African Department

11/4

South Africa:
Macro Policy Mix and Its Effects on Growth and the Real Exchange Rate–Empirical Evidence and GIMF Simulations

Jorge Ivan Canales-Kriljenko

INTERNATIONAL MONETARY FUND

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Contents

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Empirical Evidence and Global Integrated Monetary and Fiscal Simulations

Jorge Iván Canales-Kriljenko

1 Executive Summary

Would a tighter fiscal, looser monetary, and greater reserve buildup increase growth and depreciate the rand in real terms? The existing empirical and theoretical literature would say "maybe." Such a policy mix would reduce macroeconomic vulnerabilities and help prevent financial crises that set back macroeconomic progress. But such a policy mix does not guarantee higher growth or competitiveness even under steady external conditions.

A fresh look at the experience of South Africa and its peers[1] over the last 20 years, through the lens of several econometric techniques that control for the external environment, concludes the same. These techniques range from cross-section regressions to panel and South Africa–specific dynamic systems.

A key insight from cross-country evidence is that higher public spending increases growth, but the higher public revenue and public debt needed to fund it eventually offset it. In particular, the estimated cross-country parameters suggest that increasing public spending and revenue in the same amount would dampen growth. Countries that funded the higher fiscal spending with debt grew more than countries that funded the increase fiscal spending with taxes. Nevertheless, this higher growth will be partly offset when these countries need to raise taxes to pay back or stabilize public debt. The cross-country evidence also suggests that countries that built more reserves and had lower real policy rates grew more.

[1] Unless otherwise indicated and depending on data availability, South Africa's peer group in this paper includes Argentina, Brazil, Chile, China, Colombia, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, Peru, Philippines, Poland, Russia, Thailand, Turkey, and Ukraine.

These results suggest the shift in the policy mix under discussion will raise growth only if the expansionary effect of monetary and reserve policies offset the adverse effect on growth of the tighter fiscal policies. Three points are worth making. First, a tighter fiscal policy hurts growth in the short run. Both raising fiscal revenue and cutting spending lower growth, and although a lower debt typically increases growth, the net effect is clearly negative. The effect of fiscal policies on exchange rates is ambiguous. Second, a looser monetary policy, characterized by lower real interest rates, increases growth in the medium run and depreciates the domestic currency in real terms. Finally, reserve buildup seems to have contributed to higher growth, even if it has coincided at times with stronger domestic currencies in real terms.

Theoretical models with sound microeconomic foundations can also support the conclusion that that fiscal tightening contracts economic activity in the short run and has ambiguous effects on the real exchange rate. Simulations using a version of the IMF's Global Integrated Monetary and Fiscal (GIMF) model calibrated for South Africa clearly make this point. They also show that funding and the composition of fiscal spending matters for growth, with cuts in public investment hurting growth the most. It also shows the monetary policy reaction is crucial for determining the macroeconomic impact of fiscal measures.

Despite the caveats from the cross-country evidence and theoretical simulations, it is possible to make a case for rebalancing the policy mix in South Africa. An estimated empirical model suggests that rebalancing the policy mix in a way that is neutral on economic activity in the short run would depreciate the rand in real terms. The change in the policy mix would allow the economy to tap foreign saving to fund investment despite its low saving rate. The more depreciated rand would create incentives to direct the higher investment toward industries that could sustainably service foreign savings.

The rest of this paper elaborates on the empirical evidence and the policy simulations. Section 2 discusses the exercises that highlight the cross-country differences. Section 3 describes policy simulations using the GIMF model. Section 4 describes the empirical model that would support a change in the policy mix for South Africa. Section 5 concludes.

2 Cross-Country Evidence

The external environment strongly affects emerging markets. Yet, some countries grow faster than others over the same period. Most would accept that economies with lower income levels are gradually catching up to advanced economies. But, can policy differences help explain the difference in

growth outcomes across countries? A change in the policy mix might be able to have an effect on growth only if they do.

Three exercises help answer this question. First, the average growth between 1990 and 2010 is regressed on average real short-term rates, public debt-to-GDP ratio, fiscal revenue and spending, and the increase in the reserve-to-GDP ratio. Second, a pool regression is conducted with annual observations of these variables. To highlight cross-sectional differences and implicitly control for time variations, the pool regression includes random fixed effects. Finally, the chapter estimates a panel vector error correction model to identify the longer-run effects, controlling for key external variables. The same three exercises are conducted for the real effective exchange rate. Data description is presented in Table 2.1.

The results suggest that policy differences help explain part of the cross-country differences in growth (Table 2.2). The different growth regressions provide a consistent view on the qualitative impact of alternative policies. More fiscal spending increases growth, but higher taxes and public debt decrease it. Also, low real short-term rates increase growth as do increases in reserve buildups.

On the fiscal, the exercises suggest that an average 1 percentage-point-of-GDP increase in fiscal spending would increase growth by 0.1 to 0.5 percentage points a year. Nevertheless, it matters how the authorities fund fiscal spending. Both higher fiscal revenue and higher public debt lower growth. Yet, the adverse effect of debt is smaller, until of course public debt is repaid or serviced through higher fiscal revenue. Countries can in principle enjoy a windfall gain while they are increasing their debt levels. But in doing so, they face the risk that it may be difficult to stop at a prudent level, especially if country authorities have a limited term in office and may not fully bear the cost of the later adjustment. In addition, a higher debt level exposes the government to sharp changes in interest rates that could force it to default.

The exercise also suggests that an increase in the size of the government may hurt growth. Taking the point estimates, the GDP contraction from higher fiscal revenue is higher than the GDP expansion from higher public spending. A temporarily higher public spending lowers future growth, although this may be warranted when urgent needs arise in the present.

The result that reserve buildup increases growth may not be surprising to those who think that currency undervaluation explains some of the fast growth in Asia. The results also suggest that reserve buildup through sterilized foreign exchange intervention has a lower impact than unsterilized intervention once the costs of servicing the higher public debt are considered. These exceed any return earned on liquid international assets.

Table 2.1. Cross-country Regressions: Data Description

Variable	Description and source
Real growth	Annual percent year of real GDP (W[xxx]NGDP_R) from the IMF's WEO database.
Real exchange rate	Annual percent change of I[xxx]EREER from the IMF's Information Notice System database.
Real short-term rate	Real money market interest rate, computed as (1+[xxx]60B..ZF…(t)/100)/(W[xxx]PCPI(t)/W[xxx]PCPI(t-1))*100-100
Fiscal spending	General-government-expense-to-GDP ratio, estimated as W[xxx]GGE(t)/W[xxx]NGDP(t)*100 with data from the WEO database.
Fiscal revenue	General-government-revenue-to-GDP ratio, estimated as W[xxx]GGR(t)/W[xxx]NGDP(t)*100 with data from the WEO database.
Public debt	General-government-gross-debt-to-GDP ratio, estimated as W[xxx]GGXWDG(t)/W[xxx]NGDP(t)*100 with data from the WEO database.
Reserve accumulation	Reserve buildup in percent of GDP of the previous year, computed as ([xxx].1L.DZF…(t)-[xxx].1L.DZF…(t-1))/w[xxx]NGDPD(t-1), with data from the
World growth	World growth computed as the annual percentage change of the series W001ngdp_r from the WEO database.
Terms of trade	Percent change in the terms of trade, computed as the difference in annual growth rates of the price deflator of exports and imports of goods and services,
Real U.S. federal funds rate	Computed as (1+ 11160B..ZF…(t)/100)/(W111TX_D(t)/W111TX_D(t-1))*100-100 from the IMF's IFS and WEO databases.
Chicago Board of Options Exchange VIX index	Annual average of daily values of the VIX, taken from the Haver Analytics database.

Table 2.2. Effect of Potential Growth of Alternative Monetary, Fiscal, and Reserve Accumulation

Effect on Potential Growth of Alternative Monetary, Fiscal, and Reserve Accumulation

Variable	Cross-section[2]	Pool regression[3]	Panel cointegration[4]
Real short-term rate	-0.11*	-0.08***	-0.10**
Fiscal spending	0.18**	0.10***	0.52***
Fiscal revenue	-0.21**	-0.18***	-0.64***
Public debt	-0.03**	-0.03***	-0.06***
Reserve accumulation	0.03*	0.08***	0.22**
Constant	4.15***	8.28***	8.55***
Adj. R-squared	0.71	0.40	0.56
Observations	15	249	207

[1]An increase means appreciation.
[2]Average variables over 1990-2010 period. Computed by least squares.
[3]Pool regressions, random period effects. No controls for external variables.
[4]Coefficients from cointegrating vectors, rearranged. Short-run dynamics not shown. Controls for world growth, terms of trade, real U.S. federal funds rate, and the VIX.

Table 2.3. Effect on Real Exchange Rate of Alternative Monetary, Fiscal, and Reserve Accumulation

Effect on Real Exchange Rate of Alternative Monetary, Fiscal, and Reserve Accumulation

Variable	Cross-section[2]	Pool regression[3]	Panel cointegration[4]
Real short-term rate	0.03	-2.98	0.30**
Fiscal spending	0.04	0.11	0.13
Fiscal revenue	0.06	0.00	-0.02
Public debt	-0.03	0.16	-0.03
Reserve accumulation	-0.02	-0.06**	0.46**
Constant	-0.09	0.36***	-7.33
Adj. R-squared	-0.05	0.05	0.51
Observations	15	249	207

[1]An increase means appreciation.
[2]Average variables over 1990-2010 period. Computed by least squares.
[3]Pool regressions, random period effects. No controls for external variables.
[4]Coefficients from cointegrating vectors, rearranged. Short-run dynamics not shown. Controls for world growth, terms of trade, real U.S. federal funds rate, and the VIX.

Table 2.4. Effect of Real Exchange Rate and Growth of Changes in Monetary, Fiscal, and Reserve Accumulation Variables

Effect on Real Exchange Rate and Growth of Changes in Monetary, Fiscal, and Reserve Accumulation Variables

Variable	Growth	Real Exchange Rate[1]
Real short-term rate	-0.12*	0.27**
Fiscal spending	0.55***	-0.07
Fiscal revenue	-0.66***	0.18
Public debt	-0.06***	-0.01
Reserve accumulation	0.19*	0.40*
Constant	9.33***	-7.97*
Adj. R-squared	0.51	
Observations	207	

[1]An increase means appreciation.
[4]Coefficients from cointegrating vectors in a cointegrating system, rearranged. Short-run dynamics not shown. Controls for world growth, terms of trade, real U.S. federal funds rate, and the VIX.

In contrast, the cross-section regressions do not explain well or consistently changes in the real exchange rates across countries (Table 2.3). The same result was obtained when the panel vector error correction model included two long-run relationships: one on growth and the other on the real exchange rate (Table 2.4).

3 Simulations Using the IMF's Global Integrated Monetary and Fiscal Model

The IMF's GIMF model is a useful tool for analyzing the interaction among macroeconomic policies. It is a dynamic general equilibrium model in which consumers react to incentives created by policy decisions. Monetary and fiscal policies have macroeconomic effects because the model includes nominal and real rigidities and several features that imply that Ricardian equivalence does not hold. The latter include myopic consumers with limited lifetimes, declining life-cycle-labor income, some consumers that lack access to financial markets, and distortionary taxes, among the most relevant (Kumhof and others, 2010).

Earlier versions of this model have already analyzed policy issues in South Africa (Gueorguiev, 2008, 2009). The current version uses a model structure described in the 2010 paper by Kumhof and others (2010) and Clinton and others (2010). The model parameters used here yield the main macroeconomic ratios in South Africa. Calibrated parameters used for the following simulations and selected steady-state ratios are in Tables 3.1 and 3.2. These could be compared with those in Kumhof and others (2010).

The calibration provides some local flavor to the model simulations. Although the calibrated model delivers macroeconomic aggregates that resemble those of South Africa, it may be a stretch to say the model accurately describes the South African economy. The simulations analyze the likely impact of fiscal and monetary policies on a model economy with sound microeconomic foundations and that delivers macroeconomic indicators similar to those in South Africa.

Simulations

This chapter presents three sets of simulations. All of them consider an expansion of fiscal spending and present the results as impulse responses of key macro variables. The three simulations distinguish between three types of primary fiscal spending, including government consumption, public investment, and transfers. They also distinguish between a five-year increase in spending and a permanent one. All simulations consider a real expansion of one percentage point of potential GDP. The main differences between the sets of simulations are the following:

- The first set funds the fiscal expansion with lump sum taxes to isolate the effect distortionary taxes or debt dynamics could have on the economy.

- The second set funds the five-year fiscal expansions with a permanently higher public debt level.

- The third set expands fiscal spending and lets the countercyclical monetary and fiscal policy rules in the model run freely. The fiscal policy reaction function is the described by Kumhof and others (2010) and involves raising distortionary taxes to stabilize public debt. The parameters used for South Africa are in Table 3.1.

The simulations suggest that higher fiscal spending increases economic activity, given the non-Ricardian features and nominal and real rigidities. To some extent, this is by model design. Taking these as given, the model suggests that funding, composition, and time horizons of public spending matter for the outcome. The simulations also suggest that, except perhaps for public investment, the impact of public spending on economic activity fades in the long run.

The simulations also suggest the effect of public spending on the exchange rate is ambiguous. The sign could in principle go either way depending on the funding, composition, and time horizons of the fiscal spending policy. Interestingly, the "pure" effect of government consumption and investment in the model, that is, when the funding comes from lump sum taxes, is to depreciate the currency.

Fiscal Spending Funded by Lump Sum Taxes

This experiment consists of increasing fiscal spending and lump sum taxes in the same amount and at the same time. As a useful crosscheck, the model simulations deliver the intuitive result that no macroeconomic aggregate changes when the increase in fiscal spending takes the form of lump sum transfers.

The simulations suggest that, in this economy, increases in public investment have the stronger early impact on economic activity. The effect is stronger in the medium to long run with a permanent increase in public investment. In turn, the effects of the temporary increase in public investment would eventually die out. Moreover, temporary increases in public spending would contract economic activity when the stimulus is withdrawn. Temporary and permanent increases in government consumption do not have a lasting impact on economic activity in this economy (Figure 3.1).

In this scenario, all types of fiscal spending increases depreciated the domestic currency in real terms. The effect of public investment was at the two extremes, with permanent increases giving the largest depreciation.

Increases in government consumption yielded intermediate levels of depreciation.

Fiscal Spending Funded by Debt Creation

This experiment focuses on the five-year increases in fiscal spending and explores the effect of funding them with higher debt. At the end of the experiment, public debt remains permanently at a higher level. Thus, it involves a fiscal expansion and a permanently higher debt level, for which the authorities will need to increase taxes in the future.

The results suggest that increasing public spending funded by higher debt has a stronger effect on economic activity than when it is funded by lump sum taxes. The increase is higher for public investment than it is for government consumption. Yet the increase in output is temporary and reverses when the authorities withdraw the stimulus (Figure 3.2).

The effect on the real exchange rate varies with the form of public spending. Government consumption appreciates the domestic currency while public investment still tends to depreciate it.

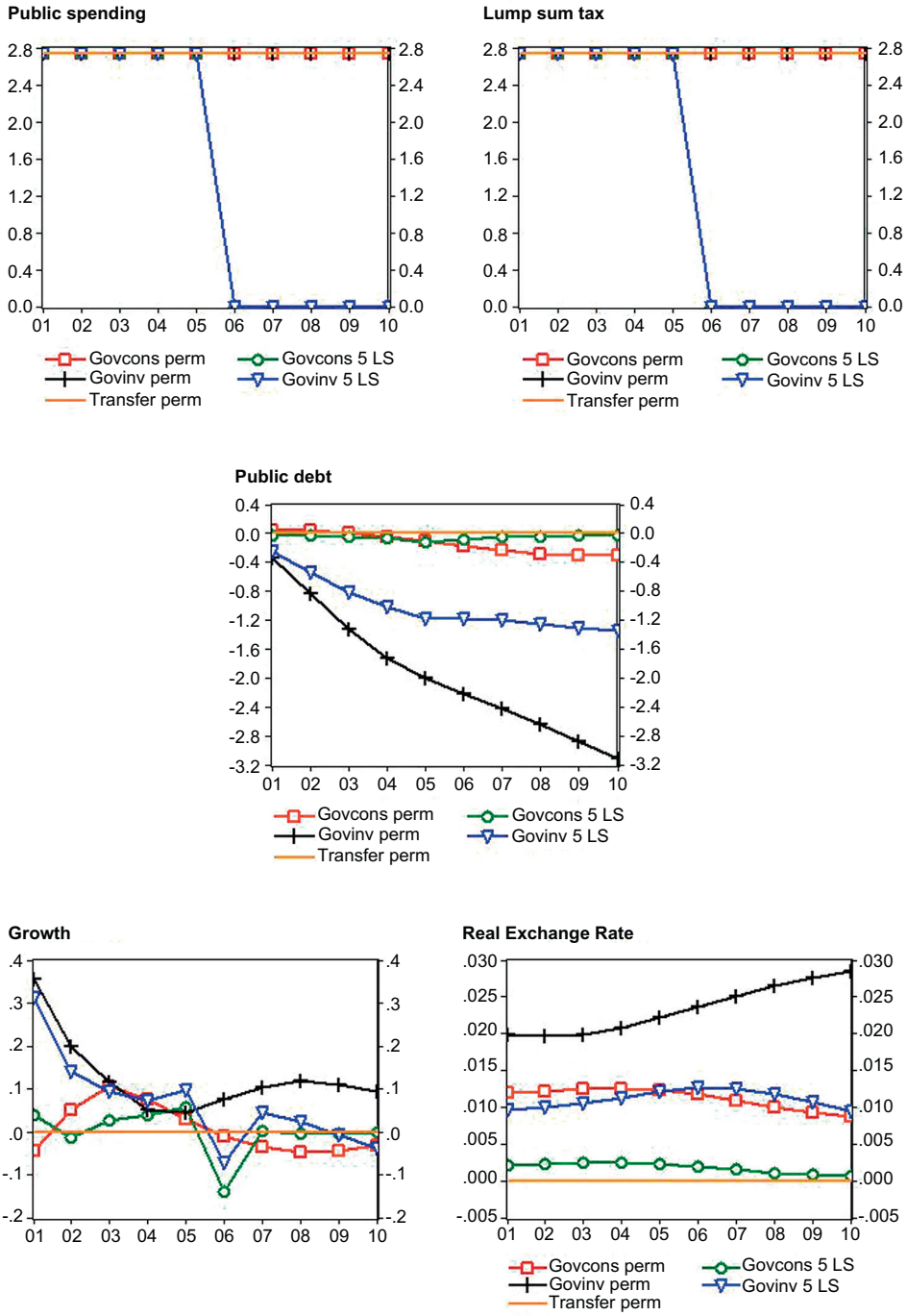
Fiscal Spending and Macroeconomic Rules

The last experiment simply increases public spending and lets the countercyclical fiscal (and monetary) rule in the model run freely. This fiscal rule is a long-run fiscal deficit rule that allows the government to react countercyclically to the output gap, as described in Kumhof and others (2010).

The results more uniformly suggest that an expansion in fiscal spending increases output initially, independently of the type or persistence of the increase. It remains true that a contraction should take place when the authorities remove stimulus. Thus, it would make sense to expand fiscal spending when facing a downturn and withdraw the stimulus when the economy is facing a boom (Figure 3.3).

The effect on the real exchange rate remains ambiguous. The main difference is that under this scenario, increases in government consumption appreciate the currency, while increases in public investment depreciate the currency.

Figure 3.1. Fiscal Spending Funded by Lump sum Taxes, Simulations



Deviations from steady state. Real effective exchange rate increase means depreciation.

Figure 3.2. Fiscal Spending Funded by Debt, Simulations

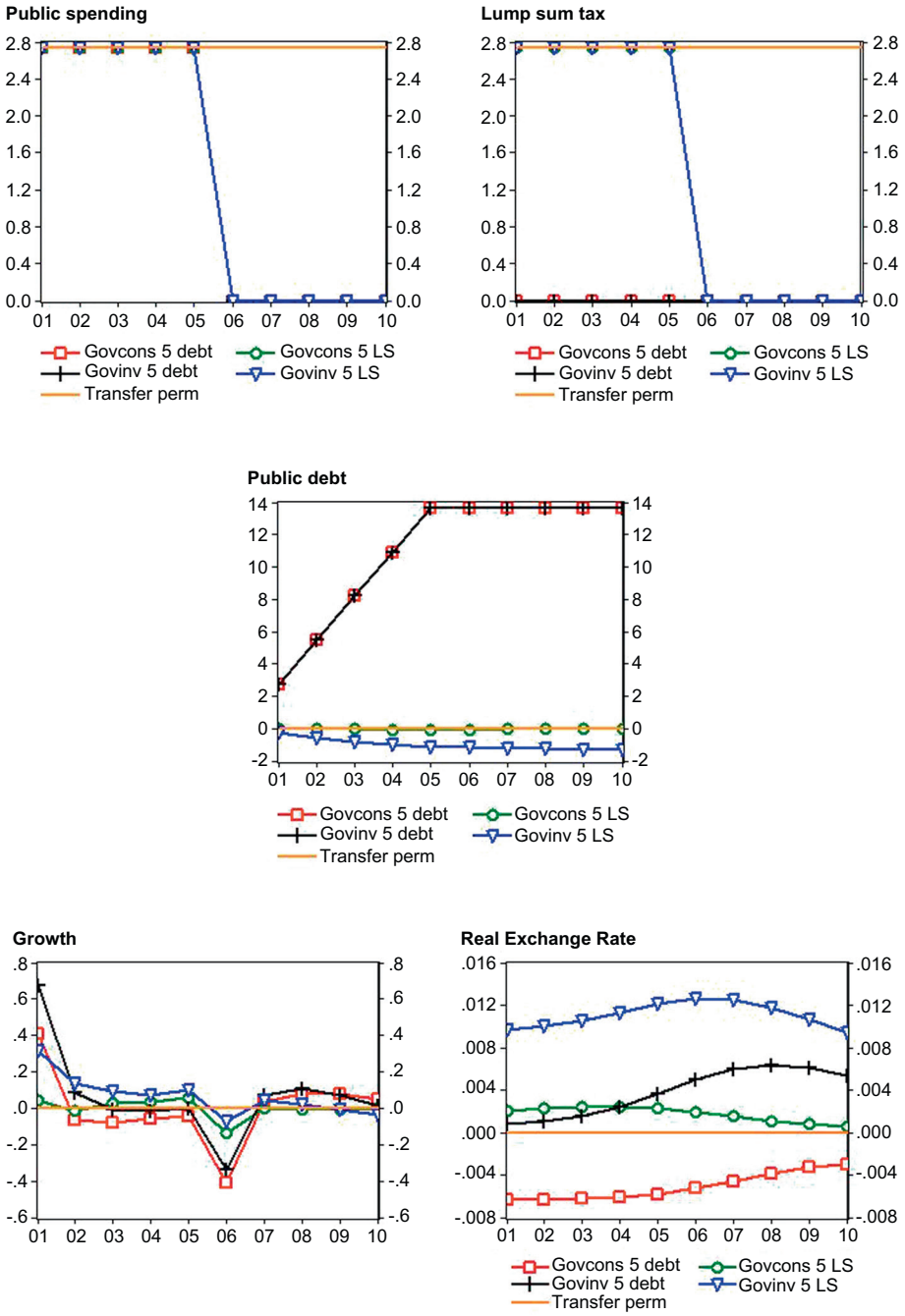


Figure 3.3. Fiscal Spending and Fiscal Rule Stabilization, Simulations

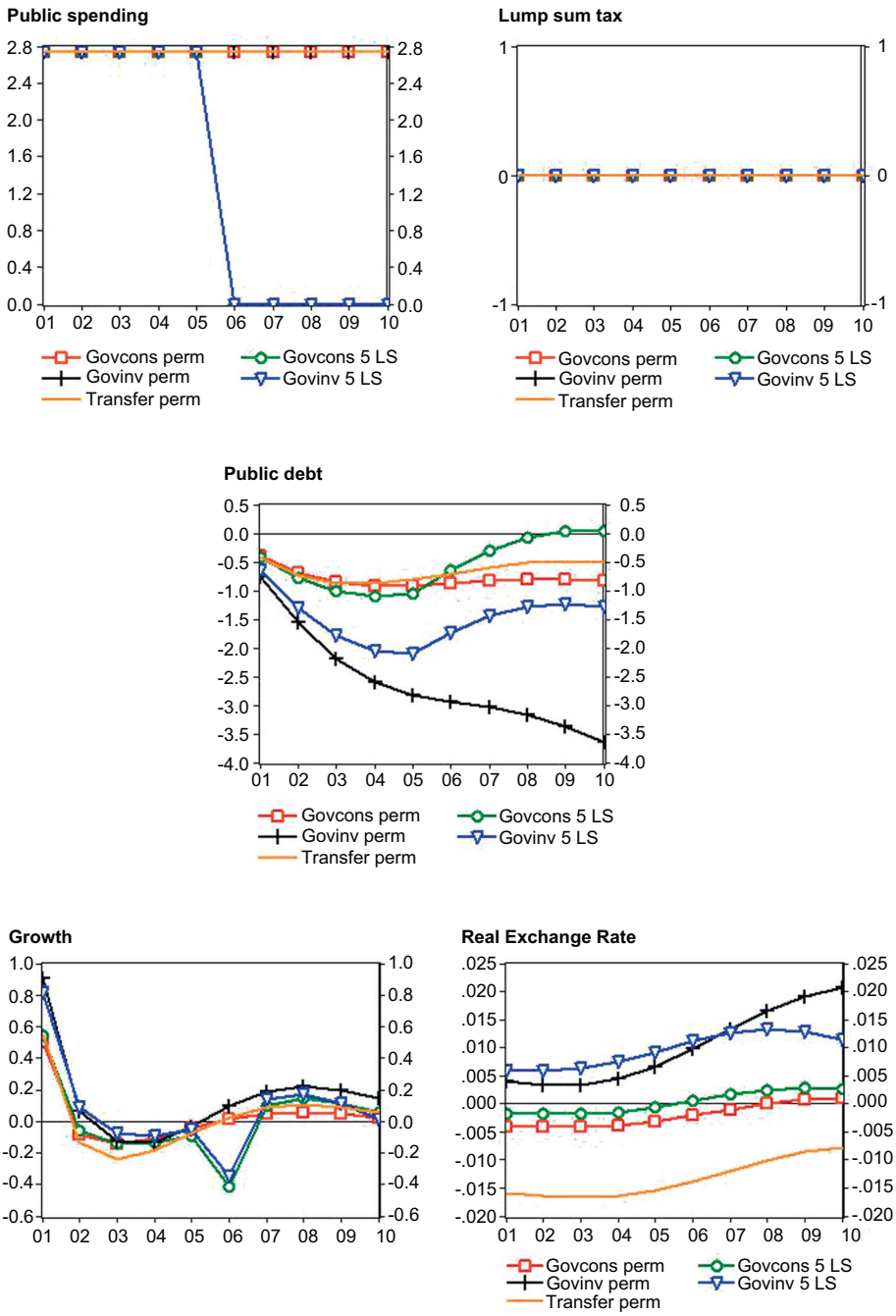


Table 3.1. GIMF South Africa: Calibrated Parameters

Variable	Program Code	Value
Real Gross Interest Rate in terms of final output	RR_HO	1.026
Net External Financial Asset Position to GDP (NFA/GDP)	F_RAT_HO	-0.100
Real World Growth Rate	gbar	1.040
Population Growth Rate	popgrowth	1.000
Steady State Inflation Rate	piebar_HO	1.045
Scale of GDP	GDPGAP_HO_SS	0.000
Country Size in Terms of Population	popsize_HO	0.570
Size of home GDP in percent of World GDP	gdpsize_HO	0.570
Probability of Surviving (10 year planning horizon, degree of myopia)	theta_HO	0.800
Income Decline Rate (20 year remaining working life)	chi_HO	0.800
Inverse of Intertemporal elasticity of substitution, Coefficient of Relative Risk Aversion	gamma_HO	4.000
Habit persistence (degree of)	nu_HO	0.400
Share of Liquidity Constrained Agents	psi_HO	0.700
Liquidity Constrained Agents: Share in Dividends/Share in Population	divishare_HO	0.250
Depreciation Rate of Private Capital (preliminary)	dep_k_HO	0.100
Depreciation Rate of Government Capital	dep_kg1_HO	0.040
Depreciation Rate of Human Capital	dep_kg2_HO	0.100
Elasticities of Substitution		
Between Varieties in nontradable sector	sigma_N_HO	6.000
Between Varieties in tradable sector	sigma_T_HO	6.000
Between Varieties in retail sector	sigma_R_HO	21.000
Between Varieties Distributors sector	sigma_D_HO	21.000
Between Varieties in Union sector	sigma_U_HO	6.000
Between Varieties Importers of final goods	sigma_DM_HO	41.000
Between Varieties in importers of intermediate goods	sigma_TM_HO	41.000
Between Domestic and Foreign Goods	xi_D_HO	1.500
Between Private Ouput and Public Capital	xi_A_HO	0.500
Between Domestic and Foreign Goods	xi_T_HO	1.500
Between Foreign Final Goods from Different Countries	xi_DM_HO	0.750
Between Foreign Intermediary Goods from Different Countries	xi_TM_HO	0.750
Between Labor and Capital in the Tradable Sector	xi_ZN_HO	0.990
Between Labor and Capital in the Non Tradable Sector	xi_ZT_HO	0.990

Table 3.1. GIMF South Africa: Calibrated Parameters (continued)

Variable	Program Code	Value
Shock Persistence		
autocorrelated monetary policy shock	rho_INT_HO	0.000
exogenous stochastic process for government consumption	rho_GC_HO	0.000
stochastic discount factor of utility function of consumers LIQ and OLG (private savings rate)	rho_BBETA_HO	0.600
shock to investment	rho_INV_HO	0.600
exogenous increase in government investment in infrastructure	rho_GOVINV_HO	0.600
labor augmenting stationary technology in nontradables	rho_A_N_HO	0.600
labor augmenting stationary technology in tradables	rho_A_T_HO	0.600
worldwide technology unit root	rho_TGROWTH	0.000
Monetary Policy		
Interest rate smoothing (lagged nominal interest rate coefficient) in the monetary policy r eaction function	mui_HO	0.828
Inflation Target Coefficient in the monetary policy reaction function	mu_mon_pie_HO	1.796
GDP Growth Coefficient In The Monetary Policy Reaction Function	mu_mon_ygr_HO	0.000
Output-Gap Coefficient In The Monetary Policy Reaction Function	mu_mon_y_HO	0.045
Exchange Rate Depreciation Coefficient In The Monetary Policy Reaction Function	mu_mon_e_HO	0.000
Fiscal Policy		
Government consumption smoothing in the government spending policy rule	mug_HO	0.500
Government spending reaction to deviations from inflation target	mu_fisc_pie_HO	0.000
Government spending reaction to GDP growth	mu_fisc_ygr_HO	0.000
Government spending reaction to output gap	mu_fisc_y_HO	-0.150
Government spending reaction to deviations from desired domestic currency depreciation	mu_fisc_e_HO	0.000
Tax revenue smoothing parameter. The reciprocal assumes zero deficit in equilibrium	mut_HO	0.500
Tax revenue reaction to deviations from desired debt-to-GDP ratios.	mu_fisc_bt_HO	0.100

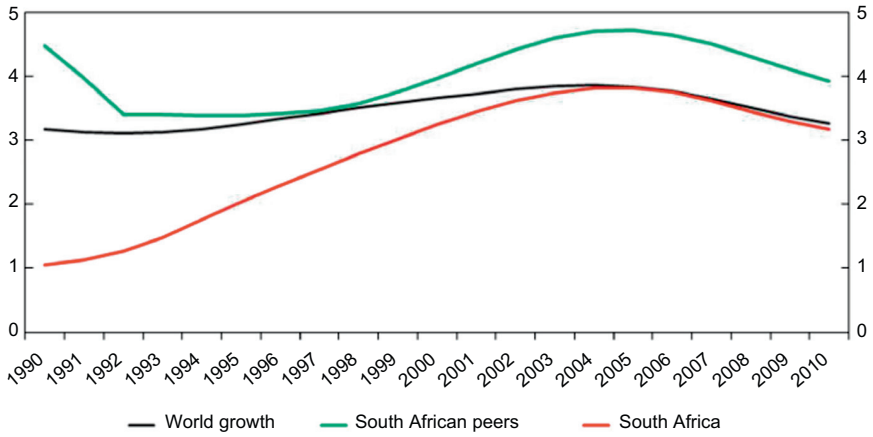
Table 3.2. GIMF South Africa: Selected Ratios

Variable	Program Code	Value
Labor Income Share in Total Economy to GDP	LABOR_RAT_HO	44.800
Labor Income Share in Non Tradable Sector to GDP	LABOR_NTG_RAT_HO	38.000
Investment Share to GDP (tradables and nontradables)	INV_RAT_HO	18.000
Nontradables Shares	NTGSHARE_HO	0.500
Imports of intermediate goods to GDP	IMPORTS_T_RAT_HO	2.700
Imports of final goods to GDP	IMPORTS_D_RAT_HO	3.600
Exports value of intermediate goods to GDP	EXPORTS_T_RAT_HO	3.100
Government Overall Spending Ratios to GDP	GOV_RAT_HO	26.000
Government Consumption to GDP	GOVCONS_RAT_HO	19.500
Government Debt to GDP Ratio	B_RAT_HO	30.000
Tax revenue share of consumption tax	CTAXSHARE_HO	40.000
Tax revenue share of tax on return on capital stock	KTAXSHARE_HO	57.800
Tax revenue share of profit tax	PTAXSHARE_HO	2.200

4 Insights from the Experience of South Africa

How would a change in the policy mix affect South Africa? Although the cross-country experience and theoretical simulations provide useful context, the question can only be answered properly by exploring the effect that monetary and fiscal policies have had on South African macroeconomic outcomes. And considering that South Africa is a small open economy increasingly integrated to the global economy, one needs to take proper account of the external environment to identify the effect of macroeconomic policies.

South Africa; Relative Potential Growth Performance
(Percent a year)



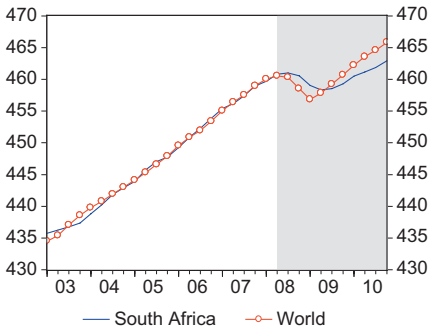
Like in many small open economies, external developments exert a strong influence on South African economic activity. Since the end of apartheid in 1994, and as the country has increased its integration to the global economy and the international community eased sanctions, South African growth has risen to world-average levels. That was at least until up to the global financial crisis. Although South Africa's economic activity did not fall as fast or deep as it did on average in the rest of the world, its recovery has lagged well behind. Does the slow recovery reflect that South Africa is more closely integrated to Europe, whose economic activity continues to suffer from the legacies of the crisis?

In part it does. First, although South Africa has lagged behind the world economy, so have its main trading partners. A projection of GDP of the euro area, the United States, Japan, and China onto South Africa's GDP, estimated with data through 2008Q2, does a good job at explaining the 2010Q4 South African GDP. This could suggest the fate of South Africa closely follows that of its trading partners. This close integration explains much of the progress achieved over the last decades but, on this particular occasion, helps explain the recession and the slower recovery.

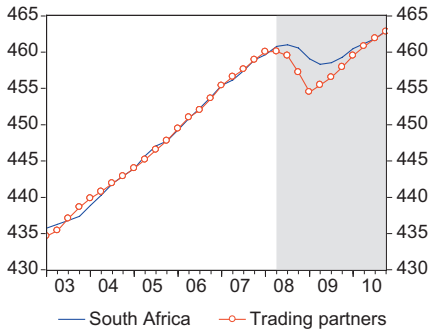
To study these issues, this chapter estimates an econometric model exploring the relationship among the main external variables, domestic policy variables, and South African macroeconomic outcomes, including the output gap, inflation, and the current account.[2] It evinces the following:

- External developments play a crucial role in explaining South African macroeconomic cycles.
- South African authorities have reacted to these cycles following countercyclical monetary and fiscal policies during 2003–10.

South Africa and World GDP
(Log index numbers, 2008 = 0)



South Africa and Trading Partner GDP
(Log index numbers, 2008 = 0)



IMF's WEO and fund staff estimates.

[2] For an early exploration of the effect of macroeconomic policies on growth, see Stryker and others (2000).

- These policies have influenced the final macroeconomic outcomes in the expected way. High real policy interest rates and low public spending have helped contain economic activity when needed, and vice versa.

- Because monetary and fiscal policies affect output as intended, policymakers can always calibrate the policy mix to ensure fiscal sustainability and keep forecast inflation on target over the medium term.

- World Economic Outlook estimates for GDP growth in the main trading partners suggest that South Africa could grow at an average 3.3 percent over the next five years. Higher growth could come from trading with more dynamic trading partners or temporarily through more expansive policies that would need adjustment down the road.

Empirical Links between the External Environment, Domestic Policies, and Macroeconomic Outcomes

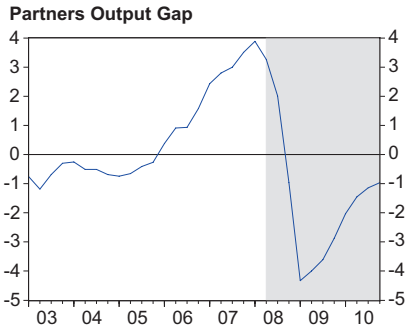
Estimation

The estimated model is a set of linear equations relating key South African macroeconomic outcomes, the external environment, and domestic policies. The key macro outcomes include the output gap, real exchange rates, and the current account. The external environment includes the output gap of trading partners, real interest rates in the United States, global risk aversion (VIX index), and the terms of trade for South Africa. Most real variables are in log deviations from the trend in trading partners GDP, including the domestic output gap and the main fiscal variables.[3] The model was estimated by seemingly unrelated regressions with quarterly data for 2003–10. Bayesian estimation of a slightly smaller model, using the seemingly unrelated regression estimates as priors, delivered the same qualitative results. Tables 4.1 and 4.2 present the estimated coefficients by the different methods, and Tables 4.3 and 4.4 describe the data.

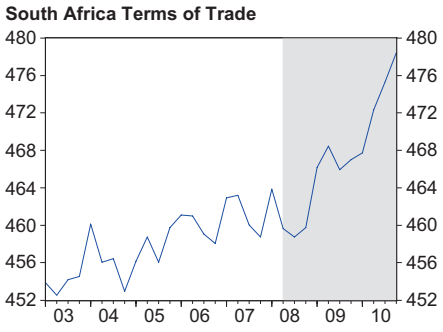
External Developments

How did the external environment behave during the period of estimation? The output gap of trading partners, a measure of external demand, went through one business cycle. In turn, relative prices of South African exports were increasingly favorable.

[3] Fiscal spending is taken from the national accounts and, for consistency, fiscal revenue, public debt, and the current account balance are deflated by the corresponding GDP deflator.



IMF's WEO and fund staff estimates.



IMF's WEO and fund staff estimates.

The empirical model suggests the output gap of trading partners displays some persistence and responds to changes in global risk aversion (VIX).[4]

$$y_t^{partners} = \underset{(+)}{\alpha_{ypartnerspartners}} y_{t-1}^{ypartners} + \underset{(-)}{\alpha_{ypartnersvix}} (VIX_{t-1} - 20.2) \quad (1)$$

$$(tot_t^{SA} - 471) = \underset{(+)}{_{tottot}} (tot_{t-1}^{SA} - 471) \quad (2)$$

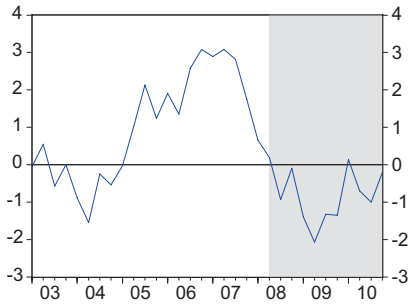
External financial conditions have also displayed cycles. Global risk aversion was low during the earlier boom for trading partners and rose sharply during the crisis. Real interest rates in the United States were increased during the boom and lowered to the extent of being negative during the global financial crisis.

Technically, the VIX follows a simple autoregression (AR1). In turn, real policy rates in the United States shows some persistence but also respond to changes in economic activity in South Africa's trading partners, which explain much of world trade and activity.

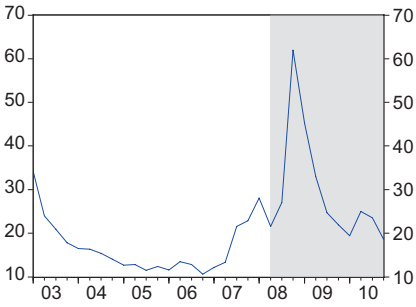
$$(VIX_t - 20.2) = \underset{(+)}{\alpha_{vixvix}} (VIX_{t-1} - 20.2) \quad (3)$$

$$(r_t^{USA} - 3) = \underset{(+)}{\alpha_{rusar}} (r_{t-1}^{USA} - 3) + \underset{-}{\alpha_{rusapartners}} y_{t-1}^{partners} \quad (4)$$

[4] The VIX and the terms of trade enter into the model as deviations from a calibrated level consistent with a constant in a linear regression.



IMF's WEO and fund staff estimates.



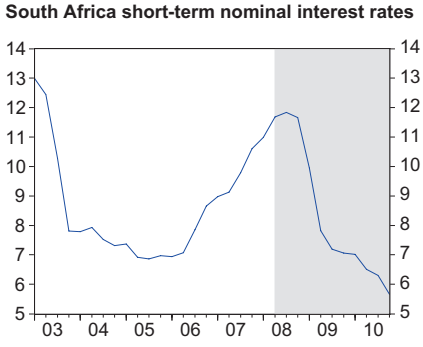
IMF's WEO and fund staff estimates.

Monetary Policy

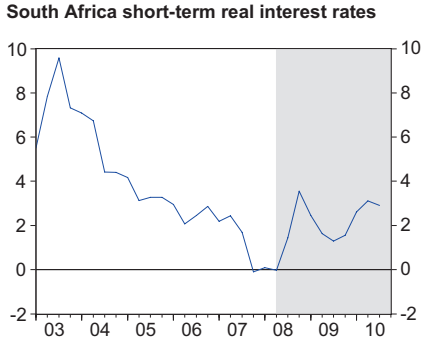
The South African Reserve Bank (SARB) has set nominal policy rates as a function of inflation deviations from the target band. The empirical model suggests that policy decisions have responded to forward looking inflation. As we will see, inflation expectations depend on the output gap, so indirectly the SARB has reacted to the output gap as well. The adjustments, however, are gradual, which implies some persistence in the rate. For simplicity, inflation deviations in the model are calculated with respect to the midpoint of the target band, although the SARB does not assign a specific role to the midpoint.

The estimated coefficients of the monetary policy reaction function have the right sign, but the evolution of the associated real interest rate could suggest that the monetary policy reaction could have been stronger.[5]

$$(R_t^{SA} - 8.5) = \alpha_{RC}(R_{t-1}^{SA} - 8.5) + (1-\alpha_{RC})\left(\underset{(+)}{\alpha_{Rpit\,\arg 3t}}(\pi 4_{t+1}^{SA} - 4.5)\right) \quad (5)$$



IMF's WEO and fund staff estimates.



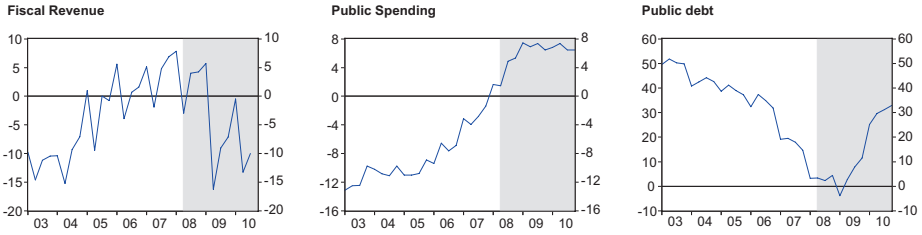
IMF's WEO and fund staff estimates.

[5] An alternative specification with one-year-ahead inflation expectations and the output gap would yield a positive sign on the output gap and a negative one on the inflation expectations.

Fiscal Policy

South African fiscal policy reduced public debt during the boom years and increased it during the recession. Although both fiscal revenue and public spending increased during the boom years, fiscal revenue grew faster. During the recession, fiscal revenue collapsed while public spending remained stable.

South Africa: Evolution of Main Fiscal Variables
(In log deviations from potential output of trading partners, rescaled so that 2008 = 0)



IMF's WEO and fund staff estimates. IMF's WEO and fund staff estimates. IMF's WEO and fund staff estimates.

The model captures this by implying that fiscal revenue is procyclical because it increases with the output gap but has also responded to the terms of trade.

$$prev_t^{SA} = \underset{(+)}{\alpha_{prevy}} y_{t-1}^{SA} + \underset{(+)}{\alpha_{prevtot}} (tot_{t-1}^{SA} - 471) \tag{6}$$

Primary public spending has also been technically procyclical but less so than fiscal revenue. Public spending also has some degree of persistence.

$$(pspend_t^{SA} - 7) = \underset{(+)}{\alpha_{pspendpspend}} (pspend_{t-1}^{SA} - 7) + \underset{(+)}{\alpha_{pspendy}} y_{t-1}^{SA} \tag{7}$$

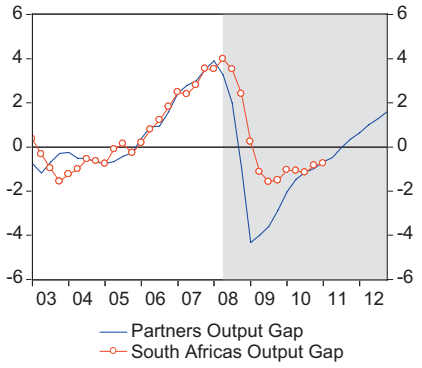
As a result, the fiscal balance and public debt have been markedly countercyclical. In particular, public debt has fallen during good times and increased during bad times. Public debt has fallen when the output gap has been positive and risen when it has been negative. It also has fallen when the terms of trade have increased and increases when they have fallen. Higher real interest rates have increased public debt.

$$pdebt_t^{SA} = \underset{(-)}{\alpha_{pdebty}} y_{t-1}^{SA} + \underset{(-)}{\alpha_{pdebttot}} (tot_{t-1}^{SA} - 471) + \underset{(+)}{\alpha_{pdebtr}} (r_{t-1}^{SA} - (y_t^{SA} - y_{t-1}^{SA})) \tag{8}$$

Macroeconomic Outcomes

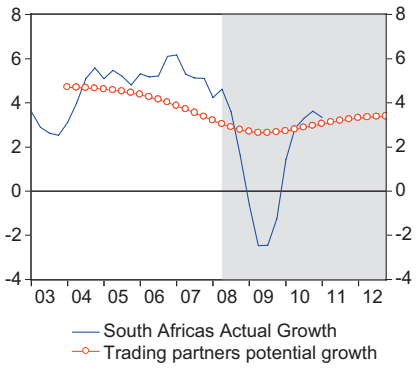
The South African output gap has closely followed the output gap of its trading partners. Financial and commercial trade with the euro area has established a strong bond between the two economies. But South Africa's external linkages have grown well beyond the euro area because it has increasingly become more integrated into the world economy. China's entry into the World Trade Organization has expanded South Africa's trade with Asia, and China is now the single largest trading partner of the country.

South Africa and World Output Gaps
(Log differences from potential)



IMF's WEO and fund staff estimates.

South Africa and Partners Potential Growth
(Percent)



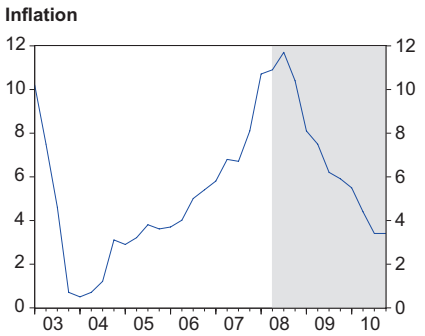
IMF's WEO and fund staff estimates.

Domestic macroeconomic policies, however, have also influenced the output gap. In particular, the South African output gap also has fallen with increases in expected short-term real interest rates and real appreciation and has risen with public spending.

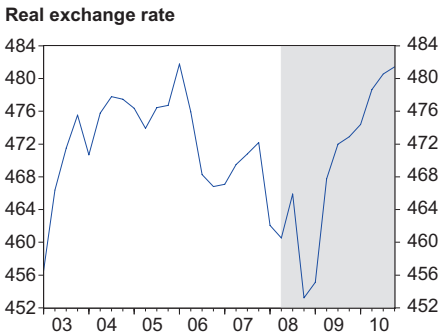
$$y_t^{SA} = \underset{(+)}{\alpha_{yy}} y_t^{partners} + \underset{(-)}{\alpha_{yr}} (r_t^{SA} - 4) + \underset{(-)}{\alpha_{yreer}} (reer_t^{SA} - 469)$$

$$+ \underset{(+)}{\alpha_{ypubspend}} (pubspend_t^{SA} - pubspend_{t-1}^{SA}) \qquad (9)$$

Has the real exchange rate also responded systematically to the external environment and domestic policies? Or has it behaved as a random walk? The data suggests the former. Although the South African real effective exchange rate has been persistent, the rand has appreciated in real terms with real interest rate differentials. These are measured as expected excess South African real returns over those in the United States. A relative cut in domestic short-term real interest rates, under central bank control, has lowered real appreciation and increased the output gap. And, an increase in real domestic



IMF's WEO and fund staff estimates.



IMF's WEO and fund staff estimates.

interest rates has appreciated the rand in real terms. In addition, higher public spending over revenue has led to appreciation and higher global risk aversion has led to depreciation.[6]

$$(reer_t^{SA} - 469) = \underset{(+)}{\alpha_{rreerreer}}(reer_{t-1}^{SA} - 469) + \left(\underset{(+)}{\alpha_{reerr}}(r_t^{SA} - 4) - \underset{(+)}{\alpha_{reerr}}(r_t^{US} - 3) \right)$$

$$+ \left(\underset{(-)}{\alpha_{rreervix}}(VIX_{t-1} - 20.2) + \underset{(+)}{\alpha_{reerdef}}(pubspend_t - prev_t) \right) \quad (10)$$

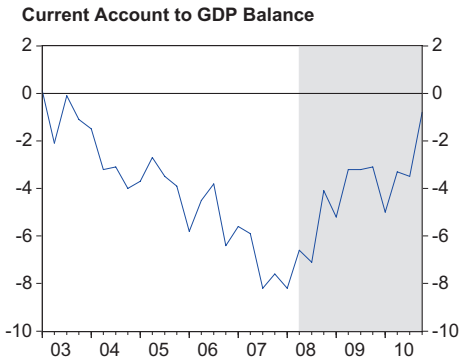
What about domestic inflation? Inflation in South Africa has increased with the domestic output gap and fallen with higher expected real short-term interest rates. It also has increased with public debt (alternatively with higher fiscal deficits). It has fallen with real appreciation. Global food prices have played a role, but neither oil prices or wage increases have directly and systematically affected inflation.

$$(\pi 4_t^{SA} - 4.5) = \underset{(+)}{\alpha_{\pi\pi}}(\pi 4_{t-1}^{SA} - 4.5) + \underset{(+)}{\alpha_{\pi y}} y_{t-1}^{SA} + \underset{(-)}{\alpha_{\pi r}}(r_{t-1}^{SA} - 4)$$

$$+ \underset{(-)}{\alpha_{\pi reer}}(reer_{t-1}^{SA} - 469) + \underset{(-)}{\alpha_{\pi food\pi}}(food\pi_{t-1} - 7) \quad (11)$$

And the current account? The current account balance has worsened during the boom years and strengthened during the recession. Consistent with this observation, the model identifies a systematic negative relationship with the output gap. It also finds a systematic negative relationship with real

[6] See MacDonald and Ricci (2004) for an earlier empirical study of determinants of the real exchange rate in South Africa.



appreciation, suggesting that currency appreciation leads to higher current account deficits.

$$(cab_t^{SA} + 4) = \underset{(-)}{\alpha_{cabreer}}(reer_{t-1}^{SA} - 469) + \underset{(-)}{\alpha_{caby}} y_{t-1}^{SA} \qquad (12)$$

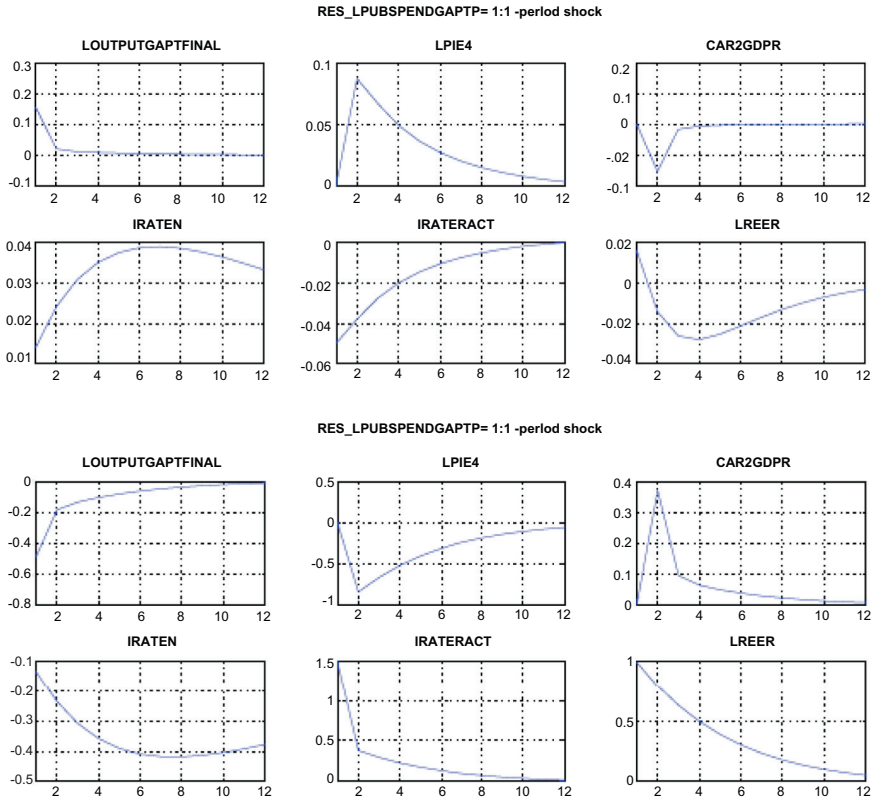
Implications for the Policy Mix

What does this imply for the policy mix? An activity neutral change in the policy mix that tightens the fiscal policy, permitting a looser monetary policy, would on the margin depreciate rand in real terms and increase inflation in the short term.

The empirical model sheds light on some of the possible channels. The immediate effect of cutting public spending is to hurt economic activity [eq. (1)]. If the cut in public spending does not lead to a reduction in tax revenues, it could lead to currency depreciation (or lower appreciation) [eq. (10)]. Rand depreciation would then offset some of the initial losses in economic activity [eq. (11)]. Some cuts in policy interest rates need to take place to keep economic activity unchanged. The lower interest rates would further depreciate the currency. The higher depreciation would then lead to higher inflation.[7] Both lower real interest rates and currency depreciation would increase inflation, assuming the effect of the change in the policy mix on the output gap is neutral [eq. (11)]. The change in the policy mix would also strengthen the current account [eq. (12)].

Impulse responses computed from the Bayesian system estimation suggest in the end the change in the policy mix would depreciate the

[7] The real depreciation would also lead to a marginal reduction in the current account deficit.



rand, lead to higher inflation, and weaken the current account balance. Several observations follow. First, to offset the negative impact on the domestic output gap of a one percentage point of potential GDP cut in public spending requires a cut in real interest rates of about one-third of a percentage point. Second, the cut in public spending results in a negligible real appreciation that is largely offset by the currency depreciation associated with the cut in real interest rates. Third, the small deflationary effect of the cut in fiscal spending is offset by the inflationary impact of the cut in real interest rates. Finally, the effect on the current account is uncertain at the beginning, but the change in the policy mix would deteriorate the current account for a while after a few quarters.

Thus, a tighter fiscal stance and a looser monetary policy calibrated to avoid an effect on activity may require higher appetite or room to tolerate an increase in inflation in the short run. This could easily be supported when inflation is at record lows or below the target band. Such recomposition in the policy mix would seem ideal when facing capital inflows, whose effect is to appreciate the currency (that has a negative effect on output) and to lower inflation. The change in the policy mix

would offset both the currency appreciation and the associated (lower) inflationary pressure. Yet, higher inflation may be more challenging when it already exceeds the target band, and further increases could endanger central bank credibility.

Would such a policy mix rebalancing generate higher growth in the medium term? A more depreciated real exchange rate would not deliver a higher growth rate than the one permitted by South Africa's interaction with its partners in the world economy in the long run. Yet, a more depreciated real exchange rate may be the only way to be able to at least get there under the current political realities. Sustainable world growth levels require more investment than currently in place and eventually will require higher savings. South Africa reached world growth levels during 2005–08 by significantly increasing its investment rate despite its stable low saving rate. This was possible by tapping foreign savings or, in other words, by running a current account deficit.

If investments were funded by tapping foreign saving, the rand would need to depreciate more in real terms to guarantee external sustainability. It would encourage direct investment in sectors that can service the foreign savings used, either because they produce tradable goods or because they are complementary to such production, like investment in infrastructure.

An alternative way to achieve higher investment rates is to take measures that increase the saving rate. This could include lowering real wages in the public sector, reforming the wage bargaining system to undermine market power from the unions, and lowering minimum wages, among others.

Current Account , Saving and Fixed Capital Formation
(In percent of GDP)

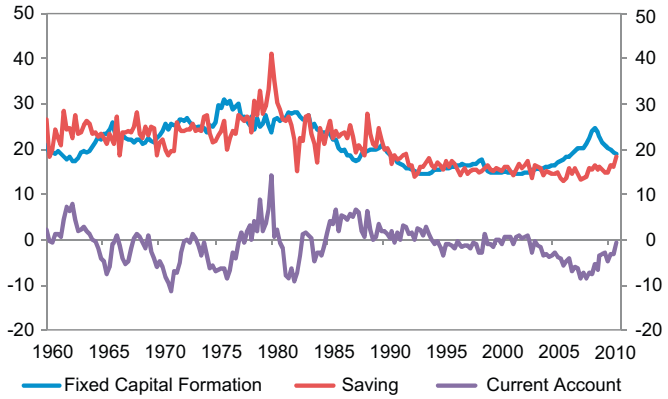


Table 4.1. Estimated System Parameters

System
Estimation Method: Seemingly Unrelated Regression
Sample: 2003Q1 2010Q4
Included observations: 32
Total system (unbalanced) observations 442

		Coefficient	Std. Error	t-Statistic	Prob.
C(2)	αyy	0.54	0.04	13.54	0.00
C(3)	αyr	-0.31	0.03	-10.15	0.00
C(7)	αyreer	-0.07	0.01	-7.45	0.00
C(8)	αypubspend	0.18	0.04	4.19	0.00
C(22)	αreerreer	0.35	0.06	5.85	0.00
C(23)	αreerr	0.66	0.16	4.11	0.00
C(24)	αreervix	-0.37	0.05	-6.93	0.00
C(26)	αreerdeficit	0.19	0.05	3.50	0.00
C(351)	αππ	0.42	0.03	12.53	0.00
C(352)	απy	0.43	0.05	8.24	0.00
C(354)	απr	-0.43	0.04	-10.75	0.00
C(359)	απreer	-0.09	0.01	-7.46	0.00
C(355)	απfoodfor	0.01	0.00	6.77	0.00
C(553)	αcabreer	-0.08	0.02	-4.22	0.00
C(557)	αcaby	-1.07	0.11	-10.00	0.00
C(215)	αRR	0.96	0.01	72.92	0.00
C(214)	αRpitarget	3.00	1.11	2.71	0.01
C(405)	αprevy	2.63	0.47	5.60	0.00
C(406)	αprevtot	0.33	0.07	4.53	0.00
C(303)	αpspendpspend	0.94	0.01	67.78	0.00
C(305)	αpspendy	0.39	0.11	3.70	0.00
C(457)	αpdebty	-3.61	1.13	-3.18	0.00
C(458)	αpdebttot	-1.24	0.28	-4.52	0.00
C(459)	αpdebtr	2.98	0.79	3.78	0.00
C(501)	αypartnerpartner	0.91	0.05	19.53	0.00
C(502)	αypartnervix	-0.05	0.01	-6.12	0.00
C(601)	αtottot	0.91	0.04	23.50	0.00
C(71)	αvixvix	0.69	0.10	6.58	0.00
C(703)	αrusar	0.96	0.04	22.14	0.00
C(704)	αrusapartner	-0.16	0.07	-2.47	0.01
C(705)	αrusavix	-0.02	0.01	-1.77	0.08
C(90)	αEπc	4.02	0.32	12.54	0.00
C(92)	αEππ	0.47	0.05	9.57	0.00

Table 4.2. Bayesian System Estimation

Bayesian System Estimation

		Prior		Posterior	
		Mode	**Dispersion**	**Mode**	**Dispersion**
C(2)	αyy	0.543	3.503	0.597	0.054
C(3)	αyr	-0.308	4.649	-0.287	0.046
C(7)	αyreer	-0.074	6.189	-0.063	0.014
C(8)	αypubspend	0.184	5.146	0.142	0.067
C(22)	αreerreer	0.351	3.59	0.548	0.11
C(23)	αreerr	0.663	3.171	0.664	0.168
C(24)	αreervix	-0.373	4.226	-0.297	0.078
C(26)	αreerdeficit	0.19	2.789	0.049	0.248
C(351)	απ	0.421	3.978	0.49	0.061
C(352)	απy	0.433	3.922	0.432	0.085
C(354)	απr	-0.429	3.94	-0.414	0.063
C(359)	απreer	-0.087	8.743	-0.024	0.028
C(355)	απfoodfor	0.014	21.48	0.003	0.004
C(553)	αcabreer	-0.079	9.203	-0.11	0.034
C(557)	αcaby	-1.068	2.499	-0.986	0.12
C(215)	αRR	0.961	2.634	0.946	0.012
C(214)	αRpitarget	3.002	1.49	3.008	0.157
C(303)	αpspendpspend	0.941	2.662	0.994	0.007
C(305)	αpspendy	0.395	4.11	0.352	0.125
C(501)	αypartnerpartner	0.913	2.702	0.869	0.056
C(502)	αypartnervix	-0.049	11.616	-0.053	0.011
C(601)	αtottot	0.912	2.314	0.966	0.027
C(71)	αvixvix	0.688	3.113	0.788	0.115
C(703)	αrusar	0.956	2.641	0.944	0.041
C(704)	αrusapartner	-0.164	6.375	-0.094	0.061
C(705)	αrusavix	-0.02	18.409	-0.034	0.013
C(90)	αEπc	4.019	1.288	4.019	0.136
C(92)	αEππ	0.467	3.778	0.467	1

Table 4.3. South Africa's Series Description

Variable	Description
y_t^{SA}	*South African output gap*. Estimated as the difference between the log of real GPD and the trend component of the Hodrick-Prescott filter (lambda = 1,600) on the log of real GDP from trading partners. The latter is estimated as the weighted average GDP of the euro area, the United States, Japan, and China, with the weights taken from the 2008 market share of these countries in South African exports, as computed from the IMF's Direction of Trade Statistics Database.
r_{t-1}^{SA}	*South African real short-term interest rate*. Computed as where R- $E\pi$, where R is the nominal interest rate on three-months bankers' acceptances (Haver Analytics code N199RB3M@EMERGEMA) and $E\pi$ is the actual four-quarter headline inflation one-quarter ahead as measured by the .
$REER_{t-1}^{SA}$	*South African real effective exchange rate* as computed by the SARB. Index (2000 = 100), an increase means appreciation (Haver Analytics code N199XRE@EMERGEMA). The series has been rebased to the year 2008 and expressed in natural logarithms. An increase means an appreciation.
$pdebt_{t-1}^{SA}$	*South African public debt*. Expressed in constant 2005 rand as deviations from potential output. Computed by deflating South Africa's gross national government debt (Haver code N199FDG@EMERGEMA) by South Africa's GDP price deflator (Haver code S199NGPJ@EMERGEMA). The series has been rebased to the year 2008 and expressed in natural logarithms.
$prev_t^{SA}$	*South African public revenue*. Expressed in constant 2005 rands as deviations from potential output. Computed by deflating South Africa's consolidated general government cash receipts from operating activities (SARB's database code KBP4856) by South Africa's GDP price deflator (Haver code S199NGPJ@EMERGEMA). The has have been rebased to the year 2008 and expressed in natural logarithms.
$pspend_t^{SA}$	*South African public spending*. Computed by adding real government consumption (Haver code S199NCGC@EMERGEMA) and real fixed investment by public authorities (Haver code S199NIAC@EMERGEMA) and public corporations (Haver code S199NIPC@EMERGEMA) from the national accounts. The series has been rebased to the year 2008 and expressed in natural logarithms.
cab_t^{SA}	*South Africa's current account balance*. Expressed as a percent of real GDP. Computed by deflating South Africa's current account balance (Haver code, S199BCD@EMERGEMA) by the U.S. implicit price deflator of GDP (Haver code DGDP@USECON) and then expressing as percent of South Africa's dollar GDP at 2005 prices and exchange rates (Haver code S199NGCD@EMERGEMA).

Table 4.4. External Environment Description

Variable	Description
$y_t^{partners}$	*Cyclical component of partners weighted average GDP computed using the Hodrick Prescott filter (lambda = 1,600) from quarterly data obtained from Haver Analytics and extended through 2014 with projections from the WEO database. The partners are the euro area, the United States, Japan, and China.*
VIX_{t-1}	*Chicago Board of Options Exchange SP500 market volatility index* (the VIX) (Haver code SPVXO@USECON).
r_{t-1}^{US}	*U.S. real expected federal funds rate*. Computed as (1 +R) / (1 +$E\pi$) where R is the U.S. federal funds effective rate (Haver code FFED@USECON) and $E\pi$is the one-year-ahead core inflation expected by professional forecasters (Haver Analytics code ASACCX@SURVEYS).
tot_{t-1}^{SA}	*South African terms of trade, excluding gold* (Haver code S199PFTX@ EMERGEMA). The series have been rebased to the year 2008 and expressed in natural logarithms.

5 Conclusions

What are the effects of fiscal tightening, monetary loosening, and reserve buildup on growth and the real exchange rate? Cross-country evidence and policy simulations with a dynamic general equilibrium model suggest they are uncertain. The cross-country evidence suggests that a fiscal tightening would increase growth only if the expansionary effect of lower real interest rates and reserve buildup offset its contractionary effect. No clear message comes for the real exchange rate. The policy simulations confirm a cut in fiscal spending would negatively affect growth, while its effect on the exchange rate would be unclear. The policy simulations show the composition, funding, and persistence of the fiscal policy matters for the outcomes.

Nevertheless, the experience of South Africa during the last business cycle suggests that such a rebalancing may have a chance of delivering higher growth if countercyclical monetary and fiscal policies remain in place. The empirical relationships suggest that a tighter fiscal balance would depreciate the rand and lead to a weaker current account balance. Access to foreign saving would allow more investment than allowed by the low saving rate. Also, the more depreciated rand would help guide those funds toward projects that yield returns that could help service the foreign savings.

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South Africa:
Macro Policy Mix and Its Effects on Growth and the Real Exchange Rate–Empirical Evidence and GIMF Simulations