



## THE EXISTENCE OF REVENUE GAP IN SOUTH AFRICA

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### Abstract:

*The paper provides an empirical analysis of the macroeconomic factors that enhance revenue gap in South Africa using the multivariate cointegration techniques for the period 1965 to 2012. The results from the cointegration analysis indicate that the revenue gap in South Africa is negatively associated with the level of imports while positively related to external debt and underground economy. The former finding is consistent with the notion that imports are subjected to more taxation than domestic activities because of certain features of international trade that tend to make tax evasion difficult. On the other hand, the positive relationship between external debt and tax gap shows that the South African government relies upon external debt to finance its budget deficit resulting from missing revenues. Furthermore, the observed negative effect of the post-apartheid dummy confirms that the tax policy reforms that South Africa introduced following the liberation in 1994 have led to a reduction in missing revenues. The results from the Granger causality test also show that there is a unidirectional causality running from imports and underground economy to revenue gap, while revenue gap on the other hand is found to Granger-cause national income and external debt in South Africa.*

**Key words:** revenue gap, tax gap, underground economy, cointegration, South Africa

### 1. Introduction

The tax policy objectives of the South African government following liberation in 1994 have centered on curbing tax evasion, promoting greater compliance and ensuring equitable tax regime (AfDB, 2010). This is so because the government generally relies on tax revenues to run its budgets and finance its expenditures. Nevertheless, the collected revenues from the taxes are sometimes lower than what is expected and such a difference could be attributed to the missing revenues, which are normally defined as revenue or tax gap (Siddiqi and Ilyas, 2011). In the literature, there are several factors highlighted that can either enhance or discourage the existence of revenue gap. For instance, Rimmer (2010) argues that factors such as high tax rates,

corruption and complexity of tax policy are positively related to the missing revenues since they promote tax avoidance. On the other hand, measures that discourage tax evasion, which include public trust, regulation and effective administration, are considered to lead to a reduction in tax gap. The evidence on the effects of some of these institutional and economic policy factors is offered by the work of Palil and Mustapha (2011) on tax compliance within the Asian and European countries and by that of Chaudhry and Munir (2010) on tax revenue performance in Pakistan.

Pyle (1989) further suggests that revenue gap can be influenced by the shadow or underground economy, which refers to all the economic activities that escape official statistics and hence remain untaxed by the government. Apart from the shadow economy, there are other macroeconomic factors such as the level of economic growth, imports and external debt as well as inflation and unemployment rates that can either have positive or negative effects on the missing revenues (Salar et al., 2013). For example, the theory postulates that there is a negative relationship between the level of economic growth and revenue gap. This is because economic growth leads to economic development, which results not only in a greater capacity for both individuals and firms to pay taxes, but also for the government to levy and collect taxes. Furthermore, the link between imports and tax gap is expected to be negative since some features of international trade such as specific entry and exit points tend to make tax evasion difficult and as a result, imports are subjected to more taxation than domestic activities.

Conversely, a positive relationship is assumed between revenue gap and external debt due to the fact that missing revenues can increase the country's dependence on external debt in order to finance the government budget. Inflation is also expected to be positively associated with tax gap and in the presence of high inflation rates, governments may face budget deficits due to missing revenues resulting from rising tax burden. Alternatively, the effect of unemployment on revenue gap is ambiguous since rising unemployment levels can either lead to an increase or a decrease in tax evasion. Tax gap, on the other hand, can hinder economic growth by creating shadow economy and resulting in high levels of inflation, unemployment and budget deficits. The studies by Salar et al. (2013), Siddiqi and Ilyas (2011), and Mazhar and Pierre-Guillaume (2011) thus provide supporting empirical evidence on the relationship between revenue gap (or tax burden) and some of its aforementioned macroeconomic determinants.

Although some empirical studies have analysed the relationship between missing revenues and its macroeconomic factors in other emerging countries, the South African experience on the subject is much less well researched. It is therefore the object of this paper to determine the macroeconomic factors that enhance revenue gap in South Africa using the multivariate cointegration techniques for the period 1965-2012. The study contributes to the empirical literature on the determinants of missing revenues in emerging economies using South Africa as a case study. The rest of the paper is then structured as follows. Section 2 specifies the model while section 3

presents the estimation strategy. The results and their analysis are reported in section 4 and section 5 offers the concluding remarks.

## 2. Model Specification

The paper follows the work of Sookram and Watson (2005) as well as Salar et al. (2013) to analyse the macroeconomic factors that enhance tax gap in South Africa. The model of revenue gap ( $RGP$ ) is then specified as a function of national income ( $GDP$ ), imports ( $IMP$ ), external debt ( $DBT$ ), unemployment ( $UMP$ ), inflation ( $INF$ ) and underground economy ( $UGE$ ) as follows:

$$\ln(RGP) = \beta_0 + \beta_1 \ln(GDP) + \beta_2 \ln(IMP) + \beta_3 \ln(DBT) + \beta_4 \ln(UMP) + \beta_5 \ln(INF) + \beta_6 \ln(UGE) + \beta_7 D1994 + \varepsilon \quad (1)$$

where  $\varepsilon$  is the error term, the  $\beta$ 's are parameters to be estimated and  $D1994$  is a dummy variable for the post-apartheid period (equal to 1 from the year 1994 when apartheid was abolished and 0 otherwise). The post-apartheid dummy captures the impact of the tax policy reforms introduced following the liberation in 1994, which have an important bearing on revenue gap. These reforms include the recommendations made by the Katz Commission, which focused on the following main sources of tax revenue in South Africa: personal income tax, corporate income tax, value-added tax and capital gains tax, and other measures that aligned South Africa's tax policies with modern international best practices (see AfDB, 2010).

The sign of the coefficient  $\beta_1$  on income ( $GDP$ ) in equation (1) is expected to be negative and the same sign is expected for the coefficient  $\beta_2$  on imports ( $IMP$ ). The coefficients  $\beta_3$ ,  $\beta_5$  and  $\beta_6$  on external debt ( $DBT$ ), inflation ( $INF$ ) and underground economy ( $UGE$ ), respectively, are expected to have a positive sign while the expected sign of the coefficient  $\beta_4$  on unemployment is ambiguous. The coefficient  $\beta_7$  on post-apartheid dummy ( $D1994$ ) is expected to have a negative sign, which will imply that the tax policy reforms introduced following the liberation in 1994 have led to a reduction in the missing revenues by curbing tax evasion and promoting greater compliance with the tax laws.

## 3. Estimation Strategy

The Johansen's (1988, 1995) multivariate cointegration technique is used to estimate equation (1) since it performs better in terms of determining the long-run relationship among variables with the same order of integration. The augmented Dickey Fuller (ADF) test is first used to ascertain the presence of unit root among the series (Dickey and Fuller, 1979, 1981). If the series are integrated of the same order, that is,  $I(1)$ , the maximum likelihood estimation of the following unrestricted vector autoregression (VAR) model is undertaken to determine the existence of cointegrating relationships:

$$X_t = \mu + \sum_{k=1}^p \Pi_k X_{t-k} + \psi Z + \varepsilon_t. \quad (2)$$

Given that  $X$  is non-stationary and has to be differenced in order to become stationary, equation (2) can be written in error-correction form as follows:

$$\Delta X_t = \mu + \sum_{k=1}^{p-1} \Gamma_k \Delta X_{t-k} + \Pi X_{t-1} + \psi Z + \varepsilon_t. \quad (3)$$

where  $X_t$  is a 6 by 1 vector containing revenue gap ( $RGP$ ), national income ( $GDP$ ), imports ( $IMP$ ), external debt ( $DBT$ ), inflation ( $INF$ ) and the underground economy ( $UGE$ ), all at time period  $t$ .  $\mu$ ,  $\Gamma_k$  and  $\psi$  are parameters to be estimated,  $p$  is the lag length,  $\Pi$  is a matrix of the long-run parameters,  $Z$  is a matrix containing a dummy variable and  $\varepsilon_t$  is a vector of white noise errors. The appropriate lag length  $p$  is then selected on the basis of the information criterion and the trace and maximum eigenvalue statistics are employed to establish the cointegrating rank. If there is cointegration, the matrix  $\Pi$  will have a rank of  $r$  and it can be decomposed as  $\Pi = \alpha\beta'$ , where  $\alpha$  is a 6 by 1 matrix of the adjustment coefficients and  $\beta$  is a 6 by 1 matrix of the coefficients in the cointegrating relationship. Finally, the Engle and Granger (1987) causality test within the vector error-correction model (VECM) is applied to investigate the causal relationship between the endogenous variables included in the model.

## 4. Estimation Results

### 4.1. Data Description

The paper employs annual time-series data for the period 1965 to 2012. The data on national income ( $GDP$ ), imports ( $IMP$ ), external debt ( $DBT$ ), inflation ( $INF$ ) and tax revenue is obtained from the South African Reserve Bank (SARB), with real variables being expressed in 2005 constant prices. On the other hand, the data on underground economy ( $UGE$ ), covering the period 1965-2002, is taken from Embaye (2007), who estimated the underground economy in South Africa using the currency demand approach. The forward interpolation technique is then employed in this study to obtain the missing values of underground economy for the period 2003-2012. In line with Jayasinghe (2007), revenue gap ( $RGP$ ) is calculated as an interaction of the size of underground economy (as a fraction of  $GDP$ ) and the total tax revenue. However, the variable for unemployment ( $UMP$ ) is not included in the estimations of this study due to lack of reliable data.

## 4.2. Unit Root Test Results

The paper applies the ADF unit root test to ascertain the order of cointegration of the variables and the optimal lag length for each series is selected on the basis of the Akaike information criterion (AIC). The null hypothesis states that the series is non-stationary and failure to reject the null indicates that there is a unit root. The results for unit root test in both levels and first differences are reported in Table 1 and based on the  $p$ -values, all variables are integrated of order one or  $I(1)$  at 1% level of significance. This implies that the long-run relationship might exist between revenue gap, national income, imports, external debt, inflation and the underground economy.

**Table 1:** Augmented Dickey-Fuller (ADF) unit root tests

Variable	$H_0$ : non-stationary in levels		$H_0$ : non-stationary in first differences	
	Test statistic	$p$ -value	Test statistic	$p$ -value
<i>RGP</i>	-1.099	0.708	-7.110	0.000
<i>GDP</i>	-1.117	0.701	-4.483	0.001
<i>IMP</i>	-1.199	0.668	-6.075	0.000
<i>DBT</i>	-0.989	0.750	-4.708	0.000
<i>INF</i>	-2.245	0.194	-4.884	0.000
<i>UGE</i>	-0.381	0.904	-6.368	0.000

**Notes:** All variables are in logarithmic form.

## 4.3. Cointegration Test Results

Given that the variables are found to be integrated of the same order, the Johansen multivariate cointegration procedure is employed to determine the presence of long-run cointegrating relationship among them. The specification of the optimal lag length by the AIC is 2 and Table 2 presents the cointegration test results, with the trace statistic confirming the existence of cointegration among the variables.

**Table 2.** Cointegration test results

Maximum rank	Eigenvalue	Trace statistic	0.05 critical value
0	0.765	178.66	103.85
1	0.619	113.57	76.97
2	0.490	70.17	54.08
3	0.424	39.87	35.19
4	0.207	15.08	20.26

Table 3 then provides the results for the estimated parameters of the normalised cointegrating equation together with their adjustment coefficients from the unrestricted VECM. The Lagrange multiplier (LM) and the Jarque-Bera diagnostic

tests, given at the bottom of the table, indicate that the residuals are approximately white noise at the 5% significance level. The results also show that all the coefficients have the expected signs as suggested by the theory, but only the coefficients of imports, external debt and the post-apartheid dummy are found to be statistically significant at the 5% level. Nevertheless, the estimates of the adjustment parameters for imports, inflation and the underground economy are highly insignificant and as a result, the model is re-estimated with the restrictions of weak exogeneity on these variables.

**Table 3.** Estimation results from the unrestricted VECM

Variables	<i>RGP</i>	<i>GDP</i>	<i>IMP</i>	<i>DBT</i>	<i>INF</i>	<i>UGE</i>	<i>D1994</i>
$\beta$	1.000	0.881	1.823	-1.186	-0.172	-0.725	0.136
	-	(0.505)	(2.486)	(-7.967)	(-0.489)	(-0.914)	(3.051)
$\alpha$	-0.141	-0.012	-0.010	0.081	-0.001	-0.016	-
	(-4.736)	(-2.766)	(-0.452)	(1.253)	(-0.008)	(-0.727)	-

LM-statistic (12 lags) =38.88 [0.341]

Jarque-Bera statistic (with 12 degrees of freedom) =20.44 [0.059]

**Notes:** *t*-statistics in parentheses and *p*-values in square brackets; *D1994* dummy is placed in the table for convenience and the sign of its coefficient and *t*-statistic is taken as positive, but it is actually negative.

The estimated results from the restricted VECM are reported in Table 4 and the diagnostic tests still suggest that the errors are approximately white noise. Furthermore, the *p*-value for the chi-square test justifies that imports, inflation and underground economy are weakly exogenous at the 5% significance level. The adjustment coefficient on revenue gap also has the appropriate sign and it is statistically significant. Therefore, about 12% of disequilibria from the shocks in the previous year converge to the long-run equilibrium in the current year.

**Table 4.** Estimation results from the restricted VECM

Variables	<i>RGP</i>	<i>GDP</i>	<i>IMP</i>	<i>DBT</i>	<i>INF</i>	<i>UGE</i>	<i>D1994</i>
$\beta$	1.000	1.139	1.986	-1.308	-0.158	-1.102	0.143
	-	(0.597)	(2.472)	(-8.033)	(-0.410)	(-1.270)	(3.042)
$\alpha$	-0.116	-0.010	-	0.076	-	-	-
	(-5.492)	(-3.063)	-	(1.313)	-	-	-

$\chi^2(1)$  =1.022 [0.796]

LM-statistic (12 lags) =38.63 [0.351]

Jarque-Bera statistic (with 12 degrees of freedom) =20.93 [0.051]

**Notes:** *t*-statistics in parentheses and *p*-values in square brackets; *D1994* dummy is placed in the table for convenience and the sign of its coefficient and *t*-statistic is taken as positive, but it is actually negative.

The overall results are again consistent with theory and the coefficient of the underground economy, which shows a positive association between revenue gap and the shadow economy, has become marginally significant. This could therefore imply that the South African revenue gap expands with the increasing value of all economic activities that escape official statistics and remain untaxed by the government. This argument is affirmed by similar findings from Salar et al. (2013) and Lacko (1999) concerning other emerging economies. On the other hand, the observed negative and significant relationship between imports and revenue gap renders support to the idea that imports are subjected to more taxation than domestic activities because of certain features of international trade such as specific entry and exit points, which tend to make tax evasion difficult (see Sookram and Watson, 2005). Thus, the increasing volume of imports in South Africa seems to result in a fall in missing revenues.

Alternatively, the positive and significant relationship between revenue gap and external debt implies that the South African government depends on external debt in order to finance the budget deficit resulting from missing revenues. The similar result is reported by Salar et al. (2013) in the case of an emerging economy, Pakistan. On the other hand, a negative and significant sign of the post-apartheid dummy confirms that the tax policy reforms that South Africa introduced following the liberation in 1994 have led to a reduction in missing revenues by curbing tax evasion and promoting greater compliance with the tax laws.

#### 4.4. Granger Causality Test Results

The Granger causality test within the VECM is conducted to investigate all the possible causal effects among variables of interest. The results, reported in Table 5, reveal that imports and underground economy Granger-cause revenue gap, while revenue gap is found to Granger-cause national income and external debt. Furthermore, the results show a unidirectional causality running from imports, external debt and underground economy to national income, and from external debt and underground economy to imports. Underground economy is also found to Granger-cause external debt, while on the other hand, no causality is observed between inflation and the rest of the variables.

**Table 5.** Granger causality test results

Variable	$\Delta RGP$	$\Delta GDP$	$\Delta IMP$	$\Delta DBT$	$\Delta INF$	$\Delta UGE$
$\Delta RGP$	-	6.419**	1.383	6.846**	3.843	0.535
$\Delta GDP$	3.173	-	1.084	0.641	1.914	1.519
$\Delta IMP$	4.648*	13.69***	-	0.255	2.007	1.855
$\Delta DBT$	3.761	7.567**	5.809*	-	2.450	0.339
$\Delta INF$	1.008	0.456	2.684	0.896	-	0.000
$\Delta UGE$	6.505**	5.369*	6.590**	5.105*	2.311	-

**Notes:** Wald statistics are reported; first row (column) represents the dependent (independent) variables; \*\*\* significance at 1%; \*\* significance at 5%; \* significance at 10%.

## **5. Conclusion**

The paper provides an empirical analysis of the macroeconomic factors that enhance revenue gap in South Africa using the multivariate cointegration techniques for the period 1965 to 2012. The results from the cointegration analysis indicate that the revenue gap in South Africa is negatively associated with the level of imports while positively related to external debt and underground economy in the long-run. The former finding is consistent with the notion that imports are subjected to more taxation than domestic activities because of certain features of international trade such as specific entry and exit points, which tend to make tax evasion difficult. On the other hand, the positive relationship between external debt and tax gap shows that the South African government relies upon external debt in order to finance its budget deficit due to missing revenues. Furthermore, the observed negative effect of the post-apartheid dummy confirms that the tax policy reforms that South Africa introduced following the liberation in 1994 have led to a reduction in missing revenues by curbing tax evasion and promoting greater compliance with the tax laws. The results from the Granger causality test also show that there is a unidirectional causality running from imports and underground economy to revenue gap, while revenue gap on the other hand is found to Granger-cause national income and external debt in South Africa.

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