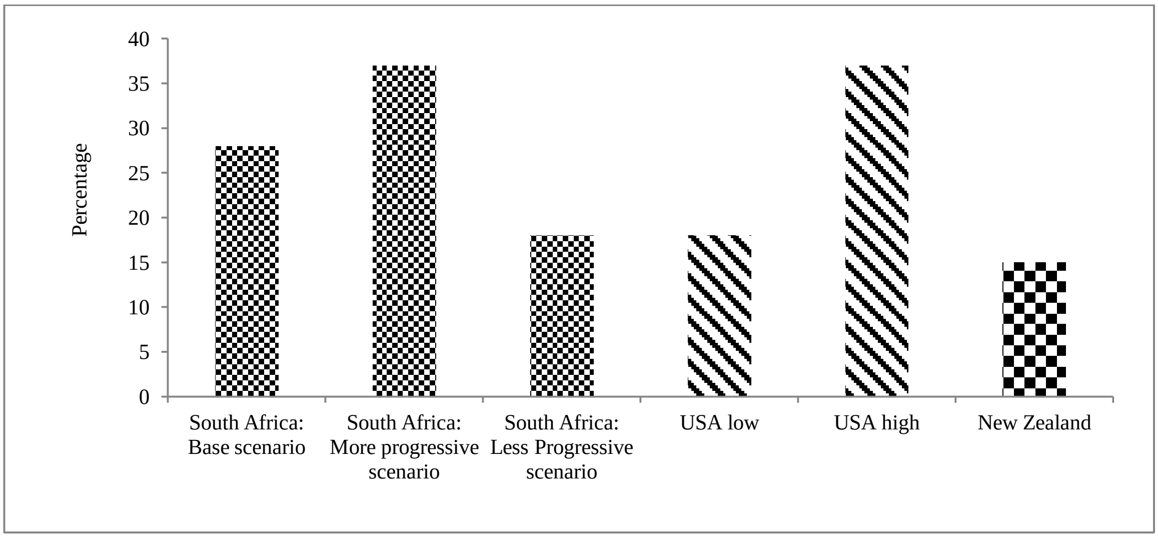
Source: Feldstein (1995:6)

Figure 5: Tax assessed and the deadweight loss



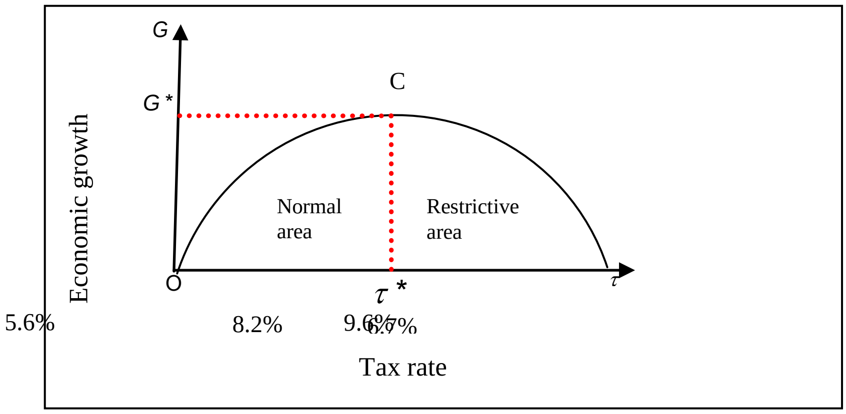
Source: Own calculations

Figure 6: Deadweight loss as a percentage of taxes



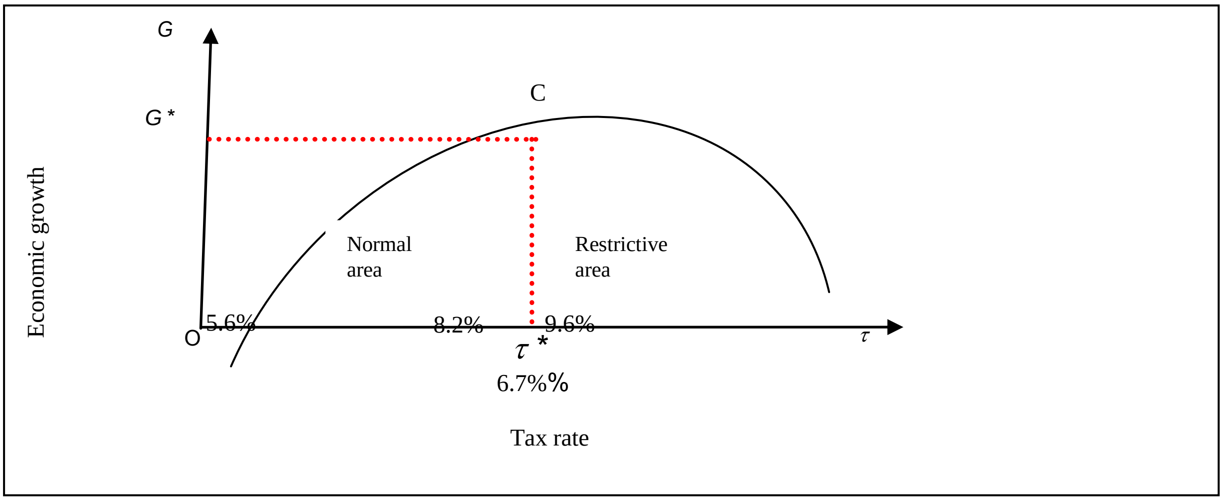
Source: Own calculations

Figure 7: Optimal growth levels



Source: Own calculations

Figure 8: Optimal growth levels



<u>Source:</u> Own calculations