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Elasticity and Buoyancy of Tax Components and Tax Systems in Kenya

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Abstract

This paper examines the elasticity and bouyancy of tax compnents and tax systems in Kenya using time series data. The data used was found to be non-stationary hence runing the first deference, the study found out that a decreasing proportion of incremental income was transferred to the government in the form of taxes, implying that the tax system was less buoyant, it was also found that a decreasing proportion of incremental income was transferred to the government in the form of tax revenues therefore implying that the tax systems in Kenya were inelastic over the study period. This study therefore recommend the reevaluation of the tax modernization strategies as well as streghtening the tax administrative mechanism.

Key words:- Tax, Elasticity, Bouyancy,GDP, Tax Modernization

1.0 Introduction

The amount of government surplus or deficit remains as the most important variable to measure the success of government fiscal policy in a given economy. In many occasions tax system fails to generate sufficient revenue to finance recurrent expenditure hence leading to budget deficits. This could be attributed to lack of responsiveness of tax revenue to changes in national income. Kenya has been experiencing budget deficits even after adoption of Tax Modernization Programme in 1986 and introduction of the Kenya Revenue Authority in 1995. These therefore raise the question of how elastic and buoyant are our tax components and the systems. This paper therefore examines the elasticity and buoyancy of tax components and tax systems in Kenya.

1.1 Trends of moving average tax revenue

Just before Tax Modernization Programme commenced in 1986, in 1985, the tax ratios were relatively low. They rose over the time up to the fiscal year 1994/95, when they again started declining gradually to their lowest levels in the 2000/01 fiscal year and then started rising again.

Total tax revenue from major tax components as a percent of GDP showed fluctuation over the years between 16.07 percent, attained in 2000/01, and 25.10 percent attained in 1994/95 fiscal year. The fiscal years 1998/99 to 2001/02 recorded the lowest tax ratios because of low economic growth rate accessioned by the political pressure in this period. Between 1994/95 and 1997/98 fiscal years, the total tax revenue ratio from major tax components remained high averaging above 22.92 percent of GDP. This was not a very healthy situation because it meant that most of the resources available for private use and for investment were being channeled to the public sector which had proved not to be a good investor. This might have resulted in crowding out of private sector investment leading to a decline in economic growth in the subsequent years.

From the fiscal year 2003/04, the ratio started to rise again. This is the period the NARC regime took power from the KANU regime. At this period the economy was revamping from negative growth to positive growth. And in the same period of the study there was a notable decline in import duties and excise duties. In 1995, the ratio of the excise duty to GDP was highest at 4.51 per cent, the following years the ratio started falling to 3.25 per cent in 2009. In the same period, the ratio of import duty to GDP was highest at 4.27 per cent but since then it has shown a declining trend. In 2009 the ratio was 2.4 per cent. This trend clearly shows that there is a shift away from international trade taxes towards taxes on domestic goods and services.

2.0 Methodology

2.1 Model specification

The productivity of the tax system is determined by applying the concepts of tax buoyancy and elasticity. Assessing tax productivity is important not only because it allows us to examine the responsiveness of the tax system, but also because it affects the system's equity and efficiency effects (Amin, 2000). The income elasticity of a tax can be broken down into tax-to-base and base-to-income elasticities. This implies that the elasticity of a tax is essentially the product of the elastic relative to the base and the elasticity of the base-to-income.

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According to Muriithi and Moyi (2003), the decomposition of elasticity into tax-to-base and base-to-income is useful for two reasons. First, it allows identification of the source of either fast revenue growth or lagging revenue growth. Second, it highlights that component of growth or lagging revenue growth. Second, it highlights that component of growth that is amenable to policy manipulation. For example, while the tax-to-base ratio is within the control of the authorities, the base-to-income lies beyond the scope of control.
Mansfield (1972) assumes a system of *n* taxes to show that the tax revenue-to income elasticity is the weighted sum of the individual tax elasticities. This can be expressed as follows:

Elasticity of total tax revenue to income

$$E_T tY = (\Delta T_t / \Delta Y)(Y / T_t)$$

Elasticity of k^{th} individual tax to income

$$E_T kY = (\Delta T / \Delta Y)(Y / T_k)$$

Elasticity of k^{th} individual tax to base

$$E_T kY = (\Delta T_t / \Delta B_K)(Y / T_k)$$

Elasticity of k^{th} individual base to income

$$E_B kY = (\Delta B_k / \Delta Y_k)(Y / B_k)$$

Where T_t is total revenue, T_k is tax revenue from the k^{th} tax, Y is income measured by gross domestic product, B is the base of the k^{th} tax, and Δ is a discrete change in the variable associated with it.

In a tax system made up of several taxes

$$E_T tY = \frac{T_1}{T_t}\left[\frac{\Delta T_1}{\Delta Y} \times \frac{Y}{T_1}\right] + \ldots\ldots + \frac{T_k}{T_t}\left[\frac{\Delta T_k}{\Delta Y} \times \frac{Y}{T_k}\right] + \ldots\ldots + \frac{T_n}{T_t}\left[\frac{\Delta T_n}{\Delta Y} \times \frac{Y}{T_n}\right] \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The elasticity of total tax revenue to income is equal to the weighted sum of individual tax elasticities, with the functional distribution to total tax by each individual tax serving as its weight. The elasticity of any individual tax can be decomposed into the product of elasticity of the tax to its base and the elasticity of base to income as follows:

$$E_T kY = \left[\frac{\Delta T_k}{\Delta B_k} \times \frac{B_k}{T_k}\right]\left[\frac{\Delta B_k}{\Delta Y} \times \frac{Y}{B_k}\right] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Combination of the equation 1 and 2 yields equation 3 below:

$$E_T kY = \frac{T_1}{T_t}\left[(\frac{\Delta T_1}{\Delta B_1} \times \frac{B_1}{T_1})(\frac{\Delta B_1}{\Delta Y} \times \frac{Y}{B_1}\right] + \ldots\ldots + \frac{T_k}{T_t}\left[(\frac{\Delta T_k}{\Delta B_k} \times \frac{B_k}{T_k})(\frac{\Delta B_k}{\Delta Y} \times \frac{Y}{B_k} + \ldots + \frac{T_n}{T_t}\left[(\frac{\Delta T_n}{\Delta B_n} \times \frac{B_n}{T_n})(\frac{\Delta B_n}{\Delta Y} \times \frac{Y}{B_n}\right]\right]$$

$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

Which is the elasticity of total revenue to income in a system of *n* taxes where elasticity depends on the product of the elasticity of tax to base and the elasticity of base to income for each separate tax, weighted by the importance of each tax in the total tax system, Mansfield concluded that equation 3 can permit identification of sources of revenue growth and identification of that part of revenue growth policy makers can control.

2.2 Estimation procedure

Generally, the elasticity concept assumes the following functional relationship:

$$T^* = \alpha B^{\beta} \varepsilon$$

Where T is tax revenue, B is tax base, α and β are parameters to be estimated, and ε is the multiplicative error term. To convert the model to a linear form we take the logarithms hence having the following equations;-

$$LogT = \log \alpha + \beta \log B + \log \varepsilon$$

The standard form;

$$\log T_t^* = \alpha + \beta \log B_t \upsilon_t$$

β; tax elasticity is defined as the responsiveness of revenue yields to movements in the base.

The proportional adjustment (PA) method of eliminating the discretionary effects from the revenue series was adopted in the study because of its superiority. The method follows the following steps

First compute:

$$T_{tt} = T_t - D_t$$

Where:

T_t = the actual tax yield in the t[th] year

D_t = the budget estimate of the discretionary change(s) in the t[th] year

$T_{t,t}$ = the actual collection of the t[th] year adjusted to the structure of that year.

PA method requires that the revenue yield for each year in the sample period be adjusted to generate a revenue yield based on the structure of a reference year. $T_{t,t}$ are to be converted to the reference year. To obtain the adjusted series for the t[th] year, we multiplied $T_{t,t}$ by the previous year's ratio of the adjusted tax revenue with reference to the base year[2] $(T^*)_{t-1}$ over the actual tax revenue (T_{t-1}), that is,

$$(T^*)_1 = T_{1,1}$$

$$(T^*)_2 = \{(T^*)_1 / T_1\}.T_{2,2}$$

.

.

$$(T^*)_t = \{(T^*)_{t-1} / T_{t-1}\}.T_{t-t}$$

Buoyancy of taxes with respect to their bases was derived by logarithmic regressions of unadjusted revenue data on these bases.

2.3 Data

The study used secondary data obtained from various Kenya Statistical Abstracts and International Financial Statistics (IFS) online database. Time series data of various taxes, total revenue and their bases, GDP deflator and consumer price index for 24 years, was collected from published economic reports. Both dependent and independent variables were converted to real variables, measured in constant (2005) Kenya shillings. Time series data for GDP and its related variables were converted from their nominal values to their real values by dividing nominal values with the GDP deflator using 2005 as the base year. The deflator was chosen because it is the

[2] 2005 was the base year adopted in this study because the prices were deemed stable during the period

most comprehensive price index for GDP and it correctly measures inflation since it amounts to weighted average of the changes in all prices in the economy (Wawire, 2006). Taxes revenues were converted to their real values by dividing their nominal values with the consumer price index (CPI). The CPI was used because it falls on the expenditure side of the GDP equation.

2.4 Stationarity test

The test for stationarity of the data was conducted using the unit root test model, $Y_t = Y_{t-1}\mu_t$ Y_t, where μ_t is the stochastic error term. Augmented Dickey and Fuller test was applied to test the stationarity of the variables. Where the computed t-statistic was greater than critical value at selected level of significance, the null hypothesis was rejected.

2.5 Data Analysis Methods

The tax revenue model for estimating tax buoyancy and tax elasticity used by Muriithi and Moyi (2003) was adopted in this study. To estimate parameters of the model using Ordinary Least Square method, however this study differed from their study in some dimensions. First, this study used data of since 1986 - 2009. Second, nominal figures were converted to real figures, which mean the study applied both the nominal and real and compared the results. Finally this study considered stationarity of a time series data.

Proportional adjustment method which was suggested by Prest (1962) and later described by Mansfield (1972) was adopted in the study. The adjusted data was then be used to estimate the elasticity. Proportional adjustment method was used because a series of discretionary changes taken place during the sample period, 1985/86 to 2009/10. And finally Hypotheses were tested by determining the significance of the regression coefficients[3]

3.0 Discussion of Findings

3.1 Diagnostic Tests of Time Series Properties of the Data

We performed the unit root test in order to test for the time siries properties of the data, following Augmented-Dickey Fuller test. The ADF test results for the variables are presented in table1.1 and 1.2. The test showed that the time series data for all the variables, in nominal terms, were non-stationary at 1%, 5% and 10% confidence intervals. Hence necesitating the need to conduct the test under the fist defference

3.2 Regression results.

The linear regressio results used to test for the hypotheses are as shown in Table 1.3. The elasticity in nominal term of whole tax system is 0.509 with a p-value 0.062 while the buoyancy in nominal term of the whole tax system is 0.525 with a p-value of 0.075. These figures are statistically significant different from 1 at 10 % test level. The difference in percentage points between the buoyancy and tax-to-income elasticity is 0.016. In real term the elasticity and buoyancy of the whole tax system are -0.108 with p- value of 0.402 and 0.261 with p-value of 0.0151 respectively. It is only buoyancy that is statistically significant different from 1 at 1% level of significance. This means the tax system yielded a 0.525% change in tax revenue, as a result of both automatic changes and discretionary policy, for every 1% change in GDP. Thus a decreasing proportion of incremental income was transferred to the government in the form of taxes, implying that the tax system was less buoyant.

All the four major taxes thta is income tax, import duties, excise duties and sales/VAT tax, showed in nominal term an elasticity of approximately 0.525 with an approximate p-value of 0.075. This implies that the elasticity was statistically significant different from 1 at 10% test level.

This result indicate that on overal the elasticity for Kenya's tax system is 0.509. it's on this ground that we can argue that the growth in GDP spurred less then proportionate automatic increase in tax revenue. This implies that the tax system yielded a 0.509% change in tax revenue, resulting from economic activity only, for every 1% change in GDP. Thus, a decreasing proportion of incremental income was transferred to the government in the form of tax revenues, meaning that the tax system in Kenya was inelastic. The overall elasticity of the tax system was as a result of the inelasticity of individual taxes. And finally comparering buoyancy and elasticity estimates

[3] The rule of the thump is;- If the p-value is less than the significance level, the null hypothesis is rejected (if p-value < α, reject the null). If p-value is greater than or equal to the significance level, the null hypothesis is not rejected (if p-value ≥ α, don't reject the null).

reveals the revenue impact of discretionary policy this is becouse buoyancies exceeded the tax-to-income elasticities in all cases. The largest difference between buoyancy and tax-to-income elasticity relates to excise duties.

3.3 Conclusions

From the findings of the study, it can be concluded that the Kenya tax system is neither income elastic nor buoyant. All major tax components in Kenya are inelastic.. Income tax and Excise duties had unity buoyancies over the study period. This disagrees with what Muriithi and Moyi (2003) finding that the two taxes had buoyancies of above 1. From the findings of this study, Import duties are the most buoyant tax component while the Sales tax is least buoyant.

3.4 Recommendations

This study strongly recommend the re-evaluation of the tax modernization issues so as to fill the gaps and finally the tax administrative unit should work on the gaps of inefficiency and block the tax evasion amongst tax payers

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Apendix

Table 1.1: Finding of unit root test for all variables in nominal terms

Variables	Form of test		Test statistic	Critical value			Decision
				1%	5%	10%	
Log nominal GDP	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-1.2685 -2.0600 -3.3730	-3.7497 -3.7667 -3.7856	-2.9969 -3.0038 -3.0114	-2.6381 -2.6417 -2.6454	Accept Accept Reject at 10%
Log nominal total tax revenue	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-1.0761 -3.0389 -3.7917	-3.0867 -2.8472 -3.8572	-3.0199 -3.8304 -3.0400	-2.6502 -3.0294 -2.6608	Accept Accept Reject at 10%
Log nominal Income tax	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-0.7167 -2.6823 -4.1756	-3.7497 -3.7667 -3.7856	-2.9969 -3.0038 -3.0114	-2.6381 -2.6417 -2.6457	Accept Reject at 10% Reject at 1%
Log nominal Import Duties	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-0.8500 -3.4462 -5.5201	-3.7497 -3.7667 -3.7856	-2.9969 -2.6417 -2.6457	-2.6381 -2.6417 -2.6447	Accept Reject at 5% Reject at 1%
Log nominal Sales tax/VAT	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-0.9476 -5.4373 -5.3992	-3.7497 -3.7667 -3.7856	-2.9969 -3.0039 -3.0114	-2.6381 -2.6417 -2.457	Accept Reject at 1% Reject at 1%
Log adjusted nominal total tax revenue	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-0.7894 -3.8241 -4.6234	-3.7497 -3.7667 -3.7856	-2.9969 -3.0038 -3.0114	-2.6381 -2.6417 -2.6457	Accept Reject at 1% Reject at 1%
Log adjusted nominal Income tax	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-0.7949 -3.0389 -4.0719	-3.7497 -3.7667 -3.7856	-2.9969 -3.0038 -3.0114	-2.6381 -2.6417 -2.6457	Accept Reject at 5% Reject at 1%
Log adjusted nominal Import duties	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-0.7949 -3.0389 -4.1719	-3.7497 -3.7667 -3.7856	-2.9967 -3.0038 -3.0114	-2.6381 -2.6417 -2.6457	Accept Reject at 5% Reject at 1%
Log adjusted nominal Excise duties	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-1.0761 -2.8473 -3.7917	-3.8067 -3.8304 -3.8572	-3.0199 -3.0294 -3.0400	-2.6502 -2.6552 -2.6608	Accept Reject at 10% Reject at 5%
Log adjusted nominal Sales tax/VAT	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-0.7949 -3.0389 -4.0719	-3.7497 -3.7667 -3.7856	-2.9969 -3.0038 -3.0114	-2.6381 -2.4617 -2.6457	Accept Reject at 5% Reject at 1 %
Log nominal domestic factor income	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-1.1657 -2.7484 -4.009	-3.7497 -3.7667 -3.7856	-2.9969 -3.0038 3.0114	-2.6381 -2.6417 -2.6457	Accept Reject at 10% Reject at 1%
Log nominal total imports	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-0.5996 -1.7234 -1.9780	-2.6700 -2.6756 -2.6819	-1.9566 -1.9574 -1.9583	-1.6235 -1.6238 -1.6242	Accept Reject at 10% Reject at 5%
Log nominal private consump-tion	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-1.3915 -2.9964 -3.9651	-3.7497 -3.7667 -3.7856	-3.9969 -3.0038 -3.0114	-2.6381 -2.6417 -2.6457	Accept Reject at 5% Reject at 1%

Source: Research data (2011)

Note: $1^{st}\Delta$ mean first difference

$2^{nd}\Delta$ mean second difference

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Table 1.2: Finding of unit root test for all variables in real terms

Variables	Form of test		Test statistic	Critical value 1%	5%	10%	Decision
Log real GDP	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-0.5064 -3.0411 -3.7665	-3.8067 -3.8304 -3.8572	3.0199 -3.0294 -3.0400	-2.6502 -2.6552 -2.6608	Accept Reject at 5% Reject at 5%
Log real total tax revenue	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-3.7507 -4.5235 -4.4197	-3.8067 -3.8304 -3.8572	-3.0199 -3.0294 -3.0400	-2.6502 -2.6552 -2.6608	Reject at 5% Reject at 1% Reject at 1%
Log real Income tax	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-2.0803 -3.3953 -3.9221	-3.8067 -3.8304 -3.8572	-3.0199 -3.0294 -3.0400	-2.6502 -2.6552 -2.6608	Accept Reject at 5% Reject at 1%
Log real Import Duties	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-2.5997 -2.9114 -3.9498	-3.8067 -3.8304 -3.8572	-3.0199 -3.0294 -3.0400	-2.6500 -2.6552 -2.6608	Accept Reject at 10% Reject at 1%
Log real Sales tax/VAT	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-2.6739 -4.1856 -4.6452	-3.8067 -3.8304 -3.8572	-3.0197 -3.0294 -3.0400	-2.6502 -2.6552 -2.6608	Reject at 10% Reject at 1% Reject at 1%
Log real Excise duties	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-1.5226 -4.7200 -8.0029	-3.8067 -3.8304 -3.8572	-3.0199 -3.0294 -3.0400	-2.6502 -2.6552 -2.6608	Accept Reject at 1% Reject at 1%
Log adjusted real total tax revenue	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-3.2545 -4.2066 -3.3137	-3.8067 -3.8304 -3.8572	-3.0199 -3.0294 -3.0400	-2.6502 -2.6552 -2.6608	Reject at 5% Reject at 1% Reject at 5%
Log adjusted real Income tax	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-3.7506 -4.5235 -4.4197	-3.8067 -3.8304 -3.8572	-3.0197 -3.0294 -3.0400	-2.6502 -2.6552 -2.6608	Reject at 5% Reject at 1% Reject at 1%
Log adjusted real Import duties	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-3.7506 -4.5235 -4.4197	-3.8067 -3.8304 -3.8572	-3.0197 -3.0294 -3.0400	-2.6502 -2.6552 -2.6608	Reject at 5% Reject at 1% Reject at 1%
Log adjusted real Excise duties	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-3.7506 -4.5235 -4.4197	-3.8067 -3.8304 -3.8572	-3.0197 -3.0294 -3.0400	-2.6502 -2.6552 -2.6608	Reject at 5% Reject at 1% Reject at 1%
Log adjusted real Sales tax/VAT	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-3.7506 -4.5235 -4.4197	-3.8067 -3.8304 -3.8572	-3.0197 -3.0294 -3.0400	-2.6502 -2.6552 -2.6608	Reject at 5% Reject at 1% Reject at 1%
Log real domestic factor income	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-0.3183 -2.9217 -4.0339	-3.8067 -3.8304 -3.8572	-3.0199 -3.0294 -3.0400	-2.6502 -2.6552 -2.6608	Accept Reject at 10% Reject at 1%
Log real private consumption	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-0.7892 -3.1291 -4.4351	-3.8067 -3.8304 -3.8572	-3.0199 -3.0294 -3.0400	-2.6502 -2.6552 -2.6608	Accept Reject at 5% Reject at 1%
Log real total imports	ADF	Level $1^{st}\Delta$ $2^{nd}\Delta$	-0.6997 -3.2592 -4.1576	-3.8067 -3.8304 -3.8572	-3.0199 -3.0294 3.0400	-2.6502 -2.6552 -2.6608	Accept Reject at 5% Reject at 1

Source: Research data (2011)
Note: $1^{st}\Delta$ mean first difference
$2^{nd}\Delta$ mean second difference

Table 1.3: Elasticity of tax revenue both in nominal and in real terms, 1985-2009

Type of tax	Tax-to-income elasticity	t-ratio	p-value	Buoyancy	t-ratio	p-value	Difference^{A}
Income tax	$0.525^{\Delta n}$	1.871	0.075	$0.5958^{\Delta n}$	1.541	0.138	0.475
	0.238^{r}	2.659	0.015	0.419^{r}	3.149	0.0005	0.181
Import duties	$0.525^{\Delta n}$	1.871	0.075	$1.572^{\Delta n}$	3.634	0.0015	1.047
	0.238^{r}	2.659	0.015	-0.535^{r}	-3.110	0.006	-0.773
Excise duties	$0.525^{\Delta n}$	1.871	0.075	$0.528^{\Delta n}$	1.023	0.317	0.475
	0.238^{r}	2.659	0.015	1.376^{r}	4.360	0.0003	1.138
Sales/VAT	$0.525^{\Delta n}$	1.871	0.075	0.879^{n}	29.728	0.0000	0.348
	0.238^{r}	2.659	0.015	-0.0414^{r}	-0.193	0.852	0.279
Overall tax	$0.509^{\Delta n}$	1.966	0.062	$0.525^{\Delta n}$	1.871	0.075	0.016
	-0.108^{r}	-0.859	0.4002	0.261^{r}	2.659	0.0151	0.369

Source: Research data 2011

Note: Δn: Indicates that the index was obtained after differencing nominal figures, r: indicates results in real term. A: Gives the difference in percentage points between the buoyancy and tax-to-income elasticity.