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Cyclicality of Revenue and Structural Balances in South Africa

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Abstract

This paper applies a disaggregated method for the calculation of the cyclical component of the budget balance for South Africa with an emphasis on the effect of commodity and asset prices, and credit cycle. Results show that the cyclicality of tax revenue is mostly explained by the variation in output gap. Change in the credit to private sector also has some affect on the revenue performance; however, asset and commodity prices are not significant in explaining the deviation of revenue from its trend. Nonetheless, quantitative effects of these prices are subject to assumptions used for long-run price levels.

JEL Classification Numbers: C32, C50, E32

Keywords: South Africa, Structural Balance, Credit Growth, Commodity and Asset Prices

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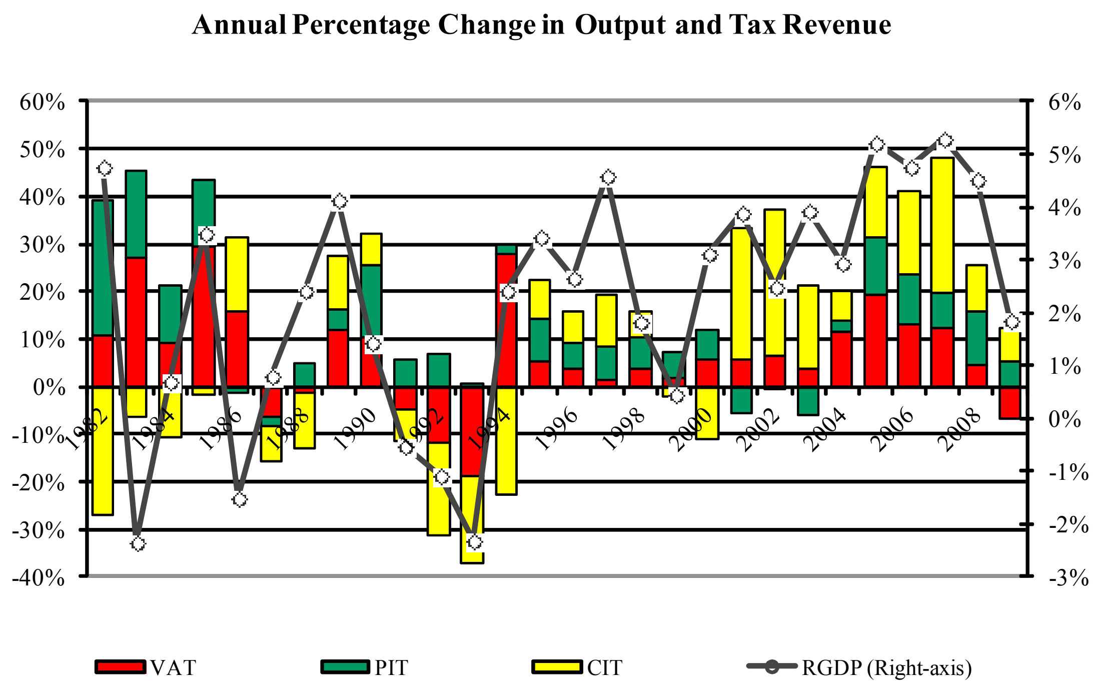
I. INTRODUCTION

This paper applies a disaggregated method for the calculation of the cyclical component of the budget balance for South Africa. In our methodology, we estimate the cyclically adjusted budget balance with an emphasis on the effect of commodity and asset prices and the credit cycle[1]. We describe quantitatively the effect of the business cycle and the changes in the commodity and asset prices and credit growth to fiscal revenue generation in South Africa.

Cyclical balances are estimated in order to net-out the impact of the economic cycle from tax revenues since tax revenue is highly correlated with the business cycle. During economic upturns tax revenues increase due to positive improvements in the supply side—such as through higher corporate and personal income taxes—and demand side, such as higher tax revenue collected on goods and services (Figure 1). Similarly, government expenditure would be lower on cyclical accounts such as unemployment benefits.

Figure 1. Tax Revenue and Business Cycle



Note: Percent changes are estimated in fiscal year; x-axis labels indicate the fiscal year ending March of that year.

There are various advantageous of cyclical adjustment. First, cyclically adjusted balances better reflect the medium-term fiscal outlook. Second, for countries that target cyclically

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[1] In this paper we use structural and cyclically adjusted balances as two interchangeable terms.

adjusted balances, they can apply and benefit from countercyclical policies, such as increased fiscal space to reduce a country's need for foreign financing and to sustain spending on social policies.

On the other hand, one should mention that there are some caveats in using cyclically adjusted balances. First, cyclical adjustment relies on potential/trend level estimates for output and tax-bases. As in any statistic, calculation of a potential level contains an estimation bias, and the estimated structural balance deviates from the true structural balance as the bias in the estimated potential increases. Second, there is a bias in the estimate of the elasticity of tax revenue to the deviations in the business cycle, commodity and asset prices and credit cycle. This bias would also cause a deviation between the true and the estimated values of the cyclically adjusted balance.

This paper studies the impact of the business cycle in South Africa's tax revenue collection together with the impact of the commodity and asset prices, and the credit cycle. We analyze the impact of the commodity prices on revenue collection due to the significant share of mining exports in total exports[2]. Mining sector constituted around 30 percent of total exports in South Africa during the late 2000s, and this share was more than 50 percent during the early 1990s.

We consider the impact of the asset prices on revenue collection due its direct impact—such as through capital gains tax collection—and its indirect effect, such as via altering the consumption and investment behavior of firms and households. Additionally, similar to the global trend experienced during the 2000s, South Africans enjoyed double digit growth rates in various asset prices. House prices on average increased by more than 15 percent, and the Johannesburg Stock Index increased by more than 35 percent per annum during the 2005-08 period.

Last, we measure the impact of the credit cycle on tax revenue performance, due its likewise asset price influence on the saving-investment behavior. Also, South Africans access to bank credit increased significantly during the 2000s. Bank credit extended to the private sector grew on average around 20 percent per annum during the mid-2000s.

Results of this paper show that the cyclicality of tax revenue is mostly explained by the variation in the output gap. Change in the credit to private sector also affects the revenue performance. On the other hand, impact of asset and commodity prices is not significant in explaining the deviations of revenue from its trend. However, one should mention that the quantitative effect of these prices is subject to the assumptions used for long-run price levels[3].

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[2] However, one should note that the share of mining revenue in total tax revenue is quite limited.

[3] Fluctuations in commodity and asset prices are measured as the deviation of these prices from their long-term levels.

In what follows Section II provides the literature review. Section III presents the data. Section IV provides the model, and presents the results of this model. Section V discusses some of the caveats in this methodology and Section VI concludes.

II. Literature

The literature on estimating structural balances is vast. Various institutions including the International Monetary Fund (IMF), European Central Bank (ECB) and Organization for Economic Co-operation and Development (OECD), as well as the National Treasuries of many countries published papers on structural budget balance estimates.

Researchers in this literature focused on methodologies to estimate the cyclical adjustment either for the aggregate revenue or for the disaggregated revenue by measuring the cyclical part of the main components of the total tax revenue.

Amongst the first strand of this literature, where structural balances are estimated from an aggregate perspective, Fedelino et al. (2009) estimate the cyclicality of total revenue with respect to the output gap by focusing on the approach used by the IMF's Fiscal Affairs Department, with a special attention to scaling factors—potential GDP versus nominal. Similarly, Congressional Budget Office (2009) estimates the cyclically adjusted budget balaces by relying on the output gap.

On the second strand of this literature, researchers followed a disaggregated methodology and they estimated the elasticities of the main components of the tax revenue with respect to the cycle in their relevant tax bases. Based on the estimation of the structural levels of individual tax revenues, total cyclically adjusted tax revenue is estimated from the sum of the structural balances of these individual components (Bouthevillain, et al., 2001). In this literature, some researchers relied on econometric estimates of tax revenue elasticities (Debrun, 2006), and some relied on the elasticities calculated on the basis of statutory tax rates and the income distribution to which they are applied (Girouard & André, 2005).

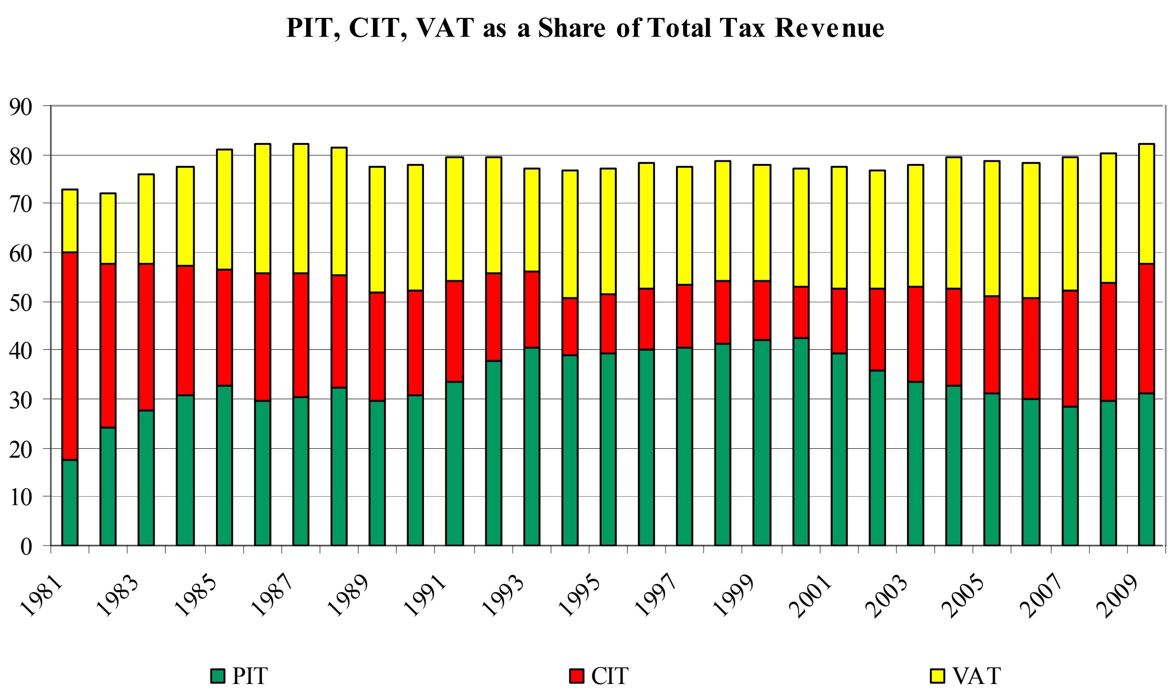
However, the literature studying the impact of the commodity and asset prices and the credit cycle on the cyclicality of tax revenue is limited. Amongst this literature, Farrington et. al (2008) adjust structural balances for equity and stock market effects. Rodriguez et. al (2007) study the impact of copper and molybdenum prices on the structural fiscal balances of Chile. To our knowledge there is no paper which studies the impact of the credit growth on tax revenue performance.

III. Data

In this paper we use seasonally adjusted macroeconomic variables available in annual and quarterly frequency from January 1980 to December 2008. These variables are national government revenue and its components, general government revenue and expenditures, output, price deflators, real interest rate, price of gold and platinum, an index of asset prices, house prices, stock price indices, price earnings ratio, and credit extended to the private sector. The first three data series are obtained from the National Treasury of South Africa, and the latter series are obtained from the South African Reserve Bank, World Economic Outlook (IMF, 2010), DataStream, and Bloomberg.

The three main components of tax revenue in South Africa are personal income tax (PIT), corporate income tax (CIT) and the value-added tax (VAT), and the sum of these three taxes constitute around 80 percent of the total tax revenue in South Africa (see Figure 2).

Figure 2. Share of three main taxes on total tax revenue



Given the high share of PIT, CIT and VAT in the total tax revenue in South Africa, in this paper, we focus on estimating the cyclical adjustment of these three tax revenues with respect to the fluctuation in their tax bases. The remaining tax revenues will be adjusted with respect to the output gap.

IV. Cyclically Adjusted Balances

A. A Simple Adjustment: Methodology

In this paper, we use a disaggregated approach, to measure the cyclically adjusted budget balances for South Africa. In this approach, we decompose revenue into its main components, and estimate individually the fluctuation in these components. Then we deduct the cyclical revenue fluctuation from the overall budget balance.

If one were to express overall fiscal balance of a country as given in the equation (1) below:

$$OB_t = R_t - E_t \tag{1}$$

where, OB_t stands for the overall fiscal balance, R_t is the total revenue and E_t is the expenditure. Then the structural balance could be expressed as:

$$\dot{O}B_t = \dot{R}_t - E_t \tag{2}$$

where, $\dot{O}B_t$ stands for the structural balance, $\dot{R}_t$ is the structural revenue[4]. We may decompose actual revenue into cyclical, R^c, and structural, $\dot{R}$, components as given in equation (3) below:

$$\ln\left(R_t\right) = \ln\left(\dot{R}_t\right) + \ln\left(R_t^c\right) \tag{3}$$

If we were to define the output gap as the logarithmic difference between the real level and the potential level of a variable, then the cyclically adjusted component of revenue can be expressed as:

$$\ln\left(R_t\right) - \ln\left(\dot{R}_t\right) = \varepsilon_R\left[\ln\left(Y_t\right) - \ln\left(\dot{Y}_t\right)\right] \tag{4}$$

In the equation above, ε_R is the elasticity of revenue with respect to the output-gap. If output is larger than the potential, then the actual revenue would be higher than the cyclically-adjusted revenue.

In the disaggregated method, we estimate tax-specific elasticities for the three main taxes: personal income tax, corporate income tax and value-added tax. Other tax revenues are adjusted relative to the output gap with an elasticity of one.

Equation (5) below shows that the disaggregated tax revenue of component *i*, R_{it}, is equal to the sum of the structural tax revenue, and the cyclical component that changes with respect to the cycle in its tax base, TB_{it}.

$$\ln\left(R_{it}\right) - \ln\left(\dot{R}_{it}\right) = \varepsilon_{iR}\left[\ln\left(TB_{it}\right) - \ln\left(\dot{T}B_{it}\right)\right] \tag{5}$$

[4] Following the empirical evidence provided on this literature, no adjustment is made on the expenditure side (Fedelino et al., 2009). Similarly, Bouthevillain et al. (2001) use a near zero (-0.2) adjustment on the cyclical component of the total expenditure.

In equation (5), there are three unknowns: potential revenue, potential tax base, and elasticity of tax revenue with respect to its tax-base. In the literature, researchers used various methods to eliminate the number of unknowns in this equation.

Some researchers approximated elasticity of that tax revenue, ε_{iR}, with respect to the cycle in its tax base, by estimating the change in revenue over time with respect to the change in tax base over time, as shown in the following equation below:

$$(\ln R_{it} - \ln R_{it-s}) = c + \hat{\varepsilon}_{iR}\left(\ln TB_{it} - \ln TB_{it-s}\right) + \nu_t \quad (6)$$

where, the subscript s stands for the frequency of the data, where *s* is equal to 1 in annual data, and to 4 in quarterly frequency –to net out the impact of seasonal fluctuations.

Other researchers approximated the elasticity of that tax revenue, ε_{iR}, by estimating the change in revenue over time to the gap in its tax base.

There are some problems associated with these approximations. First, approximation of $\hat{\varepsilon}_{iR}$ to ε_{iR} may not be very reliable if the over time changes in tax revenue does not approximate the structural gap in the tax base. Second, the level of structural tax base is an estimated statistic, and as in any estimation, this calculation is prone to biases. By regressing the change in tax revenue over time to the output gap or to the tax-base gap, we introduce an unbalanced one-sided bias to this regression.

In our methodology, we will estimate the potential real tax base and real tax revenue through an HP filter[5]. By this, we will eliminate the problem of approximating the tax revenue gap with the over time change in tax revenue. Also, assuming that the HP filter produces a similar bias in calculating the potential level of the tax revenue and the tax base, we will eliminate the problem of introducing a one-sided bias to the regression: in our methodology, the right and the left hand side of equation (5) would be balanced.

After estimating the elasticity of tax revenue with respect to tax base gap from equation (5), the cyclical component of tax revenue is going to be calculated as a residual by deducting the actual revenue from the predicted revenue gap of equation (5).

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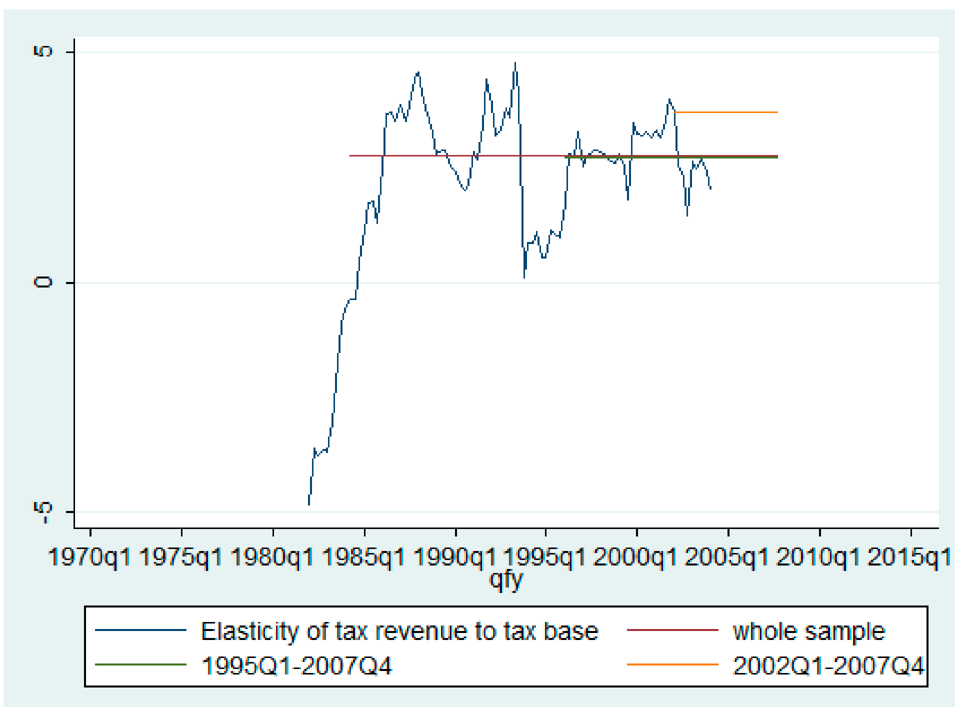
[5] One should note that there are caveats in estimating potential output and potential tax bases via an HP filter. First, the potential levels vary depending on the smoothing parameter used in these estimations. Second, there is an end-point problem in the HP-filter estimation. Nevertheless, we will try to avoid this problem by using the 2015 IMF staff projections of the IMF. Third HP filter does not detect structural breaks in the data. We discuss the bias created by these problems in Appendix B.

B. A Simple Adjustment: Results

Equation (5) is estimated recursively for each of the three main tax revenues over each business cycle, where each cycle is approximated by 24 quarters, or by six years, covering the period from 1981 to 2009[6]. Recursive estimates of CIT with respect to its base, gross operating surplus, is shown in Figure 3. Recursive estimates of PIT with respect to its base, compensation of employees, is presented in Figure 4. Recursive estimates of VAT with respect to its base, total consumption, is given in Figure 5. Results presented in these figures show that tax elasticity estimates of equation (5) are not constant over time.

As shown in these figures, elasticity of PIT, CIT and VAT with respect to their tax bases change depending on the sample selection. These results indicate that there might be some variables, other than the fluctuation of the tax base with respect to the business cycle, which blur the constancy of these elasticities. This finding motivates us to examine the impact of commodity and asset prices, and the credit growth in the cyclicality of revenue performance in South Africa.

Figure 3. Recursive Elasticity Estimate of CIT with Respect to Gross Operating Surplus



[6] In this paper, we estimate the elasticities based on the fluctuation of real variables. We deflate tax revenue with the GDP deflator in order to obtain the real variables. As discussed in the Appendix, elasticity estimates from nominal variables are biased, and the elasticity estimates tend to approach 1.

Figure 4. Recursive Elasticity Estimate of PIT with Respect to Compensation of Employees

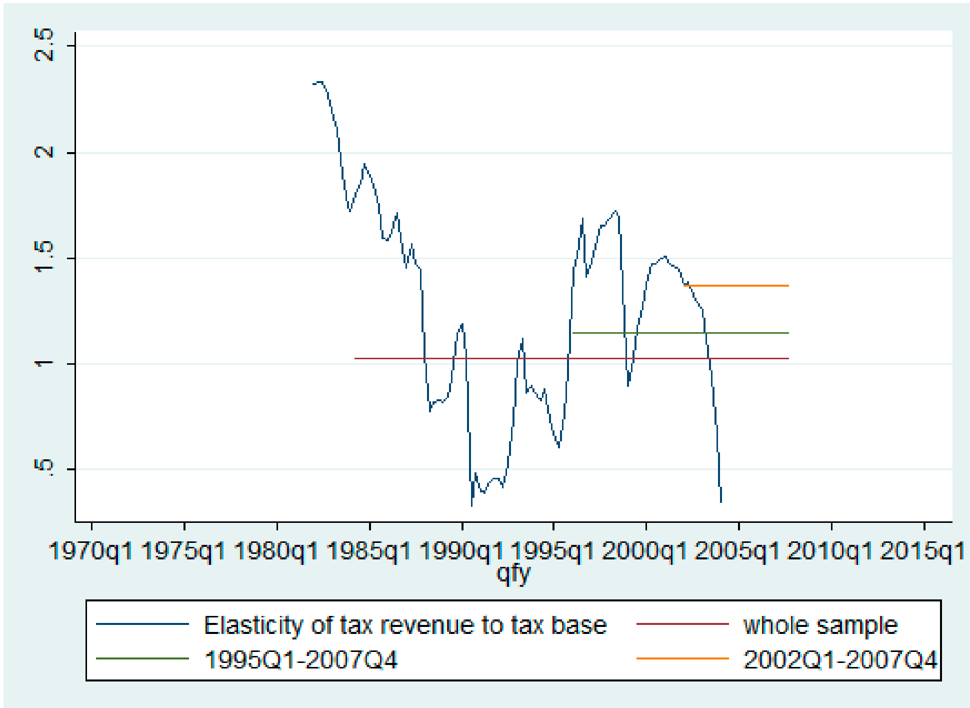
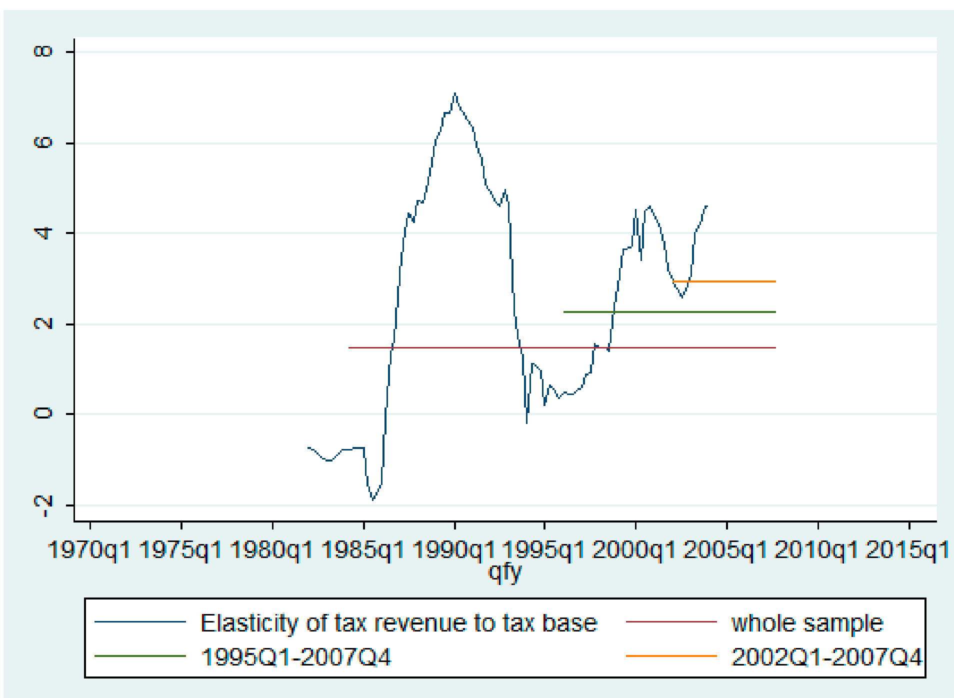


Figure 5. Recursive Elasticity Estimate of VAT with Respect to Total Consumption



C. Impact of the Commodity and Asset Prices and the Credit Cycle

Given the time-variance in elasticity estimates, we study the impact of commodity and asset prices and the credit cycle on the cyclicality of tax revenue in South Africa. In addition to the impact of these indicators, we will also control for the changes in tax policy and tax rates in South Africa. Table 1 summarizes the changes in tax policy during the last two decades in South Africa. Similarly, Table 2 presents the highest marginal tax rate for CIT, PIT and VAT during the 1990s and 2000s.

Table 1. Changes in Tax Policy in South Africa

Date	Policy	Effects
1991	Introduction of value added tax (VAT)	
1997	Establishment of South African Revenue Services (SARS)	All
2000	Introduction of world-wide income taxation (WWIT)	PIT, CIT
Oct-2001	Introduction of capital gains tax (CGT)	PIT, CIT
2003/04-2006/07	PIT tax relief	PIT
2003-2006	foreign exchange amnesty	All
2008/09	Decline in the number of registered VAT vendors	

Table 2. Marginal Tax Rates in South Africa

	Maximum Marginal Tax Rate		
Fiscal Year	PIT	CIT	VAT
1992/93	43	48	10
1993/94	43	48	14
1994/95	43	40	14
1995/96	43	35	14
1996/97	45	35	14
1997/98	45	35	14
1998/99	45	35	14
1999/00	45	30	14
2000/01	42	30	14
2001/02	42	30	14
2002/03	40	30	14
2003/04	40	30	14
2004/05	40	30	14
2005/06	40	29	14
2006/07	40	29	14
2007/08	40	29	14
2008/09	40	28	14

Given that tax elasticity is a long-run relationship between revenue and its tax base, we control for the short-term fluctuation in tax revenue due to the changes in tax policy and tax rate by introducing control variables into equation (5).

Following, we estimate the impact of the changes in the commodity and asset prices and the credit cycle on the cyclical fluctuations of tax revenue by controlling for the changes in the business cycle, tax policy and tax rate in South Africa. For this, we apply a general-to-specific method by estimating equation (7) below, and reaching the most efficient model by eliminating the insignificant variables and minimizing the error variance of the regression.

$$\begin{aligned}\left(\ln R_{it}-\ln R_{it}^{*}\right) = c_i + \sum_{j=0}^{2}\varepsilon_{ij}^{R}\left(\ln TB_{i,t-j}-\ln TB_{i,t-j}^{*}\right) + \sum_{j=0}^{2}\varepsilon_{ij}^{P^C}\left(\ln P_{t-j}^{C}-\ln P_{t-j}^{C*}\right) + \\ + \sum_{j=0}^{2}\varepsilon_{ij}^{P^A}\left(\ln P_{t-j}^{A}-\ln P_{t-j}^{A*}\right) + \sum_{j=0}^{2}\varepsilon_{ij}^{C}\left(\Delta\frac{Credit_{t-j}}{Y_{t-j}}\right) + \sum_{j\in P} d_j I_{j,t}^{Pchange} + \\ + \delta TRate_{it} + \upsilon_{it}\end{aligned} \qquad (7)$$

In the equation above, P_{t-j}^{C} denotes the commodity prices[7]. P_{t-j}^{A} is an index of asset prices—of either house prices or the price earnings ratio. The fifth term on the right hand side of equation (7) is the change in the credit to GDP ratio over time. Amongst the tax policy/rate control variables, $I_{j,t}^{Pchange}$ is an indicator variable controlling for the changes in the tax policy as listed on Table 1, and the subscript *j* stands for the policy change listed in the jth row of this table. The last variable in equation (7), $TRate_{it}$ shows the highest marginal tax rate applied to the tax revenue *i* –PIT, CIT or VAT- as listed in Table 3.

As in equation (5), variables with an "*" denotes the trend or the long-run level of the explanatory variables. Following, $\varepsilon_{ij}^{P^C}$, $\varepsilon_{ij}^{P^A}$ and ε_{ij}^{C} measure the elasticity of tax revenue *i* with respect to the fluctuation of commodity prices and asset prices from their long-term level, and the change in the credit extended to the private sector.

The challenge in this estimation is measuring the long-run levels for commodity and asset prices. In general existence of a trend value for these prices is counterfactual and hence any measurement of trend prices contains a significant measurement error. Nevertheless, in this section, we assume that prices may tend to revert back to their long term values, and we measure the long term prices from a two-sided moving average model, of going back 6 years to the past and 2 year forward.

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[7] Commodity prices are measured through various indicators: first separately from the Rand denominated prices of gold and platinum—the two largest commodity exports of South Africa—and second, through a factor analysis of the co-movement of these price indices.

The most efficient results of equation (7) based on the general-to-specific modeling are provided in Table 3[8]. In these estimations, we restricted the estimation sample to post-apartheid period, due to several reasons. First, the recursive estimates shown in Figure 3 through Figure 5, show that parameter space differs significantly during the apartheid period. Second, VAT was introduced only during the 1990s. Third, we do not have sufficient information on tax policy changes during the apartheid period.

Based on the results provided in this table, elasticity of PIT with respect to the compensation of employees (denoted as wage-gap in Table 3) is 1.8. Elasticity of CIT with respect to net operating surplus (NOS) is 1.8 for the current period, and 2.5 for the previous period. Because corporations make provisional tax payments in South Africa, both the current and the past year are relevant for CIT. Elasticity of VAT with respect to real total consumption (RTC) is 1.8.

Table 3: Elasticity of PIT, CIT and VAT

	PIT-gap	CIT-gap	VAT-gap
Wage-Gap	1.818***		
	(0.336)		
NOS-Gap		1.802***	
		(0.235)	
NOS-Gap (-1)		2.522***	
		(0.294)	
RTC-Gap			1.789***
			(0.432)
Establishment of SARS	2.616**	10.38***	
	(1.101)	(2.195)	
Capital Gains Tax	2.366*	5.488***	
	(1.093)	(1.662)	
PIT tax Relief	-2.566**		
	(1.139)		
Change in Credit/GDP		0.683**	0.491**
		(0.265)	(0.204)
Constant	-1.006	-6.778***	-0.371
	(0.793)	(1.574)	(0.643)
Observations	16	16	16
R-squared	0.813	0.941	0.755

Standard errors in parenthes
*** p<0.01, ** p<0.05, * p<0.

[8] Results on this table are presented from regressions solved with annual data. Use of annual and quarterly data does not yield different coefficient estimates, as long as seasonal deviations in quarterly data is correctly accounted for. All components of tax revenue, in particular CIT is highly seasonal.

Additionally, the estimation results reported in Table 3 show that only the credit cycle has a significant impact on the cyclical component of tax revenue. CIT has an elasticity of around 0.7 and VAT has an elasticity of around 0.5 to the changes in the credit extended to the private sector.

Last, amongst the control variables of changes in tax policy and tax rate, only the establishment of SARS, introduction of the capital gains tax and PIT tax relief are significant for explaining the deviations of PIT from its trend. For CIT only the former two aforementioned variables are significant. For VAT neither of the tax policy changes are significant. Also the marginal tax rates listed in Table 2 did not have significance as a control variable in any of the tax revenue regressions.

D. Some Practical Issues

A practical issue for those who monitor structural balances is obtaining the structural gaps in tax bases for the forecast horizon. Generally, researchers produce forecasts of output gap, but not the gap in tax bases.

In this section, we estimate the elasticity of the tax base gap with respect to the output gap, by estimating the seemingly unrelated regression below.

$$\begin{aligned}\left(\ln R_{it} - \ln R_{it}^{*}\right) &= c_i + \varepsilon_{ij}^{R} \sum_{j=0}^{2} \left(\ln TB_{i,t-j} - \ln TB_{i,t-j}^{*}\right) + \varepsilon_{ij}^{C} \sum_{j=0}^{2} \left(\Delta \frac{Credit_{t-j}}{Y_{t-j}}\right) + \\ &+ d_j \sum_{j \in P} I_{j,t}^{Pchange} + \upsilon_{it} \qquad (8) \\ \left(\ln TB_{it} - \ln TB_{it}^{*}\right) &= \tilde{c}_i + \varepsilon_{iTB} \left(\ln Y_t - \ln Y_t^{*}\right) + \varepsilon_{iTB_{-1}} \left(\ln Y_{t-1} - \ln Y_{t-1}^{*}\right) + \tilde{\upsilon}_{it}\end{aligned}$$

Equation (8) estimates the elasticity of tax revenue *i* with respect to the business and the credit cycle jointly with the elasticity of tax base *i* with respect to the output-gap. The purpose of this joint estimation is solely due to practical reasons, and that is to be able to estimate the tax base gap for the forecast horizon based on the forecasts of the output gap.

Regression results of equation (8) are reported in Table 4. Results in this table show that the coefficients estimated from the elasticity regression for PIT, CIT and VAT are stable across the estimates of equation (7) and (8).

The elasticities of tax base *i* with respect to the output gap are reported under the second columns of models (1)-(3) in Table 4. As reported in this table, compensation of employees and total consumption have a unit elasticity with respect to the output gap; whereas the elasticity of net operating surplus is around 2.

Table 4. Seemingly Unrelated Regression of Tax Revenue and Tax Base

	Model (1)		Model (2)		Model (3)	
	PIT-gap	Wage-Gap	CIT-gap	NOS-Gap	VAT-gap	RTC_fy
Wage-Gap	1.618***					
	(0.269)					
NOS-Gap			1.872***			
			(0.202)			
NOS-Gap (-1)			2.586***			
			(0.265)			
RTC-Gap					2.107***	
					(0.279)	
Establishment of SARS	2.662**		10.67***			
	(1.159)		(2.455)			
Capital Gains Tax	2.809***		5.307***			
	(1.010)		(1.879)			
PIT tax Relief	-2.768***					
	(0.958)					
Change in Credit/GDP			0.699***		0.453***	
			(0.224)		(0.124)	
output gap		0.880***		1.968***		1.148***
		(0.223)		(0.463)		(0.132)
output gap (-1)		-0.0979		-0.146		-0.257*
		(0.244)		(0.493)		(0.140)
Constant	-1.145	0.0214	-6.892***	-0.490	-0.747*	0.0341
	(1.016)	(0.293)	(2.070)	(0.576)	(0.422)	(0.163)
Observations	13	13	13	13	13	13
R-squared	0.826	0.420	0.939	0.573	0.899	0.853

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

E. Cyclically Adjusted Balances

Based on the results provided in Table 4, we estimate the structural balances for PIT, CIT and VAT. We approximate the cycle in the remaining of the tax revenue with respect to the business cycle with an elasticity of 1. Expenditures are not adjusted for the business cycle, following Fedelino et al. (2009).

Based on these estimations, structural budget balance in South Africa, together with the nominal budget balance and the output gap are presented in Figure 6. Since business cycle is measured to be the biggest contributor of the cyclical component of tax revenue, the size of the output gap will have a large impact on determining the magnitude of the structural budget balance. Therefore, the cyclically adjusted budget balance is plotted together with the underlying output gap.

Figure 6. Cyclically Adjusted Budget Balance of the National Government[9]

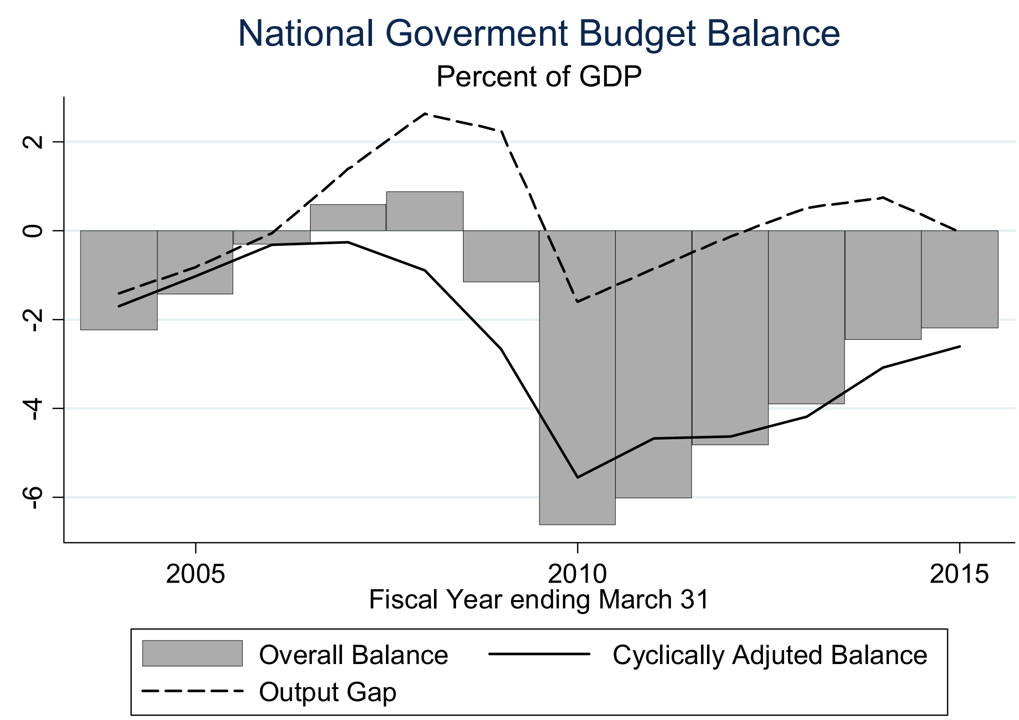
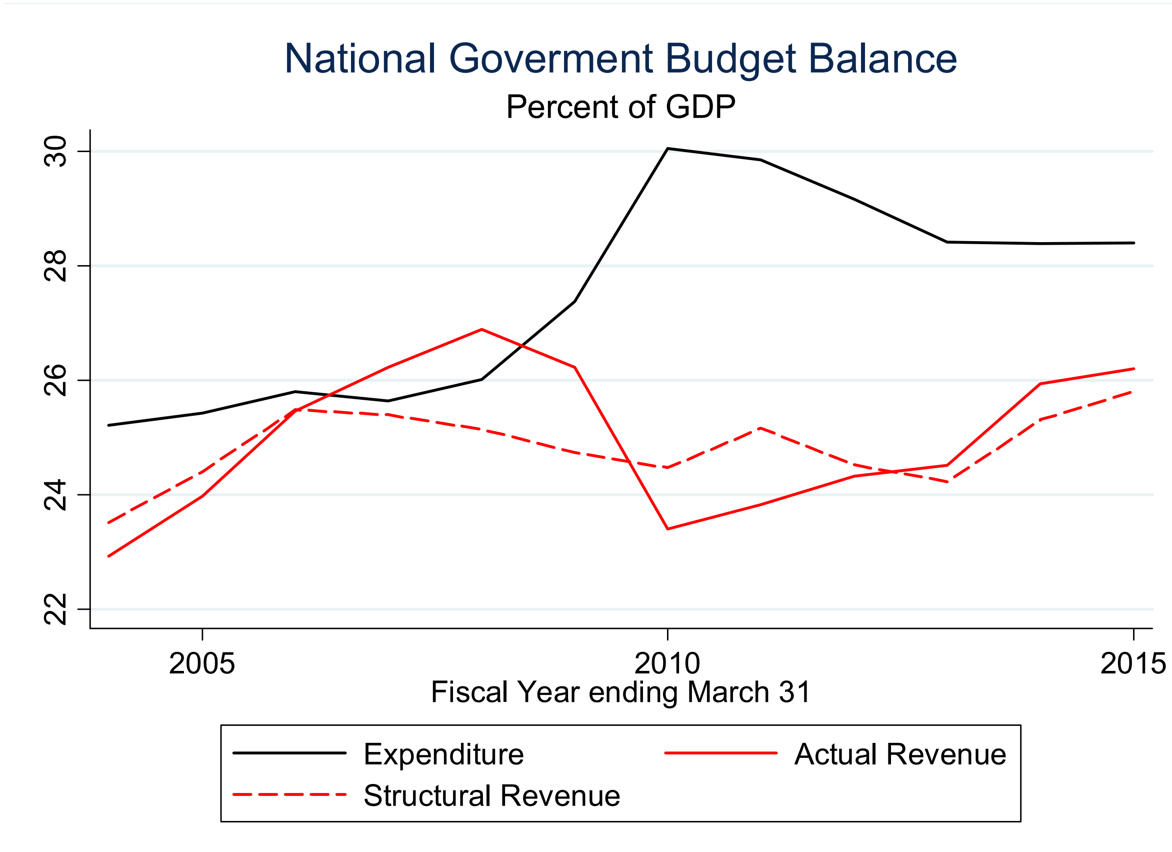


Figure 6 shows that the budget surpluses experienced in South Africa during the mid-2000s was cyclical and it was due mainly due to the positive output gap experienced in this period. However, looking at the 2009/10 fiscal year, the cyclical component in the budget deficit is quite small indicating that the budget deficit is mostly discretional. Further in Figure 7, we present structural revenue together with nominal revenue and expenditures as a share of GDP

[9] Forecast values are based on the IMF Staff projections.

in South Africa. This figure shows that nominal revenue fluctuates around the structural revenue—25 percent of the potential GDP—and the budget deficit in the 2008/09 and 2009/10 period were mainly due to the rise in total expenditures.

Figure 7. Structural and Nominal Revenue and the Total Expenditures[10]



Last, during the outer years of early 2010s, the structural balances shown in Figure 6 and Figure 7 show that as the negative output gap recovers back to the potential, nominal budget balance in South Africa will converge towards the structural balance.

F. Caveats

There are some caveats embedded in the measurement of structural balances for any economy. First, structural balance estimates are based on the economic cycles, and there are caveats in the measurement of economic cycles. Use of different methodologies may yield differences in estimating potential output, such as the use of structural models versus the HP-filter. The difference in the magnitude of the estimated potential output levels will feed into

[10] Forecast values are based on the IMF Staff projections.

the size of the output gap and hence to the magnitude of the cyclical component of tax revenue and to the size of the structural budget balance. Additionally, existence of structural breaks would also cause shifts in the potential output estimates. These problems in potential output estimates are discussed in more detail in Appendix B.

Second, there is a bias in the estimation of elasticity estimates to the deviations in the business cycle, commodity and asset prices and credit cycle. These biases would be caused by the measurement of the cycles, the choice of the deflators—or no deflators—and the choice of the estimation method[11]. These biases would also cause a deviation between the true and the estimated values of the cyclically adjusted balance.

V. Conclusion

The first paper applies a disaggregated method for the calculation of the cyclical component of the budget balance for South Africa. In our methodology, we estimate the cyclically adjusted budget balance with an emphasis on the effect of commodity and asset prices and the credit cycle. Results show that the cyclicality of tax revenue is mostly explained by the variation in the output gap, and the change in the credit to private sector also affects the revenue performance. On the other hand, the impact of asset and commodity prices is not significant in the deviations of revenue from its trend. However, one should mention that the quantitative effect of these prices is subject to the assumptions used for long-run price levels.

[11] The impact of deflators on the magnitude of tax elasticity is discussed in Appendix A.

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APPENDIX

A. Real versus Nominal Variables:

Even though fiscal balances are reported in nominal terms, in this paper we used real tax revenue to estimate tax revenue elasticities with respect to the output gap. The reason that we use real variables rather than the nominal variables is that because elasticity estimates from nominal variables tend to be biased towards 1.

As an example, equation (9) below shows a simple estimate of the tax buoyancy ratio, based on the annual changes in tax revenue and tax base.

$$TB = \frac{\%\Delta \,\mathrm{Re}\,venue}{\%\Delta Base} \tag{9}$$

Assuming that the nominal revenue increases by 20 percent, the tax base by 15, and the common price deflator by 5 percent, the tax buoyancy ratio estimated from the real balances would be 1.55, as shown in equation (10), whereas the tax buoyancy ratio estimated from the nominal values would be 1.33, as show in equation (11). This simple example shows that tax elasticity estimated from nominal balances would be biased towards 1.

$$TB = \frac{\%\Delta \,\mathrm{Re}\,venue}{\%\Delta Base} = \frac{\frac{1+.2}{1+.05}-1}{\frac{1+.15}{1+.05}} = \frac{0.143}{0.095} = 1.5 \tag{10}$$

$$TB = \frac{\%\Delta \,\mathrm{Re}\,venue}{\%\Delta Base} = \frac{.2}{.15} = 1.33 \tag{11}$$

B. Bias in Potential Level Estimates:

Figure 9 below shows that different assumptions used in the estimation of the potential output yields different output gap results. The HP filter used on the raw data estimates much larger output gaps than the one used with accounting for structural breaks. Further, the sign of the gap shows different directions in some year, such as during the mid-2000s (Figure 9).

Figure 8. Potential Output and Tax Bases with ant without Structural Breaks

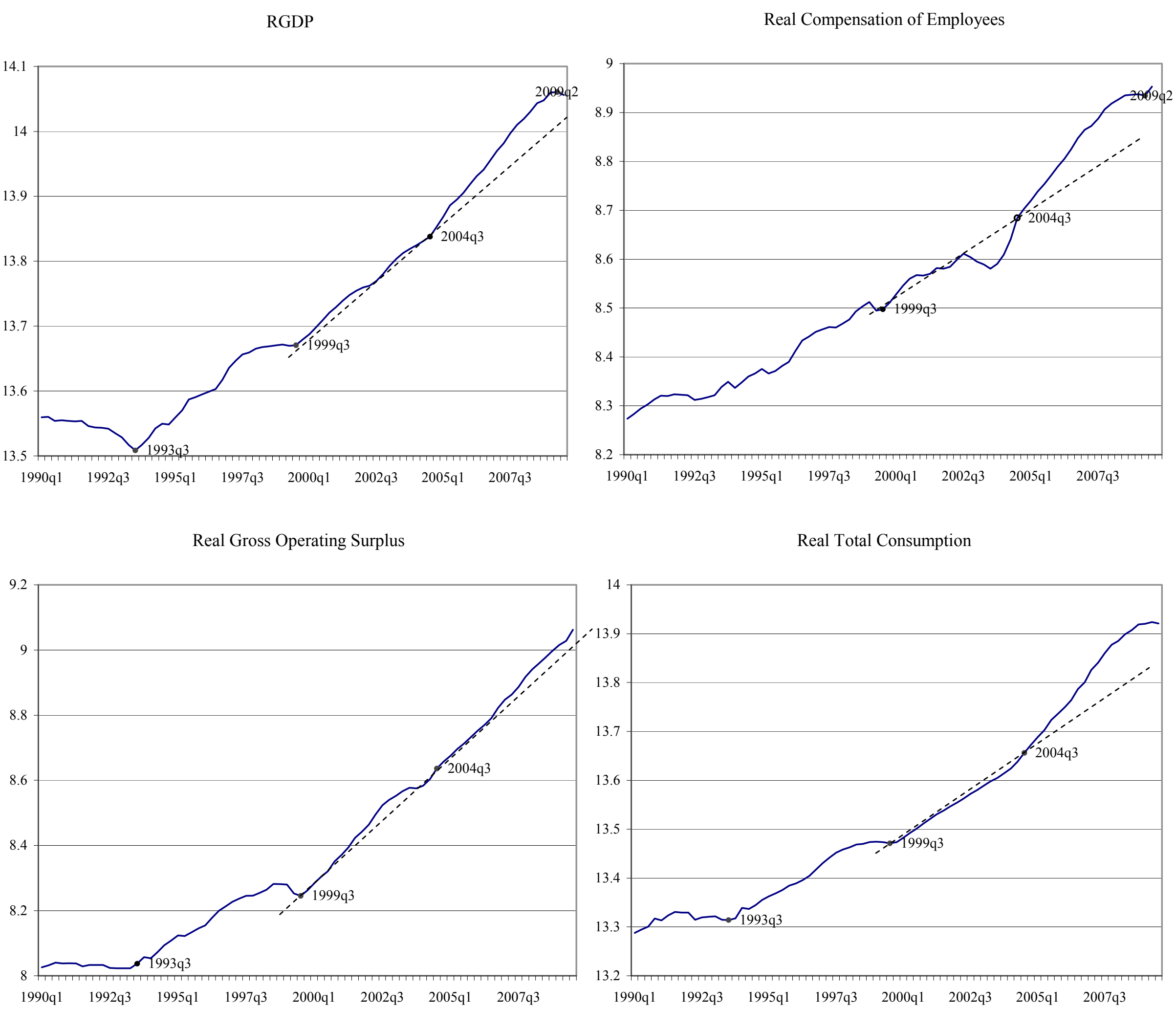

Figure 9. Output Gap and Structural Breaks