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SOUTH AFRICA

Selected Issues

Prepared by Nikolay Gueorguiev, Rodney Ramcharan, Alison Stuart, and Burcu Aydin

Approved by the African Department

July 17, 2009

Contents Page

I. Between Scylla and Charybdis: Demand Management Policies to Support Growth and Maintain Stability in South Africa[1]

A. Introduction and a Brief Model Description

1. **The global crisis has seriously affected South Africa.** Output is falling as slumping external demand and falling commodity prices reverberate through the economy. At the same time, inflation is stubbornly high and the current account deficit remains sizable, keeping the economy vulnerable to sudden shifts in capital flows.

2. **In this environment, macroeconomic policies face a complicated task of balancing between supporting domestic demand and maintaining stability.** While the opening output gap and declining employment do call for countercyclical fiscal and monetary policy easing, policy makers should also be mindful of the effects of such policies on external and internal macroeconomic stability. Sizable deterioration in measures of stability like the external current account deficit and inflation could prove counterproductive to the objective of output stabilization if, for example, they weaken investor confidence and thus raise the risk of a sudden stop of capital inflows.

3. **This note analyzes the role of announced and expected fiscal and monetary policies in South Africa in balancing between these objectives.** We first simulate the dynamics of the economy under the negative external demand and commodity price shocks brought on the South African economy by the global crisis, and then apply a package of fiscal and monetary policies consistent with the authorities' announcements and market expectations. These policies affect measures of economic activity—growth and employment, and measures of macroeconomic stability—the trade balance and inflation. We find that policies that raise output and employment also lead to higher inflation and higher trade deficit. This trade-off, however, seems broadly favorable, as the "losses" in terms of higher inflation and trade deficit appear modest relative to the "gains" in terms of higher output and employment.

4. **The analytical tool we employ is the IMF's Global Integrated Monetary and Fiscal Model.** Built from extensive microfoundations, the model is particularly suitable for policy analysis owing to its rich structure, flexible and realistic menu of policy instruments, and endogenous interaction between fiscal and monetary policy.[2] Fiscal policy has strong and persistent effects on economic activity through realistic features such as (i) the presence of liquidity-constrained households, along with intertemporally-optimizing (overlapping-

[1] Prepared by Nikolay Gueorguiev.

[2] For a detailed description, see Kumhof and Laxton (2007).

generations) ones, which presence strengthens and accelerates the impact of fiscal policies;[3] (ii) finite planning horizon for the intertemporally-optimizing households, which emphasizes the effects of current policies at the expense of future ones; and (iii) distortionary taxes on consumption, capital, and labor that affect saving, investment, and labor supply decisions. Various nominal and real rigidities (e.g., sticky prices and wages, habit persistence in consumption, and adjustment costs in investment and trade) contribute to a realistic description of the interaction between monetary policy and the real economy as well.

5. **In accordance with South Africa's policy framework, we have chosen fiscal and monetary policy representations that aim to smooth the economic cycle and maintain stability.** We model fiscal policy as strongly countercyclical, aiming to stabilize the budget balance around a chosen structural target; cyclically higher/lower revenue thus lead to higher/lower target headline balance. The description of fiscal policy objectives in government documents of recent years tends to support such representation.[4] For the purposes of this note, the public sector is calibrated to include both the general government and the state-owned enterprises, as the latter implement the main part of the public sector investment program. Monetary policy operates in an inflation-targeting framework, guided by an inflation-forecast-based rule, where the policy rate responds to expected inflation and the output gap. As the financial sector is in good shape, the monetary policy transmission—which in South Africa is strong and fast—remains fully operational. Moreover, the flexible exchange rate—an integral part of the monetary policy framework—can usefully serve as a shock absorber without harmful side effects owing to the lack of significant balance sheet exposures in foreign currencies.

6. **We have further adapted the model to the South African environment.** First, we changed the model to exempt liquidity-constrained households from labor tax, as workers at the bottom half of the income distribution (who are more likely to be liquidity-constrained) typically do not pay personal income tax in South Africa. Moreover, they do not receive a share of the dividends paid by corporations as opposed to the higher-income households, and we calibrated the model to that effect. These features would tend to reduce the effect of personal income tax changes on consumption and employment. Second, to account for the existence of a large pool of underutilized labor, willing to work at the prevailing wage rate should labor demand pick up, the labor supply elasticity of liquidity-constrained households with respect to wages has been raised significantly above that of the nonconstrained ones. This parameterization allows large response of employment of liquidity-constrained workers to small changes in wages, approximating absorption of excess labor supply at close to

[3] Throughout the note, we will use interchangeably the term pairs intertemporally-optimizing (overlapping-generations)—higher income households, and liquidity-constrained—lower income households.

[4] See *Budget Review 2009*, pp. 52–53, *Budget Review 2008*, p. 47, and the Appendix to *Medium Term Budget Policy Statement 2007*, all available at http://www.treasury.gov.za/.

prevailing wages when labor demand picks up. Finally, the risk premium on international borrowing has been linked to the terms of trade, in addition to being related to the current account deficit as in Kumhof and Laxton (2007). This allows changes in prices of exported commodities to affect the risk premium on external borrowing (i.e., the spreads on international bonds and CDS contracts), an empirically relevant feature for South Africa.[5] The model is calibrated to South Africa's national accounts data for 2008 and fiscal data for FY 2008/9.

B. Policy Scenarios and Results

7. **The baseline scenario explores the impact of a negative external demand shock and a drop in export commodity prices under a standard (pre-crisis) policy response (Figure 1).** The external demand shock is calibrated to broadly correspond to the IMF's trade-weighted projections for output and import demand dynamics in South Africa's trading partners in 2009–10; the commodity price shock corresponds to projections for a trade-weighted index of export commodity prices. The policy response incorporated in this scenario is governed solely by the pre-crisis fiscal and monetary policy rules, i.e., it reflects the play of automatic stabilizers on the fiscal side and some monetary easing as implied by the monetary policy rule, but there are no discretionary fiscal or monetary policy actions.[6] The model is calibrated at quarterly frequency; the shocks can be thought of as emanating in the fourth quarter of 2008.

8. We then consider three policy scenarios and their effects:

- The first policy scenario combines the baseline with a monetary policy interest rate path consistent with policy actions in December 2008–March 2009 and market expectations (as of April 2009) for Q2–Q3 of 2009, after which monetary policy reverts to its pre-crisis rule. This path implies some "discretionary" easing on top of the easing implied by the policy rule. Figure 2 shows the effects of such monetary policy on the main macroeconomic variables relative to the baseline.

- The next scenario adds discretionary fiscal policy measures for 2009–11 (as announced in *Budget Review 2009*) to the previous scenario. On the expenditure side, policy is introduced as the planned increases in public investment (including State-Owned Enterprises), transfers, and government consumption relative to GDP. As no major tax initiatives were announced, tax policy is modeled as maintaining the

[5] As the model has only one commodity sector, which we have chosen to represent South Africa's exported commodities (mainly platinum group metals, gold, and coal), oil price changes do not directlly reflect the terms of trade.

[6] These rules should be viewed as describing broadly the systematic mode of reaction of fiscal and monetary policies to economic developments rather than as strict rules eliciting automatic policy response.

average effective tax rates on the main taxes unchanged. As revenues adjust endogenously in line with the dynamics of their tax bases, these fiscal policy assumptions for 2009–11 incorporate the effects of both automatic stabilizers and discretionary measures. Figure 3 illustrates the effects of the combined monetary and fiscal policies relative to the baseline.

- Finally, Figure 4 demonstrates the effects of a scenario that rebalances the fiscal policy mix in years two and three in favor of investment at the expense of consumption and adds a cut in the tax on capital (see paragraph 12).

9. **In the baseline, the external demand shock and the commodity price shock lead to significant drops in output, employment, and inflation.** The sharp decline in partner country demand cuts the volume of South Africa's exports (leading to output and employment decline), while the drop in export commodity prices further reduces the value of exports and, through the terms of trade effect, raises the cost of external borrowing.[7] Consumption and investment, however, fall more slowly than output, as intertemporally-optimizing consumers try to smooth the income shock over time, and the fall in investment is cushioned by the falling real interest rate and the real exchange rate depreciation (which stimulates investment in the tradable sectors). The trade deficit initially widens, as the negative external shocks outweigh the positive impact of the notable real exchange rate depreciation.[8] From a saving-investment perspective, the overall saving rate falls as government dissaving—spurred by the strongly countercyclical fiscal rule—more than offsets the moderate increase in private saving, while investment rises a little relative to GDP. Inflation declines, as the effect of the opening negative output gap dominates the effect of the depreciated exchange rate. This allows monetary policy to ease and remain accommodative for some time. Over time, private investment begins to rise, motivated—with a lag—by the lower real interest rate, the real exchange rate depreciation, and by the recovery in partner countries. This leads to output recovery in South Africa as well. The trade balance improves as the public sector deficit is quickly reduced in the wake of the output pick-up.

10. **The monetary policy path expected by the market alleviates the effect of the shocks on output and employment early, when they are at their worst.** Its seems to work mainly through its effect on investment, which is more sensitive to interest rate changes, although consumption also improves.[9] As the monetary easing in the first year after the

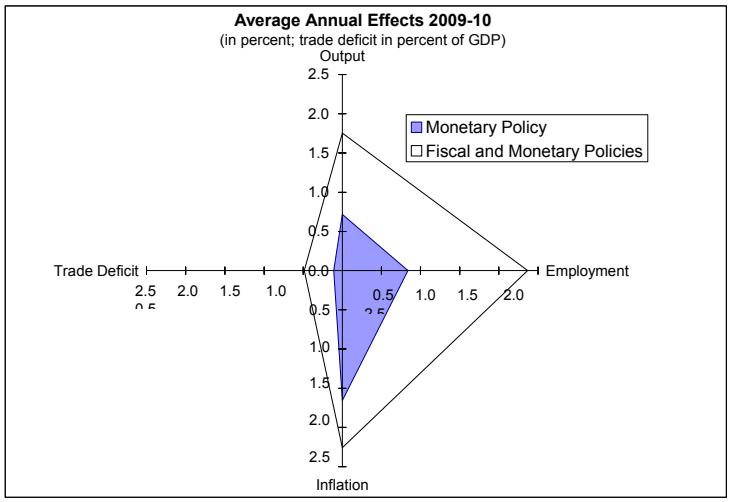
[7] The higher premium on external borrowing is also one way of accounting for the effects of the large portfolio outflows in late 2008.

[8] We focus on the trade deficit rather than the current account deficit for expositional clarity and because South Africa-specific factors make modeling the dynamics of the non-trade part of the current account difficult.

[9] The immediate effect of the interest rate easing on consumption is limited to consumers with significant net debt. Although household debt exposure is significant, it seems concentrated in upper-income households. A survey shows that consumers with mortgages accounted for only 14 percent of aggregate consumption in 2007.

shocks is more aggressive than the one suggested by the pre-crisis policy rule, it also results in somewhat higher inflation. The extra easing over the baseline suggested by this path affects the exchange rate, the external risk premium, and the trade balance only moderately.

11. **The combined package of monetary and fiscal policies has considerable effects on growth and employment with only moderate increases in inflation and the trade deficit relative to the baseline.** The text figure to the right shows the average annual increases in the four main macroeconomic variables of interest in the first two years after the external shocks under the two policy scenarios: a monetary policy response only (see Figure 2) and the same monetary policy response augmented with the fiscal policy measures announced in *Budget Review 2009* (see Figure 3). Fiscal policy appears more powerful than monetary policy largely because the presence of liquidity-constrained consumers (who cannot borrow and therefore do not benefit from the monetary easing) reduces the effect of monetary policy. The combined package of fiscal and monetary easing can raise output by about 1¾ percentage points and employment by almost 2½ percentage points at the expense of raising inflation by about 2¼ percentage points and the trade deficit by ½ percentage point of GDP (all relative to the counterfactual baseline of no discretionary policy reaction).[10] We view this as broadly encouraging, especially given that the nontrade component of the current account deficit has already begun shrinking, thus offsetting some of the projected increase in the trade balance. In addition to the higher inflation, another side effect is, however, that the fiscal expansion raises the real interest rate, which tends to crowds out private investment mildly for a few quarters. A note of caution: these results cannot be extrapolated for a much larger than planned fiscal expansion, as it would lead to rising interest rates that would diminish and eventually eliminate the output and employment gains.



12. **A moderate rebalancing of the fiscal policy mix could deliver even stronger and long-lasting growth and employment results without compromising the performance of inflation and the trade balance (Figure 4).** This policy scenario—motivated by the need to strengthen private investment, recently weakened by the drop in international commodity

[10] As South Africa follows an inflation-targeting framework, we let monetary policy respond endogenously to the rise in inflation created by both fiscal and monetary easing (relative to the counterfactual baseline) after the fourth quarter of the simulations.

prices and the decline in capital inflows—uses as a baseline the policy package used in the simulations in Figure 3 (i.e., the dynamics shown in Figure 4 are relative to the effects in Figure 3). It maintains the same monetary policy stance and rebalances the fiscal policy mix. Specifically, public investment is raised further by ¼ percentage point of GDP in years two and three of the simulations (broadly corresponding to South Africa's FY 2010/11 and 2011/12), while the envisaged increase in public consumption is reduced by similar amounts. In addition, to improve incentives for private investment, the average effective tax rate on capital is reduced permanently by one percentage point from year two onwards, financed by an increase in the "other" revenues (i.e., other than the three major taxes – on labor, capital, and consumption).[11] As private investment responds to both the tax cut and the increase in government investment (which increases private capital's productivity), this rebalancing results in moderately (but permanently) higher output and employment without measurable costs in terms of higher inflation and/or higher trade deficit.

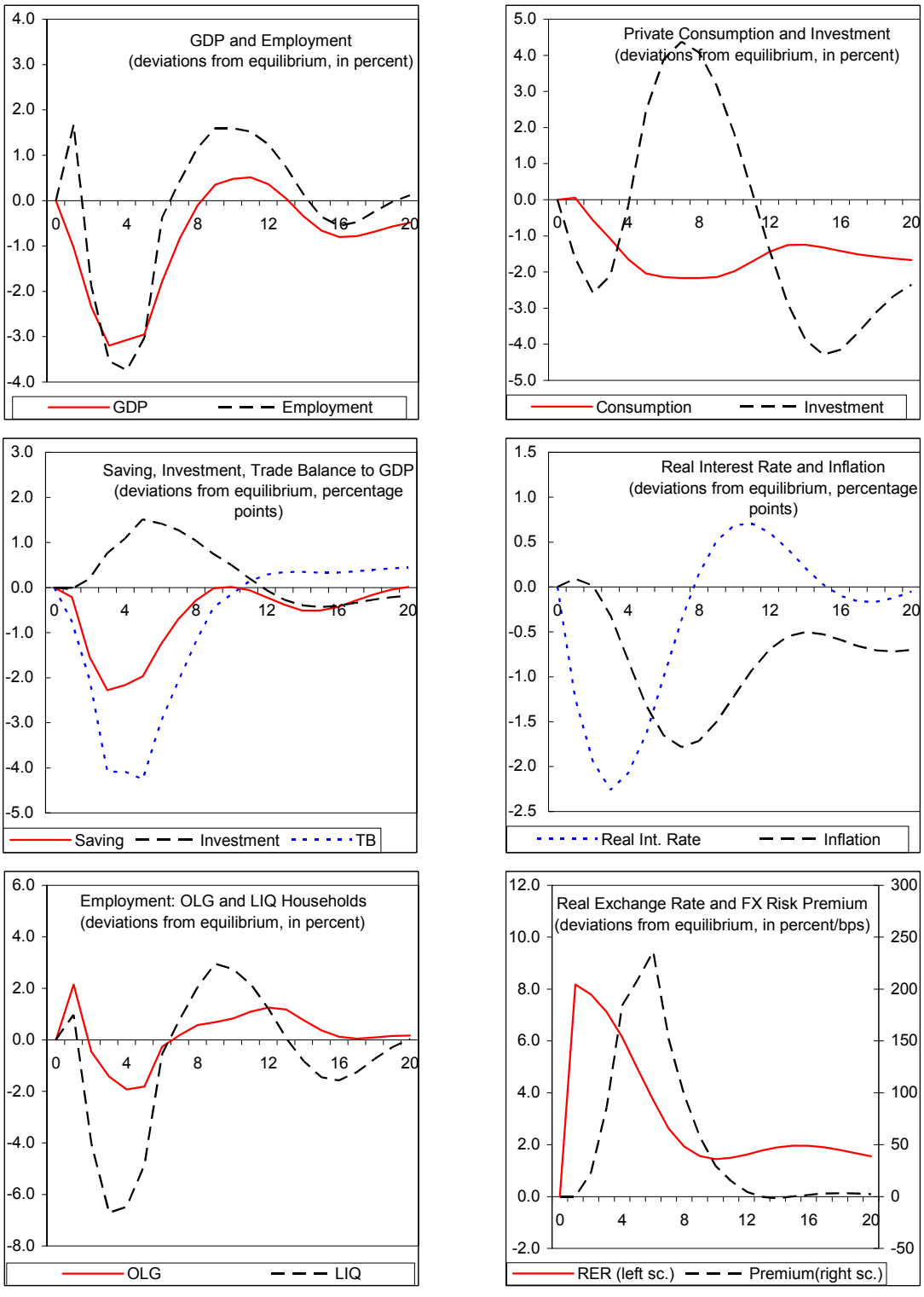
C. Conclusions

13. **While the impact of the global shocks on South Africa appears strong, demand-management policies can provide considerable relief at moderate cost.** We have analyzed the effects of the announced fiscal policy and expected monetary policy on the South African economy hit by adverse external demand and commodity price shocks. We found that the negative impact of the shocks on the economy could be worryingly strong, but active policy measures can support output and employment to a considerable extent at relatively moderate cost in terms of higher inflation and higher trade deficit relative to the counterfactual baseline scenario of no discretionary policy actions.

14. **As the economy adjusts to the shocks, the need for external financing may be greater than thought.** The model makes two unconventional predictions: (i) the trade deficit will widen considerably in 2009–10 relative to 2008 under the influence of the adverse shocks, even though expected policies do not contribute significantly to this widening; and (ii) inflation will remain elevated for a while (here the contribution of policies is more notable, but still moderate). While the specific quantitative estimates are mainly illustrative and do not take into account all relevant factors (e.g., the effects of positive supply shocks on inflation or the reduction in the nontrade component of the current account deficit), the direction of these changes gives food for thought. These results indicate that the economy adjusts only gradually to the external shocks—with positive implications for growth and employment—but they also imply that it may need larger than currently expected amount of external financing going through the adjustment process. The resumption of portfolio inflows since February 2009 is therefore most timely.

[11] These "other" revenues can represent, e.g., environment-friendly levies or higher user fees for services provided by the public enterprises, allowing them to recoup part of their investment costs.

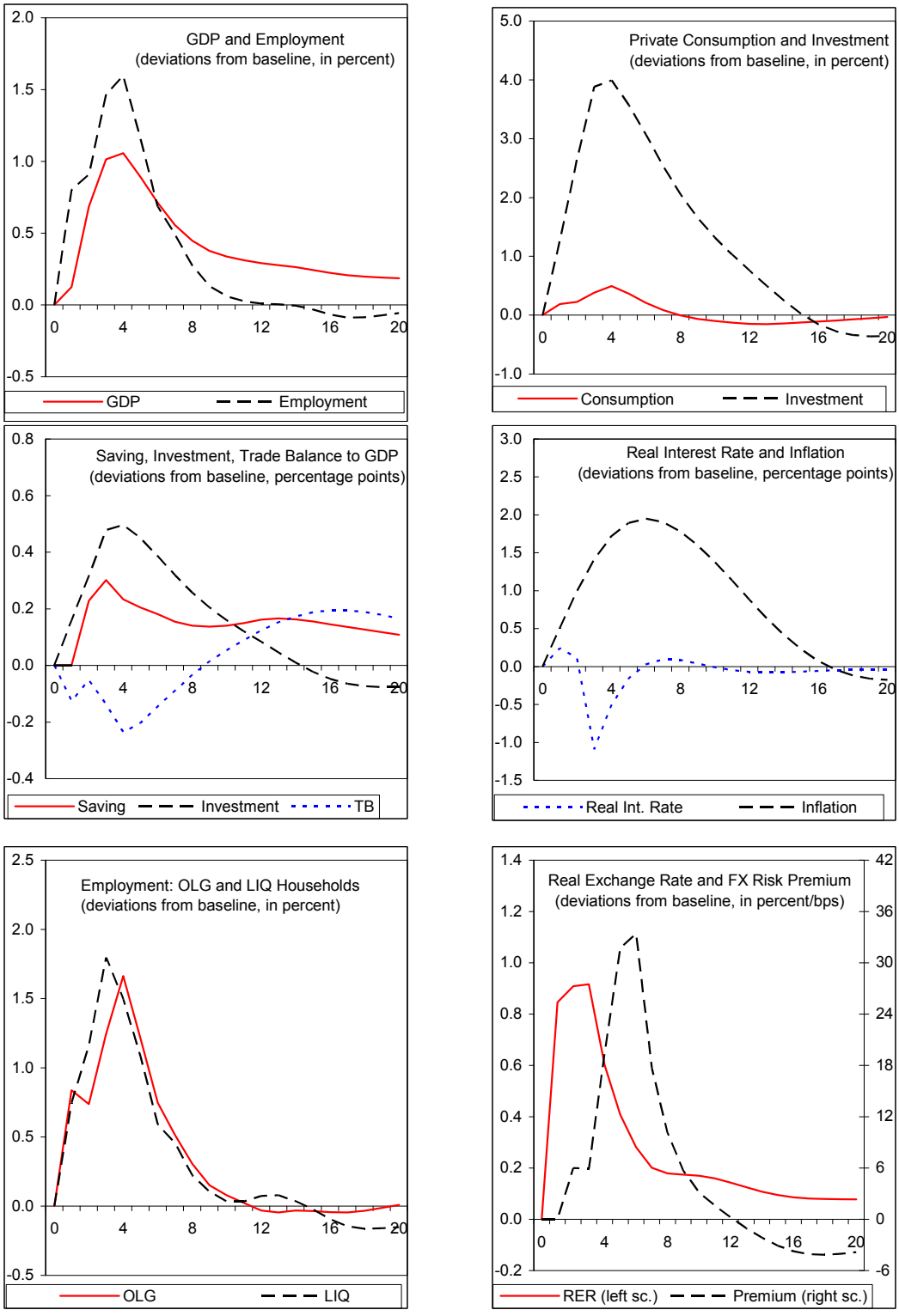
Figure 1. Baseline (External Demand Shock and Commodity Price Shock With Standard Policy Response)



Source: IMF staff calculations.

Note: Simulations are reported over 5 years; each tick mark corresponds to one quarter. The abbreviations OLG and LIQ denote the overlapping-generation (higher-income) consumers and the liquidity-constrained (lower-income) ones.

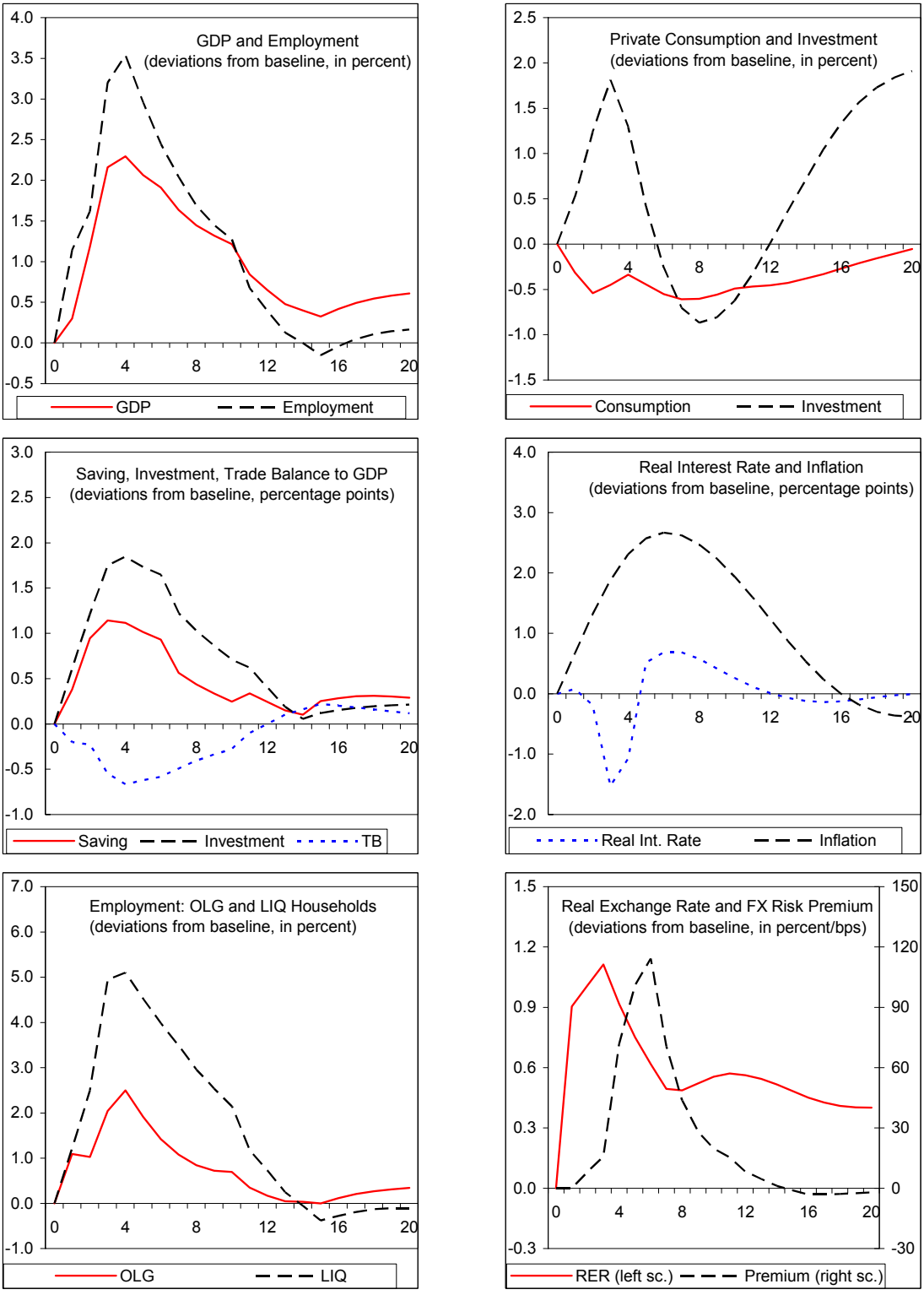
Figure 2. The Effects of Expected Monetary Policy in 2009 Relative to the Baseline



Source: IMF staff calculations.

Note: Simulations are reported over 5 years; each tick mark corresponds to one quarter. The abbreviations OLG and LIQ denote the overlapping-generation (higher-income) consumers and the liquidity-constrained (lower-income) ones.

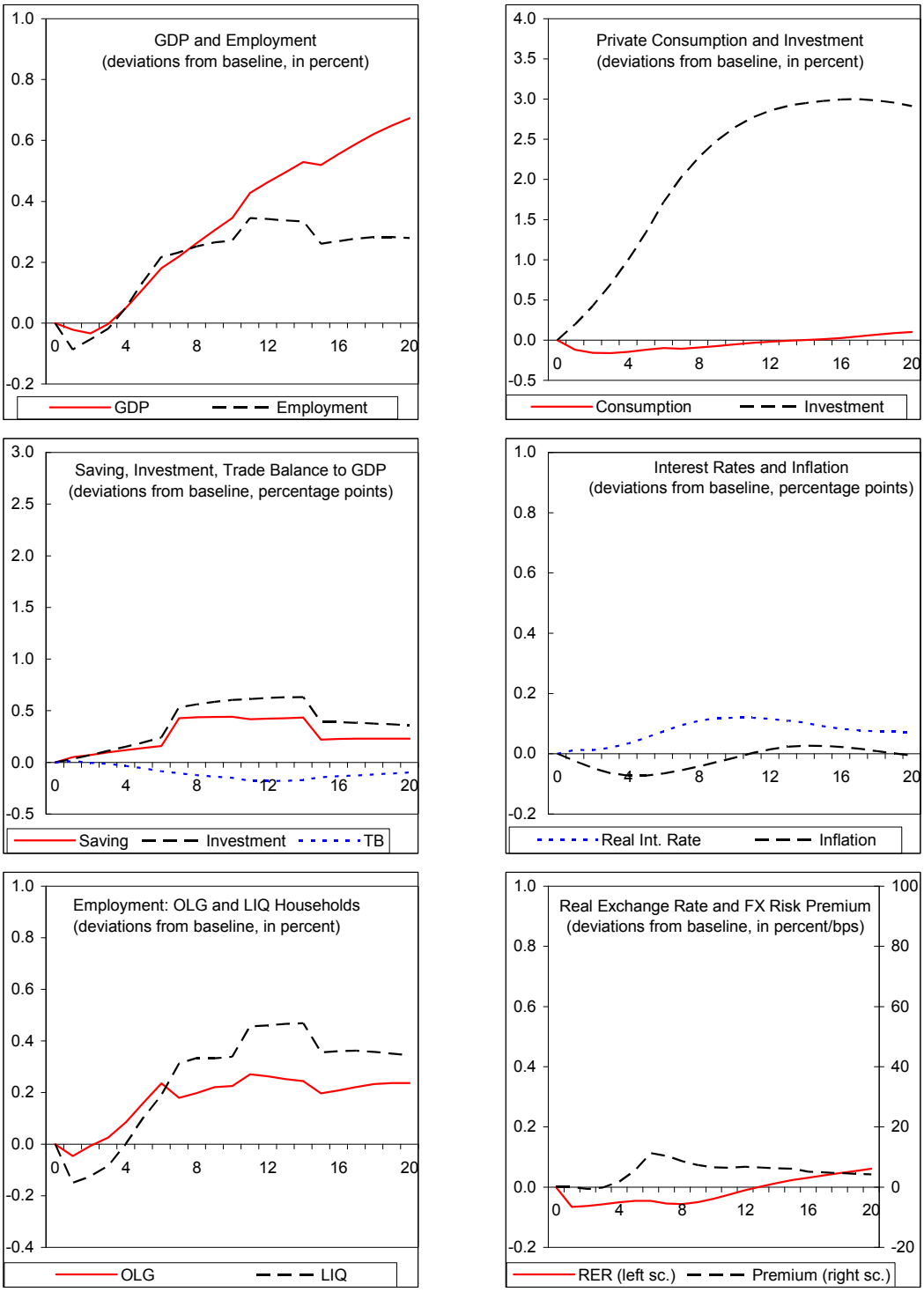
Figure 3. The Combined Effects of Announced Fiscal Policy in 2009-11 and Expected Monetary Policy in 2009 Relative to the Baseline



Source: IMF staff calculations.

Note: Simulations are reported over 5 years; each tick mark corresponds to one quarter. The abbreviations OLG and LIQ denote the overlapping-generation (higher-income) consumers and the liquidity-constrained (lower-income) ones.

Figure 4. The Effects of Rebalanced Fiscal Policy in Years Two and Three Relative to Announced Policies



Source: IMF staff calculations.

Note: Simulations are reported over 5 years; each tick mark corresponds to one quarter. The abbreviations OLG and LIQ denote the overlapping-generation (higher-income) consumers and the liquidity-constrained (lower-income) ones. The rebalanced fiscal policy package consists of higher public investment and lower taxation of capital relative to the announced policies, with lower consumption and higher public enterprise revenue keeping public sector balances at the announced target levels.

II. The Impact of Interest Rates on Real Activity in South Africa[12]

A. Introduction

In order to measure the impact of monetary policy on real activity in South Africa, this note uses information on inflation expectations to control for the South African Reserve Bank's reaction function. The estimates suggest that a one percentage point increase in the policy rate is associated with a 0.8 percent decline in output six months later. The limited sample size does not permit a modeling of the adjustment dynamics, but the point estimate for South Africa is similar to that found in the U.S. literature, and suggests that monetary policy can have a significant impact on economic activity in South Africa.

15. **This note studies the impact of interest rate movements on economic activity in South Africa.** Interest rates are a policy choice, and there are significant methodological hurdles in measuring the impact of interest rate movements on economic variables. In particular, the South African Reserve Bank (SARB) devotes a significant amount of resources to forecasting inflation and other economic variables. And movements in the policy rate are likely to respond to information about future economic developments, making it difficult to discern the causal impact of interest rate policy on economic outcomes. For example, as economic activity slows, the SARB may cut interest rates if inflation is expected to enter its target range—the policy reaction function. In such a situation, declining economic activity is likely to coincide with interest rate reductions, even if the monetary policy action is having a stimulatory impact on the economy.[13]

16. **Thus, to better control the policy maker's reaction function and help reduce these potential biases, this note develops a variation of the Romer and Romer (2004) methodology.** Specifically, as part of its inflation targeting framework adopted in April of 2000, the SARB announced that in addition to its own forecasting models, expectations data will also guide its monetary policy stance.[14] To this end, the SARB commissioned the Bureau of Economic Research at Stellenbosch University (BER) to conduct quarterly surveys of inflation, growth and exchange rate expectations among financial analysts, businesses, households and trade unions. Therefore, while having both the forecasts generated by the

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[12] Prepared by Rodney Ramcharan.

[13] See the survey in Christiano and others (1999).

[14] Article 3.13 of the SARB's "A New Monetary Policy Framework" notes that: Although these models are important tools for forecasting the future path of inflation, they can of course not provide the ultimate answer. In determining the monetary policy stance, the predicted inflation rate of these models cannot be followed blindly. A careful analysis of underlying economic conditions which could affect the predicted outcome of the models is also needed. The Reserve Bank has, in addition, initiated a survey of inflation expectations to be undertaken by the Bureau of Economic Research of the Stellenbosch University. This should further enhance the information available for our forecasting framework.

SARB's model, and the BER's expectations data would be ideal, to the extent that the BER's expectations data itself enters into monetary policy deliberations, these data can help mitigate anticipatory biases.

17. **I should emphasize that the BER expectations data do not need to be unbiased or even consistent, but only that they represent the collective expectations of major price setters in the economy—unions and businesses—and that these expectations enter into the SARB's monetary policy deliberations.** Indeed, Section 2 of this note first shows that changes in inflation expectations systematically predict changes in the policy rate, suggesting that inflation expectations among major price setters in the South African economy might feature in monetary policy decisions.

18. **Consistent with the idea that anticipatory biases are likely to underestimate the real impact of monetary policy, Section 3 shows that controlling for the SARB's reaction function yields larger estimated effects of monetary policy.** A one percentage point increase in the interest rate change is associated with a 0.8 percent decline in output six months later. There is insufficient degrees of freedom to model the adjustment dynamics, but this point estimate resembles the U.S. literature, where a similar interest rate shock is associated with a 0.3 percent and 1 percent decline in industrial production, six to nine months after.

B. Expectations and the Policy Rate Decision

19. **This subsection first assesses the role of the BER expectations data in the SARB's policy reaction function.** To this end, let ΔR(t) denote the change in the policy rate in quarter (t), while E(I|t-1) denotes inflation expectations for the calendar year, observed in the previous quarter (t-1). In order to be certain that the data are in the SARB's information set when setting policy, we typically lag the expectations variables. Moreover since the SARB has an inflation target of between 3–6 percent, we allow the impact of inflation expectations on the policy rule to vary depending on whether E(I|t-1) exceeds the band's upper bound using an indicator variable *SIX* : equals 1 if E(I|t-1) is greater than 6 and 0 otherwise. But in addition to the level of inflation expectations, we also allow the policy rate to depend on changes in expectations, defined as *ΔE(I|t-1)=E(I|t-1)-E(I|t-2)*. Modeling changes in expectations helps capture cases where the level of inflation expectations might be within the band, but the public is rapidly updating it beliefs about inflation.

20. **The data are observed from the first quarter 2000 through the final quarter of 2008, and as Figure 5 indicates, the sample period incorporates significant variation in the policy rate as well as in economic growth.** However, the length of the sample period permit only relatively parsimonious specifications:

$$\Delta R_t = \beta_1 \Delta R_{t-1} + \beta_2 E\left(I|t-1\right) + \beta_2 E\left(I|t-1\right)^* SIX + \beta_3 SIX + \beta_4 \Delta E\left(I|t-1\right) + QD\delta + e(t) \qquad (1)$$

21. **Table 1 suggests that expectations might play a significant role in shaping interest rate policy.** From column 1, a 0.37 percentage point increase in expected inflation compared to the previous quarter—about a one standard deviation increase—is associated with a 37 basis points increase in the policy rate the subsequent quarter—a 0.44 standard deviation increase. Exchange rate movements can pass through onto domestic inflation, and thus, exchange rate expectations can also enter into deliberations over interest rate policy. Column 2 controls for both the expected rand dollar exchange rate and the change in exchange rate expectations. The expected level of the exchange rate also enters significantly into policy making. A one standard deviation increase in the expected level of the exchange rate the previous quarter—a depreciation—is associated with a 0.44 basis points or 0.5 standard deviation increase in the policy rate. Column 3 controls for expected growth, as well as changes in expected growth. Inflation and exchange rate expectations remain significant determinants of changes in the policy rate, and we use these as variables to model the policy reaction function in the next section.

C. The Impact of the Policy Rate on Real Economic Activity

Real GDP growth

22. **We now turn to measuring the real impact of changes in the policy rate. Column 1 of Table 2 simply regresses real output growth on changes in the policy rate, making no attempt to control for the anticipatory biases.** Policy rate changes are negatively and significantly associated with real GDP growth. However, because reductions in the policy rate are likely to occur during periods when inflation and economic activity are slowing, the estimates in column 1 are likely to understate the stimulatory impact of interest rates on economic activity.

23. **To help control for anticipatory reactions, we systematically include those expectation variables that are significant in the reaction function specifications (see Table 1).** In particular, column 2 includes the change in inflation expectations. Doing so increases the estimated impact of interest changes on output growth by about 10 percent: an 85 basis points or one standard deviation increase in the policy rate is associated with a 0.64 percentage point or 0.34 standard deviation decline in real output growth two quarters ahead. Controlling for the expected level of the exchange rate in column 3 yields a slightly larger impact. Changes in commodity prices can potentially shape both expectations and real activity, and column 4 controls for the lagged change in platinum prices. This variable is not significant, but in this most general specification, the impact of interest rate movements remains large and significant.

24. **To put these magnitudes in perspective, consider the estimates in Romer and Romer (2004).** They find that after adjusting for the policy reaction function, a one percentage point increase in the Federal Funds rate is associated with a 0.3 percent decline in industrial production six months after the shock, and about a one percent drop after nine

months. The peak decline—a four percent drop—occur two years after the event. We do not have the degrees of freedom to model these dynamics, but from column 4, a one percentage point rise in interest rates in South Africa suggests a 0.8 percent decline in output six months later, a magnitude that is only slightly larger than the U.S. estimates.

Consumption and investment

25. **Table 3 examines the impact of interest rate changes on consumption and investment. Column 1 uses the real growth in overall private consumption as the dependent variable.** While the impact of policy rate movements are negative, these variables are not significant. Instead, perhaps anticipating movements in the policy rate, changes in inflation expectations itself are negatively and significantly associated with the growth in aggregate private consumption, as well as the growth in nondurables consumption.

26. **However, the growth in the consumption of semi-durable goods is sensitive to both expectations and changes in the policy rate.** Specifically, one standard deviation increases in the interest rate and inflation expectations are associated with a 0.21 and 0.15 standard deviation decrease in semi-durable consumption growth, with a two and one quarter lag respectively. Expectations of a depreciation, as well as higher growth in platinum prices are however positively associated with subsequent consumption growth. A one standard deviation increase in the expected rand dollar exchange rate level and the platinum price growth rate are associated with a 0.13 and 0.1 increase in the semi durable consumption growth rate.

27. **The growth in platinum prices is also positively associated with durable consumption growth (column 4), but in column 5, these variables do not appear to be significant in explaining the consumption of service goods.** However, in column 6, inflation expectations and the growth in platinum prices have a significant impact on the growth in private investment. A one standard deviation increase in expectations is associated with a 0.30 standard deviation decline in investment growth; a similar increase in platinum prices suggests a 0.31 standard deviation rise in investment growth one quarter later.

D. Conclusion

28. **In order to measure the impact of monetary policy on real activity in South Africa, this note has used information on inflation expectations to control for the South African Reserve Bank's reaction function.** The estimates suggest that a one percentage point increase in the policy rate is associated with a 0.8 percent decline in output six months later. The limited sample size does not permit a modeling of the adjustment dynamics, but the point estimate for South Africa is similar to that found in the U.S. literature.

Figure 5. Changes in the Policy Rate and Real GDP Growth

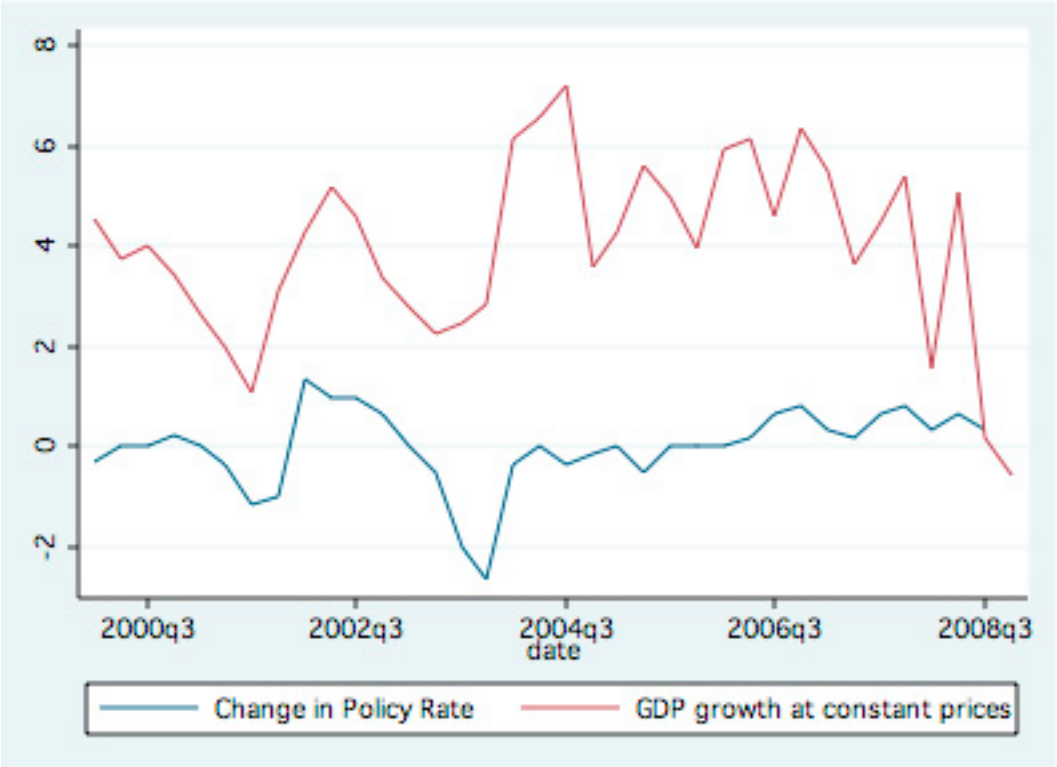

Table 1. Dependent Variable: Change in the Policy Rate

	(1) Inflation Expectations	(2) & Exchange Rate Expectations	(3) & Growth Expectations
Change in Policy Rate, Lagged One Quarter	0.307**	0.103	0.107
	(0.142)	(0.207)	(0.222)
Inflation Expectations, Lagged One Quarter	-0.164	-0.357	-0.389
	(0.171)	(0.229)	(0.279)
Inflation Expectations*Six Percent, Lagged One Quarter	0.184	0.243	0.250
	(0.172)	(0.152)	(0.173)
Six Percent	-1.597	-2.143	-2.150
	(1.292)	(1.220)	(1.304)
Change in Inflation Expectations, Lagged One Quarter	0.593***	0.634***	0.659**
	(0.193)	(0.205)	(0.291)
Exchange Rate Expectations, Lagged One Quarter	…	0.273**	0.267**
	…	(0.108)	(0.108)
Change in Exchange Rate Expectations, Lagged One Quarter	…	0.048	0.023
	…	(0.136)	(0.199)
GDP Growth Expectations, Lagged One Quarter	…	…	-0.039
	…	…	(0.172)
Change in GDP Growth Expectations, Lagged One Quarter	…	…	-0.055
	…	…	(0.353)
N	31	31	31

Newey West standard errors in parentheses: *, **, *** significant at the 10, 5 and 1 percent levels respectively. All specifications include quarter dummies.

Table 2. Dependent Variable: Real GDP Growth

	(1) No Controls	(2) Inflation Expectations	(3) & Exchange Rate Expectations	(4) & Platinum Prices
Change in Policy Rate, Lagged One Quarter	-0.167	-0.408	-0.401	-0.201
	(0.414)	(0.488)	(0.615)	(0.532)
Change in Policy Rate, Lagged Two Quarters	-0.673**	-0.745**	-0.747**	-0.799**
	(0.303)	(0.328)	(0.360)	(0.323)
Change in Inflation Expectations, Lagged One Quarter		0.523	0.522	0.398
		(0.598)	(0.613)	(0.631)
Exchange Rate Expectations, Lagged One Quarter			-0.006	-0.051
			(0.181)	(0.170)
Change in Platinum Prices, Lagged One Quarter				0.080
				(0.087)
Real GDP Growth, Lagged One Quarter	0.555***	0.637***	0.635***	0.519**
	(0.168)	(0.171)	(0.217)	(0.232)
N	32	32	32	32

Newey West standard errors in parentheses: *, **, *** significant at the 10, 5 and 1 percent levels respectively. All specifications include quarter dummies.

Table 3. The Impact of Interest Rates on Real Private Consumption and Investment

	(1) Aggregate Private Consumption	(2) Non-durables	(3) Semi-durables	(4) Durables	(5) Services	(6) Private Investment
Change in Policy Rate, Lagged One Quarter	-0.198	-0.059	-0.321	-0.912	0.035	0.183
	(0.136)	(0.250)	(0.531)	(0.998)	(0.156)	(0.365)
Change in Policy Rate, Lagged Two Quarters	-0.177	-0.109	-1.584***	0.332	-0.006	0.523
	(0.127)	(0.152)	(0.309)	(0.691)	(0.092)	(0.472)
Change in Inflation Expectations, Lagged One Quarter	-0.472***	-0.495*	-1.394**	-1.622	0.074	-1.857***
	(0.091)	(0.262)	(0.655)	(1.561)	(0.245)	(0.566)
Exchange Rate Expectations, Lagged One Quarter	0.097	-0.026	0.536*	0.588	-0.120	-0.264
	(0.079)	(0.136)	(0.263)	(0.368)	(0.086)	(0.446)
Change in Platinum Prices, Lagged One Quarter	0.029	-0.025	0.134**	0.242*	0.042	0.296***
	(0.020)	(0.032)	(0.054)	(0.136)	(0.055)	(0.085)
N	32	31	31	31	31	32

Newey West standard errors in parentheses: *, **, *** significant at the 10, 5 and 1 percent levels respectively. All specifications include quarter dummies and a lagged dependent variable.

III. The Impact of Monetary Policy Shocks on Capital Flows in South Africa[15]

A. Introduction

29. **The South African economy is largely open to international capital flows, and the country receives significant inflows of both bond and equity flows, although equity flows dominate (Table 4).** These capital flows in turn might play an important role in financing the country's current account deficits. And as a result, large and sudden movements in international capital flows can have far reaching consequences for the South African economy.[16] Thus, this policy note attempts to understand better the determinants of capital flows in South Africa, and in particular, the potential impact of monetary policy.

30. **While the South African Reserve Bank (SARB) sets monetary policy according to an inflation target, the most direct and immediate effects of monetary policy actions are usually on financial markets, making monetary policy a potentially significant determinant of equity flows in small open economies like South Africa (SA).** That said, the transmission of monetary policy actions onto international equity flows can occur through a number of different and contrasting channels, and the net impact can be theoretically ambiguous.

31. **International equity flows in part react to country specific asset prices such as the exchange rate and domestic stock returns.** And by changing real interest rates, expected future dividends, or expected future stock returns, an unexpected increase in home interest rates is generally associated with a decline in stock values (Bernanke and Gertler (1999) and Bernanke and Kuttner (2005)). An unexpected increase in interest rates is also conventionally associated with currency appreciation. But the response of international equity flows to a decline foreign stock values or an appreciation of the domestic currency can depend on portfolio rebalancing considerations as well as on informational asymmetries between domestic and foreign investors.

32. **In the case where international investors can only imperfectly hedge against exchange rate risk, portfolio rebalancing can be paramount.** The intuition underlying this approach is that while there are diversification benefits to international (U.S.) investors from holding imperfectly correlated foreign equity, such holdings are also subject to Foreign Exchange (FX) risk. Thus, an appreciation of SA stock prices relative to U.S. markets increases FX risk, inducing portfolio rebalancing as U.S. investors sell, on net, SA equity, and repatriate capital. Conversely, after a monetary policy induced decline in SA stock prices, foreign portfolio managers may increase their exposure to SA assets by purchasing additional SA equity (Hau and Rey (2006)). This channel would produce a positive association between interest rates and net foreign purchases of equity.

[15] Prepared by R. Ramcharan.

[16] Calvo and others (2008) surveys the link between fluctuations in capital flows and current account adjustment.

33. **However, in addition to differential equity market performance, exchange rate movements can also induce portfolio rebalancing.** From an international investor perspective, an unexpected increase in SA interest rates that appreciates the rand, also increases the dollar share of assets in the SA market. The higher overall foreign exchange risk exposure for foreign (U.S.) residents may induce equity market outflows from South Africa, leading to a negative association between interest rates and net foreign purchases of SA equity (Hau and Rey (2002)).

34. **Moreover, information asymmetries can also shape the reaction of international equity flows to monetary policy, as the information that is required to evaluate financial assets— such as knowledge of accounting practices, corporate culture, and the structure of asset markets and their institutions—is not straightforward and is often less available to international investors (Portes and Rey (2005)).** In particular, if investors do not know the true returns of equities, but estimate them from past returns, then this informational asymmetry may make international investors' expectations of future returns especially sensitive to past returns (Griffin and others (2004)).

35. **More so than SA investors then, foreign investors may buy SA equity following abnormally high domestic returns—trend chasing or momentum investing.** And an interest rate increase that depresses stock prices could lead to a decline in net foreign purchases of SA equity, as foreigners revise their beliefs about future SA equity returns. Likewise, because rand appreciation increases SA returns expressed in home (U.S.) currency, trend chasing partially informed investors may purchase SA after unexpected rise in interest rates (Froot and others (2001)).

36. **Since government behavior can also affect equity returns, and monetary policy actions contain information about policy preferences, foreign investors beliefs about future government policies can also affect the link between monetary policy and capital flows (Bartolini and Drazen (1997)).** Specifically, our sample period begins with the adoption of inflation targeting in South Africa—and just seven years after the end of apartheid and the introduction of democracy. Thus, partially informed foreign investors may also use interest rate policy to update their beliefs about the credibility of the SARB's monetary policy framework. And to the extent that interest rate increases signal a commitment to future price stability, and future policies that are favorable to investment, they can also attract equity inflows.

37. **In sum, after a decline in stock returns and a currency appreciation due to an unexpected rise in interest rates, theories that emphasize portfolio rebalancing considerations predict:**

- Equity inflows, as foreign investors reallocate capital to the JSE to maintain portfolio exposure.

- Equity outflows, as an exchange rate appreciation over weights the dollar share of SA assets.

38. **After a similar event, models that emphasize information asymmetries predict:**

- Equity outflows, as trend chasing investors flee negative returns on the JSE.

- Equity inflows if rand appreciation increases returns expressed in home currency.

39. **In addition to the contrasting theoretical predictions, international equity flows, stock returns and the exchange rate are usually jointly and endogenously determined.** Also, financial markets generally internalize policy announcements well before these announcements are actually made, and so, discerning the impact of monetary policy on these variables is especially difficult.

40. **Therefore to make progress in understanding the relationship between monetary policy and equity flows, the analysis uses an event study approach. Monetary policy announcements in SA occur after meetings of the Monetary Policy Committee (MPC).** These meetings are advertised well in advance, and of the 46 meetings during the sample period, only one interest rate change occurred outside of the regular schedule. Using data from the forward interest rate market the day before and right after each MPC meeting, this note decomposes monetary policy announcements into its expected and surprise elements, studying the impact of this decomposition on equity flows, stock market returns and the exchange rate.

41. **The main results are:**

- A small positive relationship between expected interest rate movements and net purchases of equity by foreigners.

- This is dwarfed by a much larger negative relationship between interest rate surprises and net purchases of equity by foreigners: an unexpected 50 basis point increase in rates is associated with a R 27 million or a 0.34 standard deviation outflow.

42. **These results appear to operate primarily through the rebalancing channel after a rand appreciation:**

- First, an unexpected 50 basis point increase in interest rates is associated with a 1 percent decrease in stock prices, about a 0.74 standard deviation drop, and a 1 percent appreciation of the rand (versus the dollar).

- But after controlling for the rand appreciation, the interest rate decomposition is not significant. Meanwhile, the rand appreciation is significantly associated with net capital outflows. The impact of stock returns is insignificant.

43. **Thus, because South Africa has one of the most advanced financial markets among emerging markets, understanding portfolio rebalancing and FX risk exposure considerations among international investors seems key to discerning the transmission of monetary policy onto net purchases of equity by foreigners.**

B. Data

44. **Net purchases of South African equity by non residents can be large and volatile.** From Table 1, while net R 66 billion flowed into the Johannesburg Stock Exchange in 2007, net outflows in 2008 were almost a similar magnitude. Daily flows also appear volatile (Figure 6). These flows are naturally closely related to stock returns and exchange rate movements, and Figures 7 and 8 plot respectively the daily changes in the Johannesburg Stock Exchange weighted index (JSE) and the rand dollar exchange rate—an increase is a rand depreciation. As with equity flows, there are periods when changes in both asset prices evince considerably volatility.

45. **Monetary policy has also varied considerably over the sample period.** The South African Reserve Bank adopted an inflation target of 3–6 percent in 2001—at the beginning of the sample period. And apart from a revision to this policy framework in December 2003, the framework has remained relatively constant throughout the sample period. Over the sample period, Figure 9 suggests three easing cycles, with the policy rate ranging from a maximum of 13.5 percent to a minimum of 7 percent.

46. **By influencing stock returns and exchange rate movements, domestic monetary policy can shape international equity flows.** And to illustrate some of the basic correlations in the data, Table 5 turns to a simple first order ARCH model. Consistent with the literature on equity flows, there is evidence of persistence, as the autoregressive coefficients up to five days are significantly different from zero (column 1).[17] But there is also evidence that conditioned on past flows, changes in the policy rate appear significantly related to capital flows.

47. **But consistent with the prediction that monetary policy might shape these flows through stock returns and exchange rate movements, including these variables changes the sign of the interest rate variable (column 2).** In this case, a 50 basis point increase in the interest rate is associated with a decline R 55 million decline in net purchases of equity three days later—about a 0.08 standard deviation drop. There is also significant evidence that past returns on the stock exchange positively affects subsequent equity flows—trend chasing. But conditioned on the past behavior of equity flows and stock returns, exchange rate depreciations are negatively linked to subsequent flows. These basic correlations persist even after controlling for other potential factors such as commodity prices and international equity returns (column 3).

48. **The correlations in Table 5 suggest that the transmission of monetary policy onto equity flows might operate through movements in the exchange rate and domestic stock prices.** However, because financial markets are unlikely to respond to policy actions that were already anticipated, the correlations in Table 5 are only suggestive. Indeed, since expectations of

[17] A variety of market microstructure models predict that traders with private information reach their desired positions slowly, in order to mitigate transaction costs. Thus, the order flow of informed traders is conditionally, and positively, auto correlated. Institutional factors can also give rise to flow persistence. For example, structural shifts in asset allocation can be undertaken on a phased basis to reduce transaction costs (Froot and Donohue (2004)).

future equity inflows might also shape both the rand and domestic stock prices, it is difficult to causally interpret the correlations in Table 5. Using daily data and conditioning on other asset prices is a useful step in addressing these biases, but the limited variation in the policy rate at a daily level can hinder inference.

C. An Event Study Approach

49. **This subsection uses an event study approach to understand the impact of monetary policy on international equity flows in South African.** As part of its inflation targeting framework, interest rate decisions are made at regular MPC meetings—usually six meetings in a calendar. The schedule of these meetings are usually announced several months in advance, and there has only been one instance—January 15th, 2002, during the rand crisis of 2001–2002—when interest rate policy was changed outside of the regular schedule. Using the relative predictability and transparency of this policy framework, we are thus able to study the behavior of asset prices around these interest rate announcements.

50. **That said, the very predictability and transparency of the monetary policy framework would make it likely that asset prices reflect anticipated policy announcements in advance of the MPC dates.** Therefore, we use data on forward interest rate contracts around the time of the MPC meetings to extract information about market participants interest rate expectations. This allows us to decompose policy changes into its expected and surprise elements. In particular, the interest rate quoted in a forward rate contract on date t, i_t^f, is for a 3 month contract, with a fixed interest rate, beginning 30 days from date t, i_{t+30}^{3month}.

51. **Thus, on any date t, the interest rate in the forward market reflects market expectations about the short term**—three month—interest rate that is likely to prevail on date t+30, as well as a possibly time varying risk premium, n_t:

$$i_t^f = E\left(i_{t+30}^{3month} \middle| t\right) + n_t$$

And if changes in the policy rate are fully anticipated prior to an MPC meeting, then policy announcements after the MPC meeting are unlikely to engender any change in the 30 day forward rate. Unexpected policy announcements are however likely to precipitate revisions in the forward market rate. To see this, let t^* denote for example the day of a MPC meeting, then the change in the forward rate around this meeting can be written as:

$$\Delta i_{t^*}^f = E\left(i_{t^*+30}^{3month} \middle| t^*\right) + n_{t^*} - E\left(i_{t^*-1+30}^{3month} \middle| t^* - 1\right) - n_{t^*-1}$$

52. **If MPC dates do not systematically coincide with other news, so that daily changes in the risk premium are relatively small, then $\eta_{t^*} - \eta_{t^*-1} \approx 0$, and the revision in expectations after a policy announcement is:**

$$\Delta i_{t^*}^{f} = E\left(i_{t^*+30}^{3month} \middle| t^*\right) - E\left(i_{t^*-1+30}^{3month} \middle| t^* - 1\right)$$

Hence, any change in the forward rate after an MPC announcement are likely to be attributable to a revision of interest rate expectations, and can help measure the surprise component of interest rate policy.

53. **The sample period begins in April 2001 and ends in December of 2009, and contains 46 MPC meetings.** Although relatively short, this sample period contains considerable variation in interest rate policy (Figure 9). The variation in the interest rate occurred via 22 discrete changes in policy; there were no policy changes announced after the other 24 MPC meetings (Table 6). Table 6 also shows that while 50 basis point changes are the most frequent, large policy changes have occurred during the sample period: there are seven instances of a one percentage point changes in the policy rate, and two cases of 1.5 percentage point changes.

Forecasting interest rates

54. **The event study approach based upon the 30 day forward market rests on the idea that the forward market is rational and efficiently forecasts future interest rate changes.** Otherwise, if differences between policy rate announcements and market expectations—surprises—are systematically correlated with economic information available to the market prior to the announcement, then this economic information contained in the surprise could also affect capital flows, biasing the results from the event study approach.

55. **Defining the interest rate surprise as the difference between the announced policy change and that expected in the forward rate market the day before the announcement, Figure 5 suggests that the forward market may underestimate interest rate increases.** To evaluate the rationality of the forward market in predicting the policy rate more systematically, we regress the policy change announced after each MPC meeting, Δi_t^*, on the expected change as imputed from the forward market the day before the change: $E\left(\Delta i_i \middle| t-1\right) = i_{t-1}^{f} - i_{t-1}$:

$$\Delta i_t^* = \alpha + \beta E\left(\Delta i_t \middle| t-1\right) + \varepsilon_t \qquad (2)$$

56. **From column 1 of Table 7, the expectations derived from the forward market the day before MPC meetings are significantly and positively correlated with the subsequent policy change.** Errors are common however. Expectations explain only about 65 percent of the variation in the subsequent policy changes, and the coefficient is less than one, suggesting, as in Figure 8, that big movements in the policy rate tend to surprise the market. Indeed, consistent with the idea that the forward market may systematically under predict policy changes, the constant term is positive and significant.

57. **That said, the remaining columns of Table 4 strongly suggest that expectations in the forward market are efficient.** Conditioned on expectations, information contained in a number of

key asset prices before the MPC meetings do not predict the policy change. Specifically, South Africa is the world's major exporter of precious metals, and fluctuations in the prices of platinum and gold, can have a big impact on the domestic economy. Column 2 includes the daily changes in these prices up to three days prior to the MPC meeting in order to ascertain whether information contained in commodity price fluctuations help predict policy rate changes.

58. **Conditioned on the forward market expectations, the commodity price variables are individually and jointly insignificant.** Similarly, column 3 shows that stock returns and changes in the exchange rate up to three days prior to each meeting also do not contain any independent information. Likewise, column 4 suggests that international equity and bond flows do not appear to anticipate systematically changes in the policy rate. Thus, while there is some evidence that the forward market is systematically surprised by large rate changes, there is little indication that policy rate surprises are predictable given the available information.

Interest rates and equity flows

59. **This subsection examines the impact of interest rate changes on equity flows.** These flows are usually highly persistent, and the correlations in Table 4 suggest they might react with some lag to policy announcements. Thus, building on the earlier results, we first examine the impact of monetary policy changes on equity flows both on the day of the announcement, as well as up to five days later:

$$F_{t+i} = \alpha_o + \alpha_1 \Delta i_t + e_t \quad for\ i = 0,1,2,3,4,5$$

60. **Using the raw change in the policy rate, the evidence in Table 8 indicates that an increase in the interest rates can have a small positive impact on equity inflows two days later.** A 50 basis point increase is associated with a R 9 million increase in equity flows—about a 0.12 standard deviation increase based on the behavior of daily flows over the sample period.

$$F_{t+i} = \alpha_o + \alpha_1 \Delta i_t^S + \alpha_2 \Delta i_t^E + e_t \quad for\ i = 0,1,2,3,4,5$$

61. **However, decomposing the interest rate change into its surprise, Δi_t^S, and expected, Δi_t^E, components suggests a more nuance reaction.** An expected increase in interest rates is associated with a small increase in capital flows, observed two and three days after the policy announcement. But the coefficient on the unexpected component of the interest rate change is significantly larger and negative (column 4). A surprise 50 basis point increase is associated with a R 27 million or a 0.34 standard deviation decrease in equity flows three days later.

62. **Figure 11 plots the conditional correlations reported in column 4 (Day 3). Standard outlier detection statistics suggests that the MPC meetings on January 15, 2002 and again on the December 11th 2003 are likely to be influential.** The meeting on January 15, 2002 is the only unscheduled meeting in the sample, and a 1 percentage point increase in the interest rate was announced in response to the rand crisis of 2001–2002. The December 2003 date was equally

noteworthy, as it marked a shift in the definition of the inflation target from an annual average to a continuous inflation target of between 3 and 6 percent for inflation measured over a period of twelve months.

63. **As a robustness exercise, column 1 of Table 10 uses a dummy variable to absorb the potential impact of these two dates.** The estimates are slightly smaller, but remain robust at the 5 percent level. "Surprises" in the forward market appear rational, but to check whether our results are driven by a trend in capital flows that unexpectedly coincides with interest rate policies, column 2 includes capital flows the day before the announcement as a control variable. The results remain robust.

64. **Stock prices and changes in the nominal exchange rate are key channels through which monetary policy might affect international equity flows.** And to understand better these results, we now turn to these variables. In particular, using the same event study methodology, column 3 of Table 10 examines the impact of interest rate changes, decomposed into its expected and unexpected components, on JOSÉ stock returns. While expected movements in the interest rate do not have a significant impact on stock returns, an unexpected 25 basis point increase in the interest rate is associated with a 0.5 percent decline in stock prices, about a 0.37 standard deviation drop. Column 4 turns to the exchange rate. An unexpected 25 basis point rise in interest rates is associated with a 0.50 percent appreciation. Moreover, unlike stock prices, monetary policy announcements explain about twenty two percent of the variation in exchange rate movements.

65. **Thus, in order to assess the role of stock market returns in explaining equity flows, column 5 includes stock returns on the day of the MPC announcement.** Returns on the JSE are not significantly related to subsequent equity flows, and there is little change in the interest rate variables. The results are however dramatically different when including the change in the rand dollar exchange rate (column 6). In this case, the interest rate variables lose significance, and their magnitudes decline by about 75 percent. In contrast, the interest rate variable is positive and significant at the 10 percent level. A one standard deviation appreciation—about 1.2 percent decrease in the rand dollar exchange rate—is associated with a R175 million outflow three days later. Table 11 shows that these results are driven by simple valuation changes, as the impact of the exchange rate remains robust when equity flows are measured both in terms of U.S. dollars. It is also robust when equity flows are deflated by the market capitalization of the Johannesburg Stock Exchange in order to yield a unit free metric of flows.

66. **In sum, these pattern of correlations are consistent with a portfolio rebalancing explanation.** An unexpected increase in the interest rate is associated with a significant appreciation of the rand, increasing the dollar share of assets in the SA market. The higher overall foreign exchange risk exposure for home (U.S.) residents may induce equity market outflows, leading to a negative association between interest rates, rand appreciation and net foreign purchases of SA equity.

Figure 6. Net Purchases of South African Equity by Nonresidents

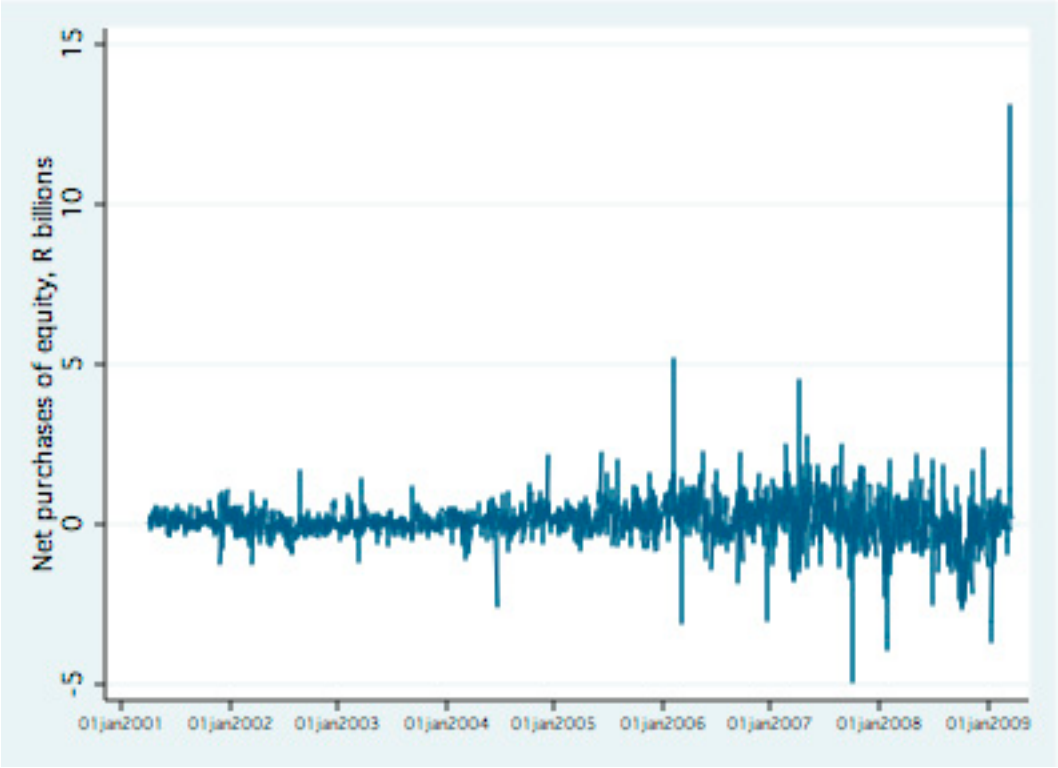

Figure7. Daily Change in the Johannesburg Stock Index

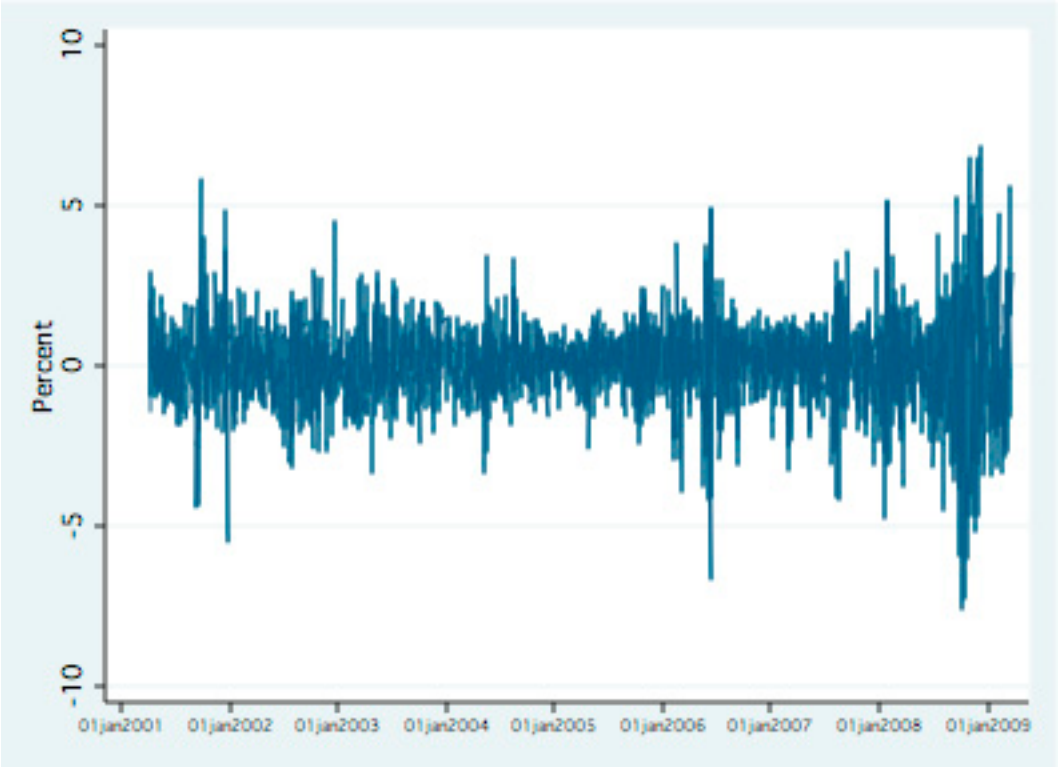

Figure 8. Daily Change in the Rand Dollar Exchange Rate

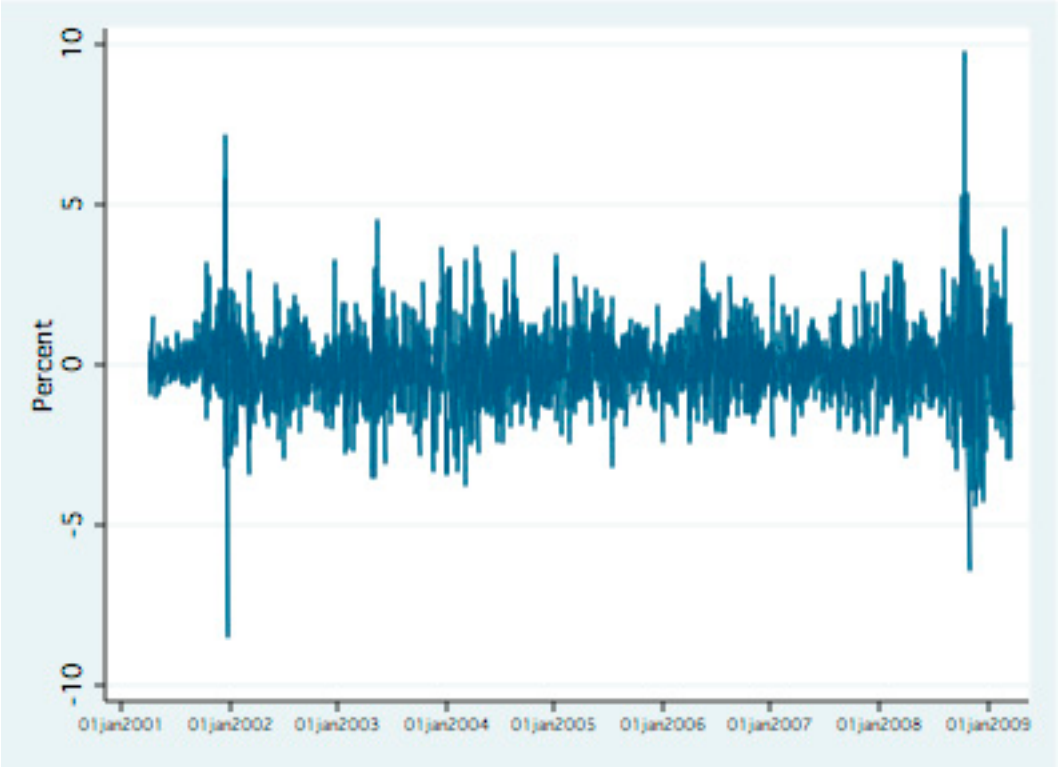

Figure 9. South African Reserve Bank's Policy Rate

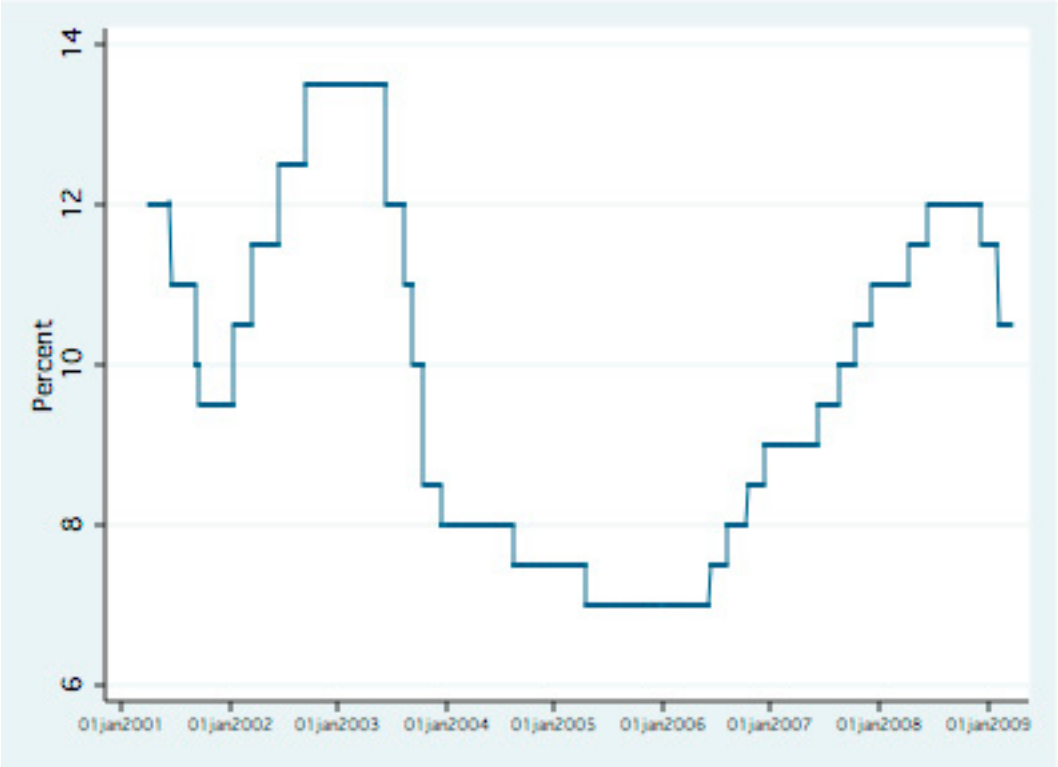

Figure 10. Density of Interest Rate Surprises

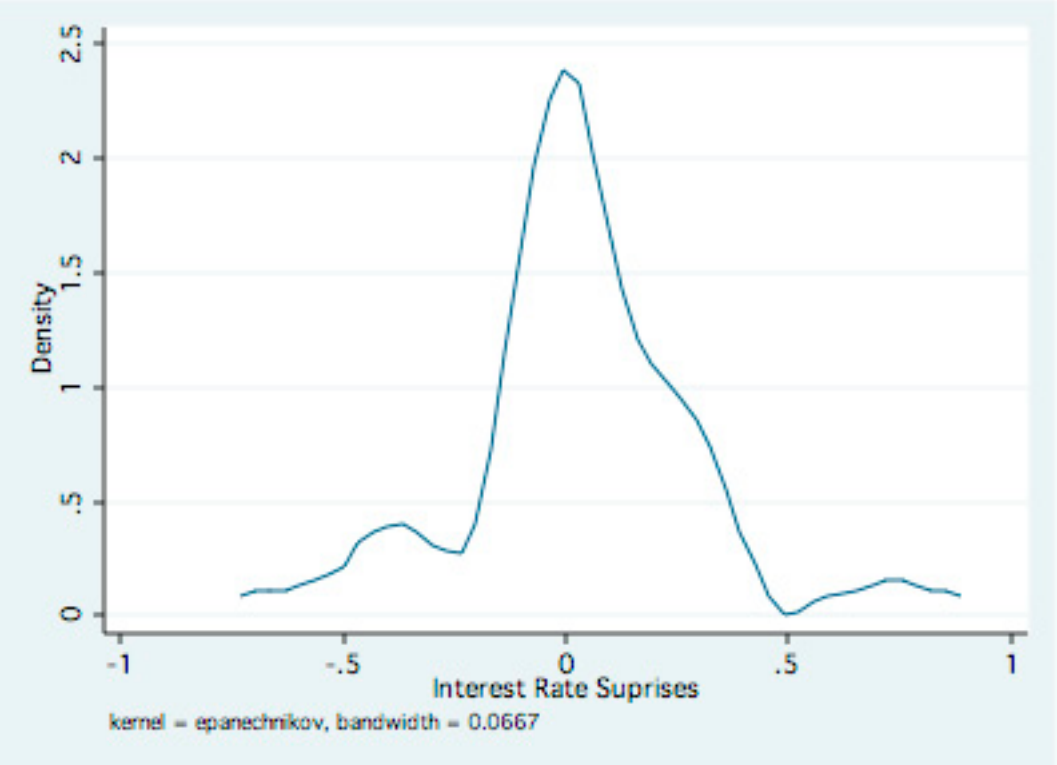

Figure 11. Conditional Correlation between Net Purchase of Equities and Interest Rate Surprises.

Table 4. Total Net Purchases of Equity and Bonds, Rand Billions

	2002	2003	2004	2005	2006	2007	2008
Equity	-4.488	0.8029998	34.089	50.222	74.016	66.614	-56.90562
Bonds	2.135	-10.16	5.151	1.809	19.144	0.2349993	-11.39695

Table 5. Dependent Variable: Daily Net Purchases of South African Equity[18] Autoregressive Conditional Heteroscedasticity (1,1)

Table 5.1 The Change in the Policy Rate

Net Purchases of Equity					
(t-1)	(t-2)	(t-3)	(t-4)	(t-5)	---
0.129***	0.168**	0.091	-0.196**	-0.165***	---
(0.041)	(0.069)	(0.070)	(0.081)	(0.049)	---
Change in the Policy Rate					
(t)	(t-1)	(t-2)	(t-3)	(t-4)	(t-5)
0.066	0.090**	0.007	(0.130)	0.066	(0.019)
(0.076)	(0.042)	(0.067)	(0.086)	(0.091)	(0.103)
Summary Statistics					
Observations	ARCH		GARCH		
1701	1.165		0.351		
	(0.827)		(0.306)		

[18] Robust standard errors in parentheses. *,**,*** denotes significance at the 10, 5 and 1 percent levels respectively. (t-i) denotes the *'i'* lagged value

Table 5.2. Including Domestic Stock Prices and the Exchange Rate

Net Purchases of Equity				
(t-1)	(t-2)	(t-3)	(t-4)	(t-5)
0.150***	0.143***	0.123***	(0.00)	-0.086**
(0.04)	(0.05)	(0.04)	(0.05)	(0.04)
Change in the Policy Rate				
(t)	(t-1)	(t-2)	(t-3)	(t-4)
0.03	0.05	0.01	-0.113*	0.02
(0.08)	(0.06)	(0.06)	(0.06)	(0.10)
Change in the Johannesburg Stock Exchange				
(t-1)	(t-2)	(t-3)	(t-4)	(t-5)
0.020**	0.027***	0.022**	0.045***	0.065***
(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Change in the Rand/Dollar Exchange Rate				
(t-1)	(t-2)	(t-3)	(t-4)	(t-5)
-0.024*	0.01	-0.026**	(0.02)	-0.059***
(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Summary Statistics				
Observations		ARCH		GARCH
1701		0.906**		0.407**
		(0.368)		(0.169)

Table 5.3. Including Domestic Stock Prices, the Exchange Rate, Commodities and U.S. Stock Prices

Net Purchases of Equity					
(t-1)	(t-2)	(t-3)	(t-4)	(t-5)	---
0.167***	0.114**	0.078**	(0.01)	(0.03)	---
(0.04)	(0.05)	(0.03)	(0.04)	(0.05)	---
Change in the Policy Rate					
t	(t-1)	(t-2)	(t-3)	(t-4)	(t-5)
0.04	0.09	(0.05)	-0.165***	0.01	0.06
(0.09)	(0.07)	(0.09)	(0.06)	(0.08)	(0.09)
Change in the Johannesburg Stock Exchange					
(t-1)	(t-2)	(t-3)	(t-4)	(t-5)	---
0.02	(0.01)	(0.01)	0.033***	0.056***	---
(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	---
Change in the Rand/Dollar Exchange Rate					
(t-1)	(t-2)	(t-3)	(t-4)	(t-5)	---
0.00	0.01	(0.01)	(0.01)	-0.053***	---
(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	---
Change in Platinum Prices					
t	(t-1)	(t-2)	(t-3)	(t-4)	(t-5)
(0.00)	0.020**	(0.01)	-0.018**	(0.01)	0.01
(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Change in Gold Prices					
t	(t-1)	(t-2)	(t-3)	(t-4)	(t-5)
0.01	0.01	0.01	0.042***	0.02	-0.069***
(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
Change in Dow Jones					
t	(t-1)	(t-2)	(t-3)	(t-4)	(t-5)
0.016*	0.01	0.025*	0.049***	0.034***	0.01
(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Summary Statistics					
Observations		ARCH		GARCH	
1378		0.875***		0.383***	
		(0.222)		(0.107)	

Table 6. Distribution of Changes in the Policy Rate

Percentage point change	Frequency	Percent
-1.5	2	4.26
-1	3	6.38
-.5	5	10.64
0	23	48.94
.5	10	21.28
1	4	8.51

Table 7. Forward Market Forecasts, OLS[19]

	No Controls	Commodities	Asset Prices	Net Purchases of Equity and Bonds
Expected Change in Policy Rate	0.578***	0.595***	0.586***	0.591***
	(0.074)	(0.074)	(0.077)	(0.131)
L1.change in platinum prices	---	0.072	0.093	0.065
	---	(0.054)	(0.074)	(0.104)
L2. change in platinum prices	---	-0.050	-0.066	-0.036
	---	(0.046)	(0.054)	(0.071)
L3. change in platinum prices	---	-0.046	-0.044	-0.038
	---	(0.066)	(0.075)	(0.111)
L1. change in gold prices	---	-0.050	-0.072	-0.051
	---	(0.060)	(0.066)	(0.118)
L2. change in gold prices	---	0.007	0.039	0.039
	---	(0.060)	(0.069)	(0.091)
L3. change in gold prices	---	0.098	0.121	0.076
	---	(0.075)	(0.080)	(0.124)
L1.change in stock index	---	---	-0.012	-0.015
	---	---	(0.067)	(0.083)
L2. change in stock index	---	---	-0.036	-0.049
	---	---	(0.046)	(0.072)
L3. change in stock index	---	---	0.007	0.055
	---	---	(0.051)	(0.076)
L1.change in exchange rate	---	---	0.014	0.120
	---	---	(0.080)	(0.150)
L2. change in exchange rate	---	---	0.072	0.053
	---	---	(0.108)	(0.193)
L3. change in exchange rate	---	---	0.035	0.045
	---	---	(0.056)	(0.072)
L1.Net Purchase of Equity	---	---	---	-0.010
	---	---	---	(0.165)
L2. Net Purchase of Equity	---	---	---	-0.089
	---	---	---	(0.233)
L3. Net Purchase of Equity	---	---	---	0.052
	---	---	---	(0.085)
L1. Net Purchase of Bonds	---	---	---	-0.001
	---	---	---	(0.068)
L2. Net Purchase of Bonds	---	---	---	-0.057
	---	---	---	(0.072)
L3. Net Purchase of Bonds	---	---	---	-0.054
R-squared	0.640	0.624	0.576	0.446
N	46	46	46	41

[19] Dependent Variable: Announced Change in Policy Rate
"L" is the lag operator. Robust standard errors in parenthesis.

Table 8. Net Purchases of Equity and Interest Rate Announcements
Dependent Variable: Net Purchases of Equity

	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5
Actual Change in Policy Rate	0.038	0.061	0.208**	0.074	-0.045	-0.106
	(0.092)	(0.095)	(0.083)	(0.099)	(0.140)	(0.169)
R-squared	-0.022	-0.021	0.023	-0.018	-0.024	-0.014
N	44	44	42	44	43	46

Robust standard errors in parentheses. *,**,*** denotes significance at the 10, 5 and 1 percent levels respectively.

Table 9. Net Purchases of Equity, Expected and Unexpected Interest Rate Announcements
Dependent Variable: Net Purchases of Equity

	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5
Expected Change in Policy Rate	0.045	0.079	0.210**	0.157*	-0.044	-0.127
	(0.107)	(0.108)	(0.090)	(0.088)	(0.149)	(0.187)
Surprise Change in Policy Rate	-0.034	-0.092	0.189	-0.550**	-0.065	0.063
	(0.248)	(0.240)	(0.243)	(0.205)	(0.290)	(0.372)
R-squared	-0.048	-0.044	-0.004	0.051	-0.050	-0.034
N	43	43	41	43	42	45

Robust standard errors in parentheses. *,**,*** denotes significance at the 10, 5 and 1 percent levels respectively.

Table 10. Net Purchases of Equity, Stock and Exchange Rate Movements, and Interest Rate Announcements

	Net Purchases of Equity b/se	Net Purchases of Equity b/se	Stock Returns b/se	Exchange Rate b/se	Net Purchases of Equity b/se	Net Purchases of Equity b/se
Expected Change in Policy Rate	0.178**	0.183*	-0.130	0.368	0.175*	0.128
	(0.088)	(0.092)	(0.403)	(0.313)	(0.091)	(0.093)
Surprise Change in Policy Rate	-0.422**	-0.441**	-2.721**	-1.997*	-0.499*	-0.130
	(0.193)	(0.194)	(1.323)	(1.029)	(0.252)	(0.210)
Net Purchases of Equity, before MPC	---	0.126	---	---	---	---
	---	(0.245)	---	---	---	---
Stock Returns	---	---	---	---	-0.028	---
	---	---	---	---	(0.045)	---
Exchange Rate Changes	---	---	---	---	---	0.147*
	---	---	---	---	---	(0.080)
R-squared	0.043	0.046	0.065	0.165	0.025	0.130
N	43	42	45	45	43	43

Robust standard errors in parentheses. *,**,*** denotes significance at the 10, 5 and 1 percent levels respectively. All specifications include a constant, and a dummy variables for meetings on January 15th, 2002 and again on the December 11th 2003.

Table 11. Additional Robustness Checks

	Net Purchases of Equity, U.S. dollar	Net Purchases of Equity, Share of JSE Market Cap
Expected Change in Policy Rate	0.012	0.475
	(0.011)	(0.481)
Surprise Change in Policy Rate	-0.023	-0.957
	(0.025)	(0.887)
Exchange Rate Changes	0.019*	0.384**
	(0.010)	(0.176)
R-Squared	0.18	0.25
N	43	43

Robust standard errors in parentheses, *, **, *** denotes significance at the 10,5 and 1 percent levels respectively. All specifications include a constant, and a dummy variables for meetings on January 15th, 2002 and again on the December 11th, 2003.

IV. An Analysis of the Macrofinancial Risks in the South African Banking System [20]

A. Introduction

This paper analyzes the macrofinancial risks for the South African banking sector. Financial risk is measured by the default probability of South African banks and it is calculated through the contingent claims analysis. Results show that this risk increased for South African banks during the global financial crisis. Financial and real variables are analyzed in a vector-autoregression framework to quantify the magnitude of the transmission of shocks from one sector to another. Results show that financial shocks are strong on the exchange rate, sizeable on economic growth; and real shocks are significant but limited on the bank default risk.

67. **The current financial crisis, which started in the summer of 2007 in the United States, raised concerns on the scope and the impact of the risks that are linked to the macro-financial environment: in particular on the extend of the vulnerabilities of one sector of the economy due to a significant slowdown/breakdown in another.** As an example, on the real side, the current financial crisis reduced the demand for exports of the emerging market economies, which slowed down their domestic economy; and on the financial side, the crisis restricted the liquidity and hence limited bank lending. This paper analyzes the magnitude of the transmission of such shocks from one sector of the economy—real/financial—onto the other for South Africa.

68. **The macro-financial analysis in this paper can be broken down into two steps.** In the first step, the paper utilizes from the contingent claims analysis (CCA) to determine the solvency risk of the South African banking system through the default risks associated with these banks. In the second step, the paper uses a vector autoregression model to analyze the interactions between the financial sector and the real economy and to measure the magnitude of the transmission of shocks from one sector to other.

69. **The literature on the contingent claims analysis relates back to option pricing theory developed by Black-Scholes (1973) and Merton (1973); where a pricing formula for options and a general framework for pricing other derivative instruments are described.** In the CCA approach bank equity is modeled as a call option on a bank's assets, where one can derive the market-based value of its asset and the implied asset volatility. After estimating these two measures, we calculate the solvency risk of a bank based on its default probability. In this methodology, default happens when the market value of a bank's assets falls short of its current debt liabilities.

70. **The main advantage of using the bank solvency risk—through CCA approach—rather than the standard financial soundness indicators is due to its forward looking dynamics.** The latter indicators are obtained through the balance sheet of a bank and hence they are backward looking; i.e. they report realized risk not the current risk. On the contrary, the CCA approach is

[20] Prepared by Burcu Aydin.

based on the stock market price of a bank, which incorporates both the current information available to the market and market's expectation on them.

71. **Results from the contingent claims analysis show that solvency risk for the South African banks increased during the recent financial turmoil.** However, compared to other financials operating in mature markets, the rise in the perceived risk of South African banks is much smaller in magnitude.

72. **In the second step of the analysis, macro-financial risks are studied through a vector-autoregression framework.** In this framework, default probability of banks are modeled endogenously with domestic variables–economic growth, house prices, exchange rate and discount rate–and exogenously with external variables–leading index of trading partners, gold prices and emerging market stock index.

73. **Results from the macrofinacial analysis show that the transmission of shocks from bank solvency risk to exchange rate is strong and to economic growth is sizeable; however, the transmission of shocks from the real economy to the financial sector is statistically significant but limited in magnitude.**

74. **This paper has the following structure. Section B sets the model and presents the results for the contingent claims analysis; section C for the macrofinancial analysis; and the last section concludes.**

B. Contingent Claims Analysis[21]

75. **The CCA approach models bank equity as a contingent claim on bank asset.** It is a contingent claim, because the value of bank equity depends on the value of bank assets and the default-free value of bank liability[22] at a particular point in time. The argument is as follows. The stockholders of a bank have a contingent claim on the residual value of a bank's assets, which is equal to the value of total assets minus debt. In this framework, equity is a junior claim, meaning that in the case of default, equity holders cannot receive any positive amount. Then, we can model equity as the following call option, where

$$E = \max\left[A - DB, 0\right] \tag{1}$$

The equation above tells us that the value of a bank's equity is equal to the value of its assets, denoted by A, minus the current debt obligations of that bank, or the default barrier, denoted by DB, if the bank can generate enough cash to cover its current debt obligations, in other words $A \geq DB$;

[21] A detailed derivation of the contingent claims analysis is provided in the Appendix.

[22] The default-free value of bank liability is equivalent to the strike price of a call option in the CCA approach.

if not, it is equal to null. In this paper, we approximate default barrier as the sum of short-term[23] and half of long-term liabilities.

76. **Imposing a boundary condition to equation (1) at time T -which is equal to one year time in this paper- will provide us the closed form solution; and it can be expressed as:**

$$E = AN(d_1) - DBe^{-rT}N(d_2) \tag{2}$$

$$\text{Where, } d_1 = \frac{\ln\left(\frac{A}{DB}\right) + \left(r + \frac{1}{2}\sigma_A{}^2\right)T}{\sigma_A\sqrt{T}}$$

$$d_2 = d_1 - \sigma_A\sqrt{T}$$

In the above equation, r is the risk-free interest rate[24]; T is the time to maturity of the risk-free debt, DB; $N(d)$ is a cumulative probability distribution function for a standard normal variable; and σ_A is the standard deviation of a bank's assets. A is the current market value of the underlying asset—namely, the bank assets, and DB (default barrier or in other words the default-free value of bank liabilities) is the strike price of a call option.

77. **The relationship between the volatility of a bank's assets (σ_A) and the volatility of its equity (σ_E) can be expressed by the following equation:**

$$E\sigma_E = A\sigma_A N(d_1) = A\sigma_A \frac{\partial E}{\partial A} \tag{3}$$

78. **In this paper, volatility of bank equity (σ_E) is measured through its historical conditional volatility.** We obtain bank equity data through the market capitalization of a bank reported by the Bloomberg database. Figures 12 and 13 present the daily logarithmic change in the market capitalization data for larger and smaller South African banks, respectively.

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[23] Short-term liabilities in this paper is equal to the sum of the short and medium-term liabilities as reported by the South African banks. The South African Reserve Bank classifies liabilities that mature in six months as medium term liabilities; and any other liability that matures later than six months is defined as long term.

[24] In the literature, use of U.S. Treasury or the swap/LIBOR curves are quite common for the risk-free interest rate. However, use of these rates would ignore the exchange rate risk for South African banks. Even though, the South African government bonds would not qualify as default-free, in order to avoid exchange rate risk complications involved by the use of a foreign interest rate as the risk-free interest rate; in this paper, we use the yield on South African government bond maturing in one-year as the risk free interest rate.

Figure12. Volatility of Market Capitalization of Largest South African Banks

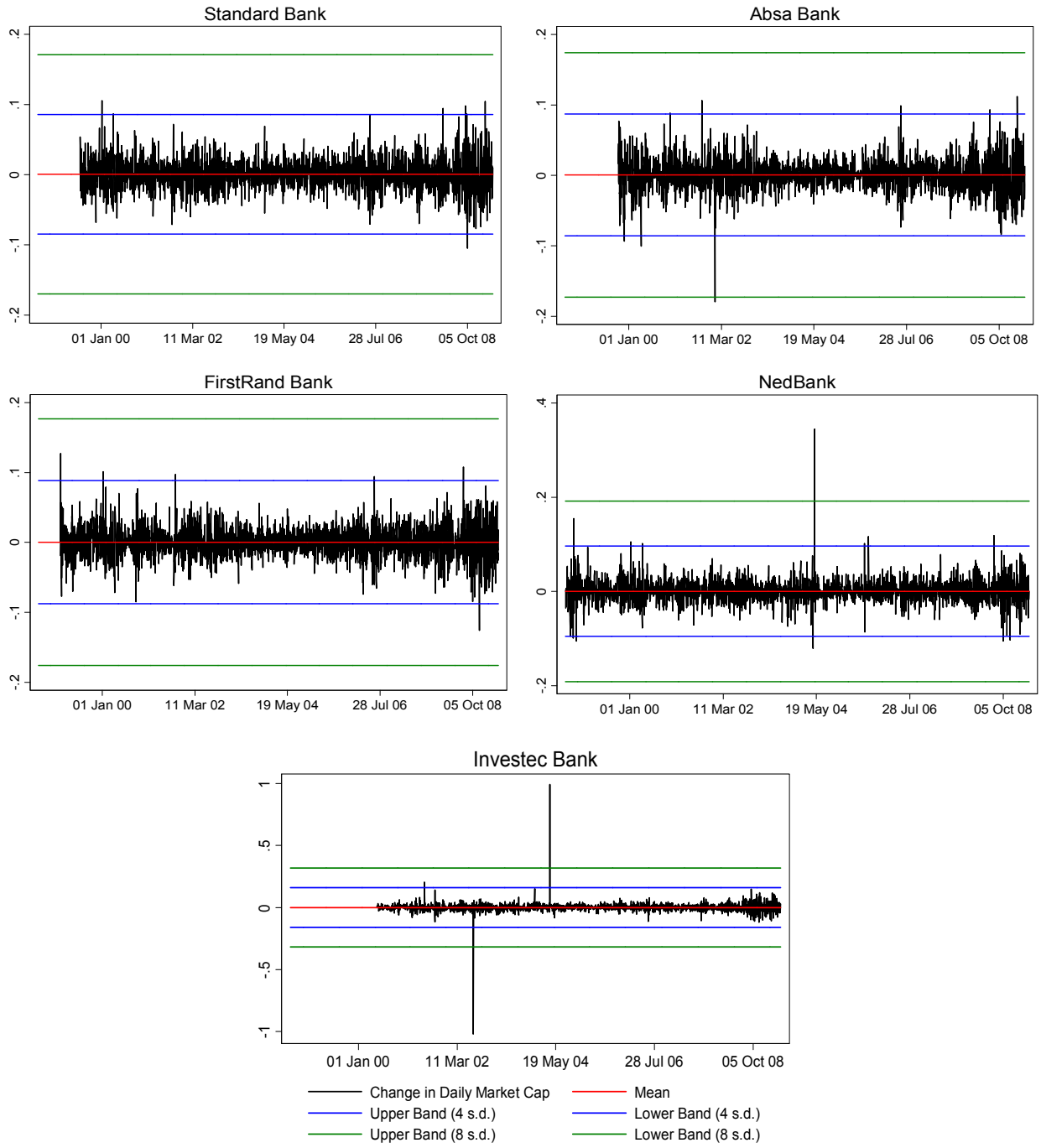
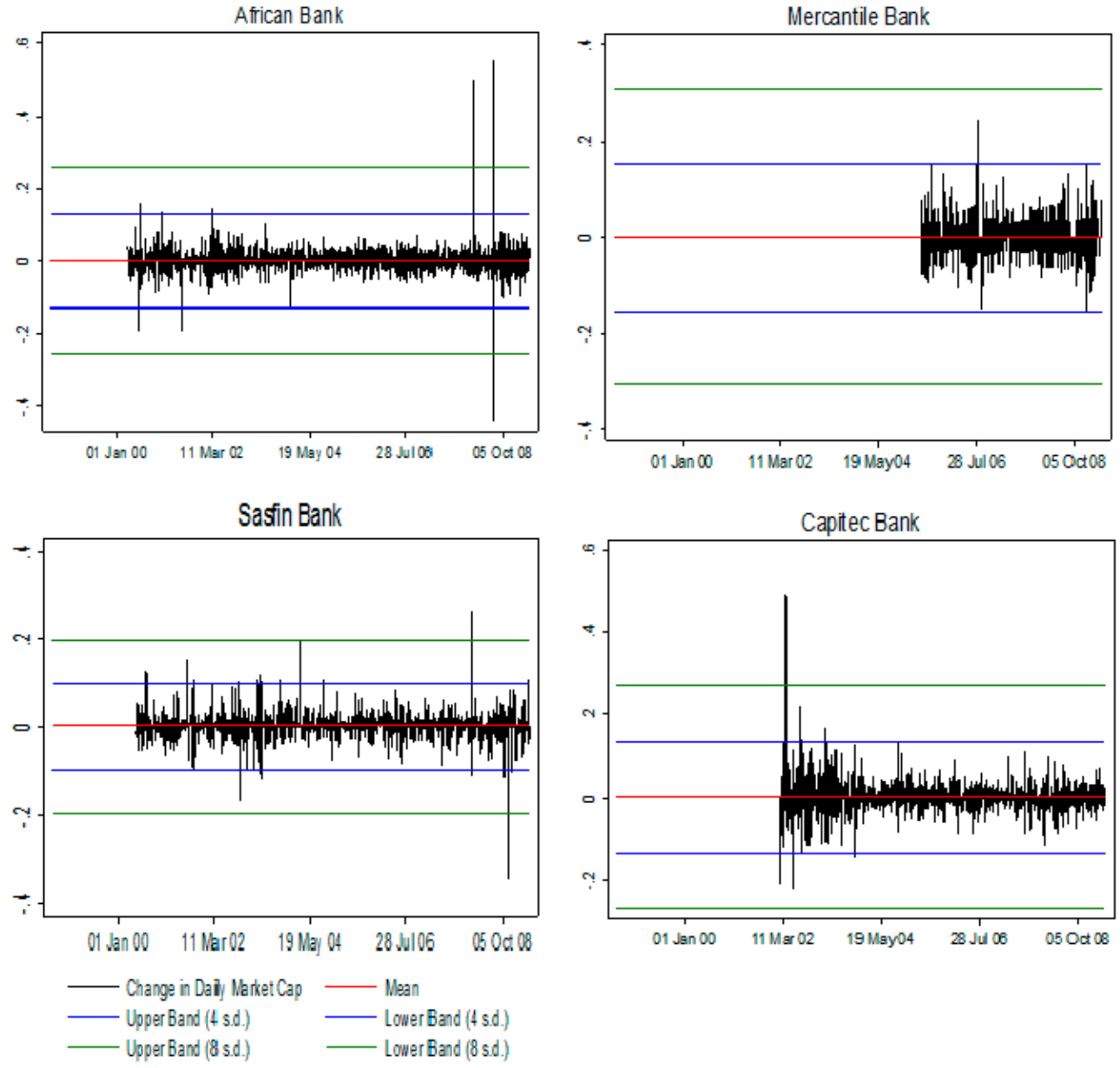


Figure13. Volatility of Market Capitalization of Smaller South African Banks



79. **Daily change in bank equity data shows high degree of clustering; and further this volatility seems to be time dependent.** As shown in Figures 12 and 13, low volatility periods are followed by low volatility, such as the mid-2004 period, and high volatility periods are followed by high volatility, such as the late 2008–early 2009 period.

80. **In order to capture the time dependence and clustering in the volatility of market capitalization data, we model bank equity by the following generalized autoregressive conditional heteroskedasticity model presented by the equation below.**

$$(1-L)y_t = c + \varepsilon_t \tag{4}$$

Where, $$Var(\varepsilon_t) = \sigma_t^2 = \gamma + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \nu_t$$

81. **Based on our GARCH(1,1) model, we estimate the conditional daily volatility for bank equity (σ_E).** In order to refrain from any systematic biases in our volatility estimation, due to the extraordinary moves either in the stock price or the shares outstanding of a bank; any daily change in market capitalization data, which is more than eight standard deviation away from its mean, is excluded from our estimation sample. The coefficient estimates of the above GARCH(1,1) model is provided on Table 12. As shown in this table, the estimation yields highly significant coefficient estimates for the volatility equation.

Table 12. Coefficient Estimates of GARCH (1,1) Model

	Standard	Absa	FirstRand	Ned	Investec	African	Mercantile	Capitec	Sasfin
Equation 1: Change in bank Equity									
Constant	0.08**	0.11***	0.07*	0.04	0.04	0.11***	-0.04	0.22***	0.15***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.08)	(0.04)	(0.11)	(0.06)	(0.04)
Equation 2: Conditional Heteroskedasticity									
ARCH Term	0.08***	0.07***	0.10***	0.09***	0.00	0.54***	0.16***	0.04***	0.12***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.02)	(0.04)	(0.00)	(0.01)
GARCH Term	0.89***	0.92***	0.87***	0.88***	-0.46	0.41***	-0.06	0.95***	0.77***
	(0.01)	(0.01)	(0.02)	(0.01)	(0.68)	(0.02)	(0.09)	(0.00)	(0.01)
Constant	0.12***	0.05***	0.16***	0.18***	22.94**	1.90***	13.23***	0.08***	0.78***
	(0.02)	(0.01)	(0.03)	(0.02)	(10.69)	(0.12)	(1.39)	(0.01)	(0.04)
Observations	2477	2413	2600	2728	2249	2287	1014	1810	2249

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

82. **The option pricing equations (2) and (3) provide us a system of equations with two unknowns: implicit value of bank asset (*A*) and implied asset volatility (σ_A).** One can solve for these two unknowns by forward iterating equations (2) and (3) for a given risk-free interest rate and maturity of debt at time *T*.

83. **Distance to default (*DD*) measure shows how many standard deviations is a bank away from defaulting on its debt.** It is defined as the distance between the market value of asset and the default barrier, normalized by the standard deviation of assets. Then, for a risk-free debt maturing at time T, we can measure it by the ratio of d_2 -which is part of equation (2)-, as shown below:

$$DD = \frac{\ln\left(\frac{A}{DB}\right) + \left(r - \frac{1}{2}\sigma_A^{\,2}\right)T}{\sigma_A\sqrt{T}} \tag{5}$$

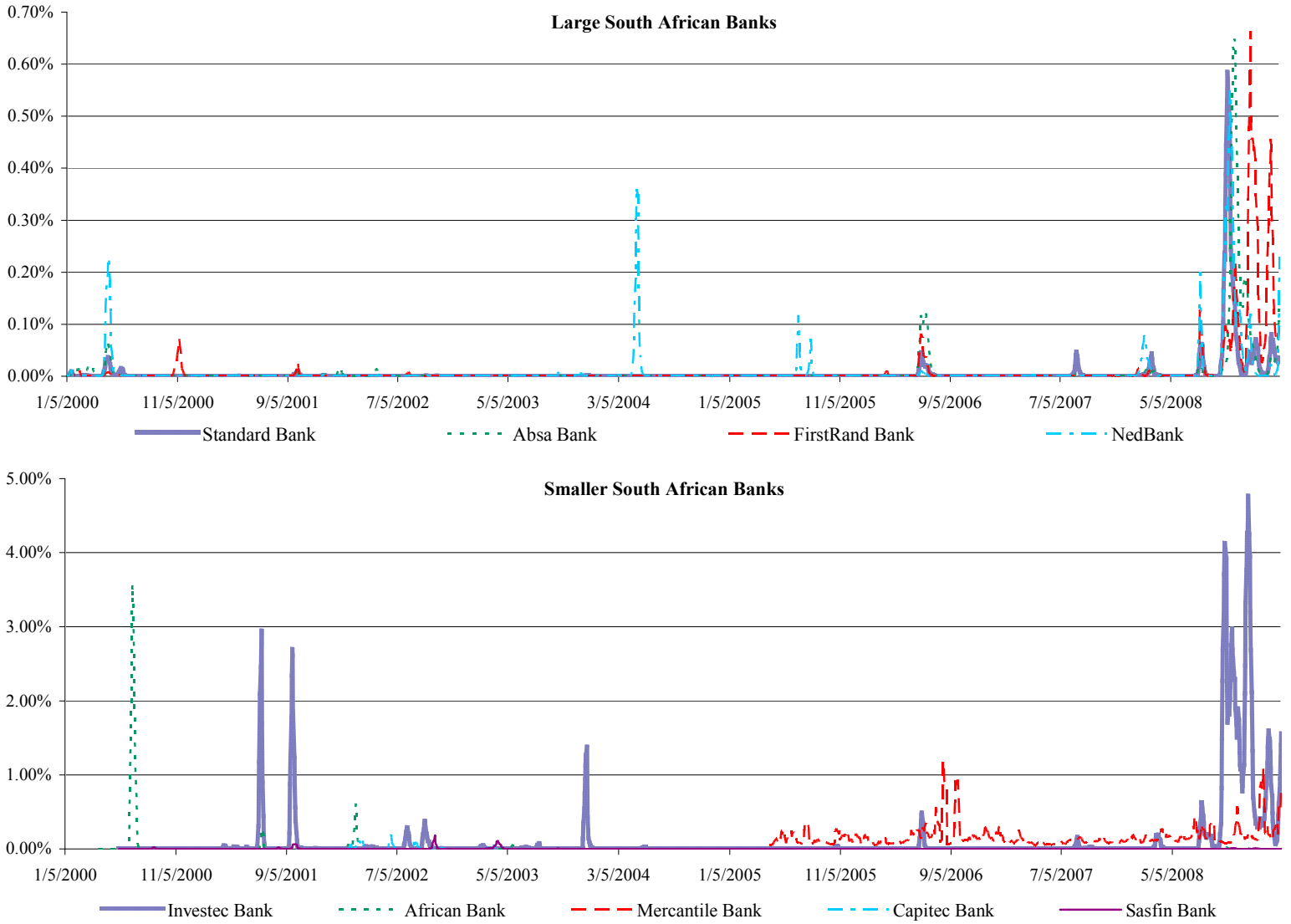
84. **Default probability measures the probability of a bank defaulting on its debt.** It is calculated as the cumulative distribution function of N(-DD) by relying on risk-neutral pricing. As an example, if a bank is two standard deviations away from defaulting on its one year maturing debt, then its probability of default is equal to 2.28 percent as $N(-2) = 0.0228$. Probability of default increases as market leverage - market value of the firm's assets which is financed by debt $\left(DB/A\right)$ - or volatility of the market value of bank asset (σ_A) increase.

85. **Default probabilities of the South African banks increased during the current global financial crisis.** Based on the CCA calculations, default probabilities of the South African banks are plotted on Figure 14: upper panel for the largest South African banks and lower for smaller banks. These graphs indicate an increase in solvency risk both for larger and smaller banks operating in South Africa. Default probabilities of larger banks, measured in daily frequency, peeked to around *0.6* percent during the September 2008–February 2009 period, which is the highest observed solvency risk ratio for these banks during the 2000s. Similarly, solvency risk for smaller banks increased during the global financial crisis; and it peaked for Investec Bank, which is the largest of the smaller banks.

86. **Solvency risk is higher for smaller banks.** During the peak of the financial crisis, default probability of smaller banks rose to around five percent, whereas it increased only to around 0.6 percent for the largest banks of South Africa. Such a finding may support the view that the market participants may incorporate the too big to fail hypothesis or that larger banks have better portfolio quality belief in their bank equity pricing decision.

87. **Despite the increase in solvency risk for the South African banks during the current financial crisis, its banking system does not incorporate any "very" risky company.** Figure 15

Figure14. Default Probability of South African Banks in One Year (In percent)



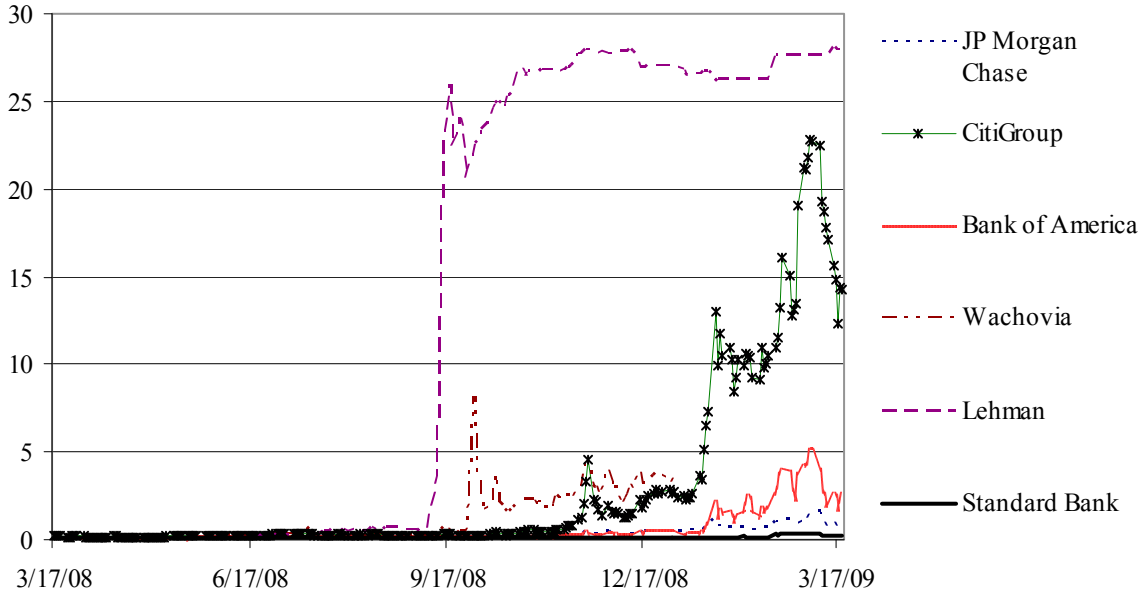
plots the expected default frequency (EDF) credit measure[25] of large U.S. financial companies, which experienced financial distress during the current financial crisis, together with the Standard Bank, the largest South African bank. As shown in this figure, the rise in the solvency risk for Standard bank is much more contained than the rise in solvency risk for the US financials during the late 2008–early 2009 period. For example, Lehman Brothers, which declared bankruptcy,[26] had an EDF credit measure of more than 25 percent by September 2008. Citigroup, which received significant amounts of government funds, had an EDF measure of more than 22.68 percent in early March 2009. Wachovia, which was acquired by the Wells Fargo Bank on December 31, 2008, had reached an EDF measure of 8.22 percent in late September 2008.

88. **Solvency risk based on default probability is a market based expectation; and it may over- or under-estimate the true default probabilities.** This measure reflects an investor's perception on the riskiness of a bank. As an example, Lehman Brothers had an average EDF measure around 0.3 percent from the start of the financial turmoil in the summer of 2007 until its announcement of filing for bankruptcy in September 15, 2008. Even the day before its announcement of filing for bankruptcy, it had an EDF measure of only 3.62 percent. This shows that market participants expected government support or some other sort of rescue plan for Lehman Brothers; and it under-reacted towards the risks associated with its default.

[25] Similar to the CCA approach, Moody's EDF credit measure calculates the market value of a bank's assets and its distance from default by employing Merton's option pricing formula. However, in order to calculate the probability of default, it uses an empirically determined function, which is measured on historical data as the observed frequency of default for a given value of the distance to default measure. In other words, this function maps the distance to default measure to the historical default rate data. For example, if the historical data shows that, on average, two out of 100 companies defaulted within a year time, amongst the companies which are three standard deviations away from default; then, this function assigns two percent to the EDF credit measure for a company with a distance to default of three. In this paper, we calculate default probabilities of South African banks as explained by the CCA methodology rather than relying on the Moody's database. Because the assumptions and function specifications used by Moody's calculations is not revealed explicitly to its users; and this creates more of a black box methodology for a researcher.

[26] Lehman Brothers Holdings announced that it would file for Chapter 11 bankruptcy protection on September 15, 2008. The same day Lehman's shares decline in value more than 90 percent.

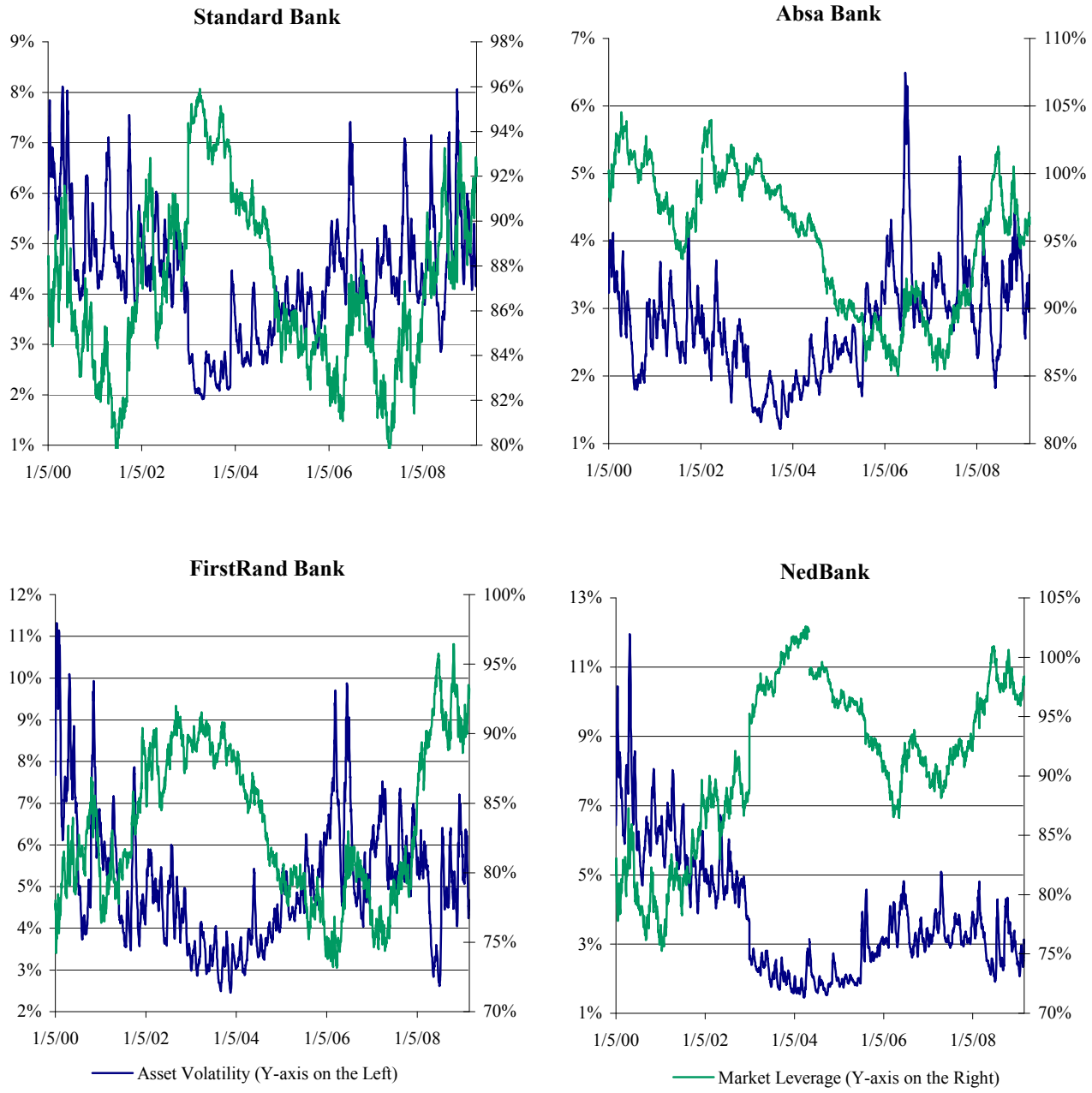
Figure15. Expected Default Frequency of U.S. Banks and Standard Bank in a Year
(In percent)



89. **Market leverage and implied asset volatility affect default probabilities: an increase in any of these measures causes an increase in the default probability of a bank.**[27] As presented in equation (4), default probability of a bank increases if a bank finances more debt with respect to its market value of assets –or in other words $\ln\left(\frac{A}{DB}\right)$ declines- and/or if the market implied volatility of its assets increase –i.e. σ_A rises. In order to observe the underlying factors for the rise in the default probabilities of the South African banks, we plot asset volatility and market leverage of the four largest banks in South Africa over the 2000s in Figure 16 and smaller banks on Figure 17. These graphs show that during the global financial turmoil, both the market leverage and the implied volatility of assets increased for most banks operating in South Africa compared to its level in mid-2000s. In particular the rise in market leverage is higher for most banks during the late 2008-early 2009 period. Nevertheless, one should mention that the increase in market leverage is likely to be due to the sharp decline in the bank equity value—and hence the implied asset value—of most of the South African banks in this period rather than a change in the debt financing behavior of these banks.

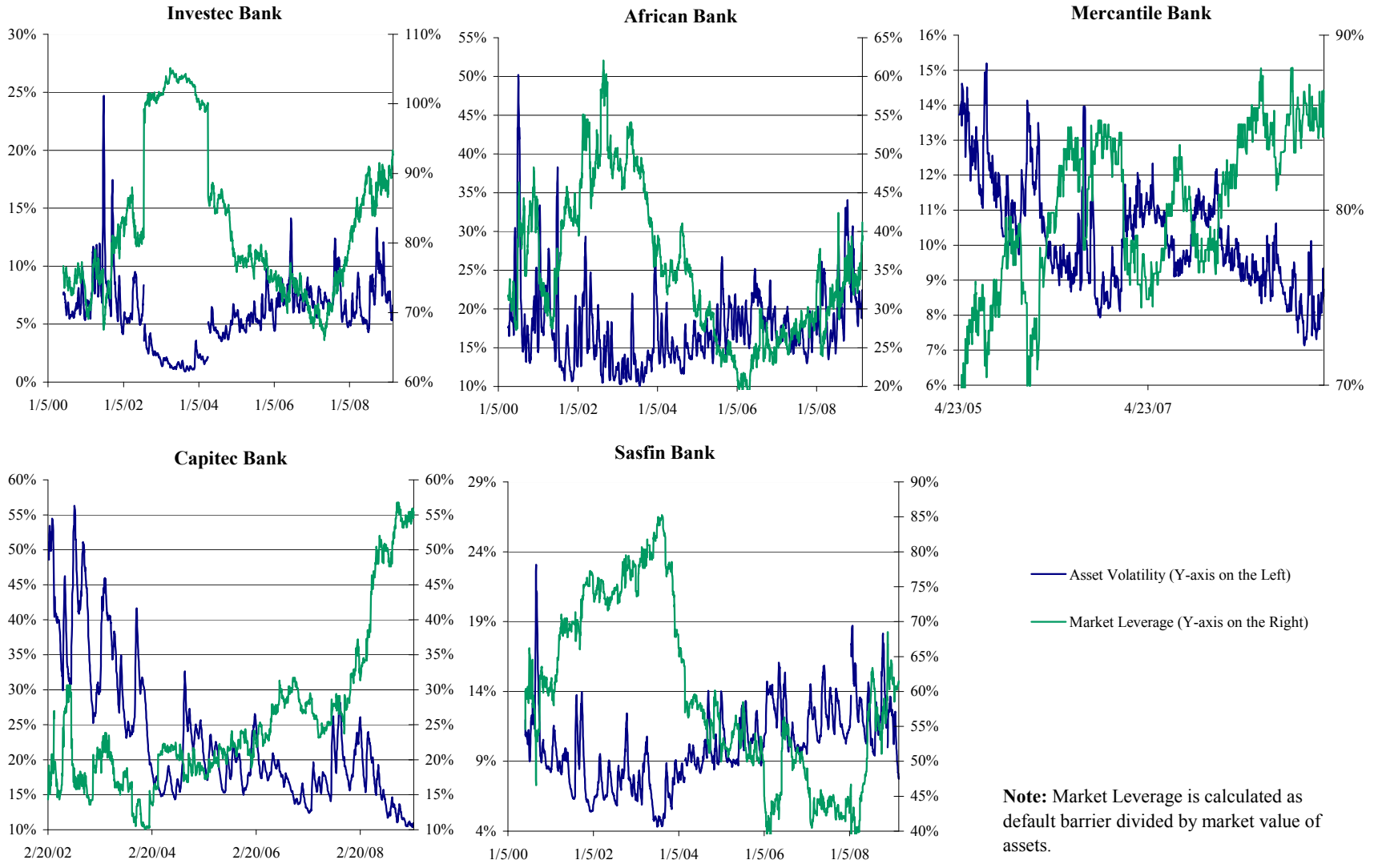
[27] A third factor which may affect the default probability of a bank is the changes in the risk-free interest rate. As it is shown in equation (4), higher [lower] values for risk-free interest rate would yield lower [higher] default probabilities. Nevertheless, one should mention that the changes in equity prices are in daily frequency whereas changes in risk-free interest rate are of much lower frequency; and hence the latter would have a limited impact on the day-to-day changes in the perceived solvency risk of the South African banks.

Figure16. Implied Asset Volatility and Market Leverage of the Largest South African Banks



Note: Market Leverage is calculated as default barrier divided by market value of assets.

Figure17. Implied Asset Volatility and Market Leverage of Smaller South African Banks



Note: Market Leverage is calculated as default barrier divided by market value of assets.

C. Macrofinancial Risk Analysis

90. **In the second part of the analysis we measure the significance and the magnitude of the risks transmitted from the real economy [financial sector] to the financial sector [real economy].** In order to estimate the transmission mechanism between the financial sector and the real economy, we estimate a set of dynamic equations composed of the solvency risk of the South African banks, through their calculated default probabilities, and important domestic and external indicators for the South African real economy, which are listed on Table 13.

Table 13. Summary Statistics for Macroeconomic Variables

	Mean	Std.Dev.	Min	Max
Nominal Effective Exchange Rate	81.35	11.89	56.38	100.54
London Gold Price	3,702.07	1,705.51	1,907.45	9,380.23
Leading Index for Trade Partners	108.33	8.12	95.10	119.63
Real GDP*	271,923.70	30,189.54	225,654.70	324,376.00
MSCI Emerging Market Index	589.68	293.87	251.40	1,337.63
Absa House Price Index	226.33	92.99	98.40	357.30
SARB Repurchase Rate	9.99	2.13	7.00	13.50

Note: All non-index variables are expressed in Rand
*: Monthly Real GDP values are extrapolated from quaterly series.

91. **The vector-autoregression model used in this paper can be characterized by the following equation below:**

$$Y_t = \begin{bmatrix} \Delta M_t^1 \\ \vdots \\ \Delta M_t^i \\ S_t^i \end{bmatrix} = c + A_1 Y_{t-1} + A_2 Y_{t-2} + \sum_{i=0}^{2} B_i X_{t-i} + e_t \qquad (6)$$

In the equation above[28], Y is a matrix composed of endogenous variables: M^i is the vector for the change in each of the domestic macroeconomic variables –i.e. RGDP, house prices, and exchange rate- and discount rate at its level, and S is the vector denoting the solvency risk of a bank. The ordering of the variables in the Y matrix is as the order in the description

[28] All variables, except discount rate and default probability, exhibit nonstationarity at its level: We cannot reject the existence of a unit root in any of these variables when we apply the Augmented Dickey-Fuller test with two lags. In order to achieve stable VAR coefficient estimates, we use the first difference of each of these series, except discount rate and default probability, by transforming these series into monthly log-differences.

statement—i.e., RGDP is listed at the top and default probability at the bottom—with respect to the relative exogeneity of the domestic variables amongst themselves. X is a matrix for the change in the exogenous variables—namely, EMSCI index, gold prices and the leading index for South Africa's trade partners. A_i and B_i are the coefficients of respectively the endogenous and exogenous variables of lag i, c is the intercept vector; and e is the vector for the error term.

92. **We estimate the vector-autoregression model presented in equation (6), separately for the default probabilities of each of the largest four banks and also for the joint default probability of the largest four.** As shown in Table 14, the largest four banks in South Africa constitute more than 85 percent of the total banking sector assets in South Africa. Hence restricting the analysis to these four banks would be sufficient to cover the system-wide risk in South Africa. The vector autoregression coefficient estimates of this model are reported in Appendix I on Tables 18–20.

Table 14. Book Value of South African Bank Assets by the end of February 2009

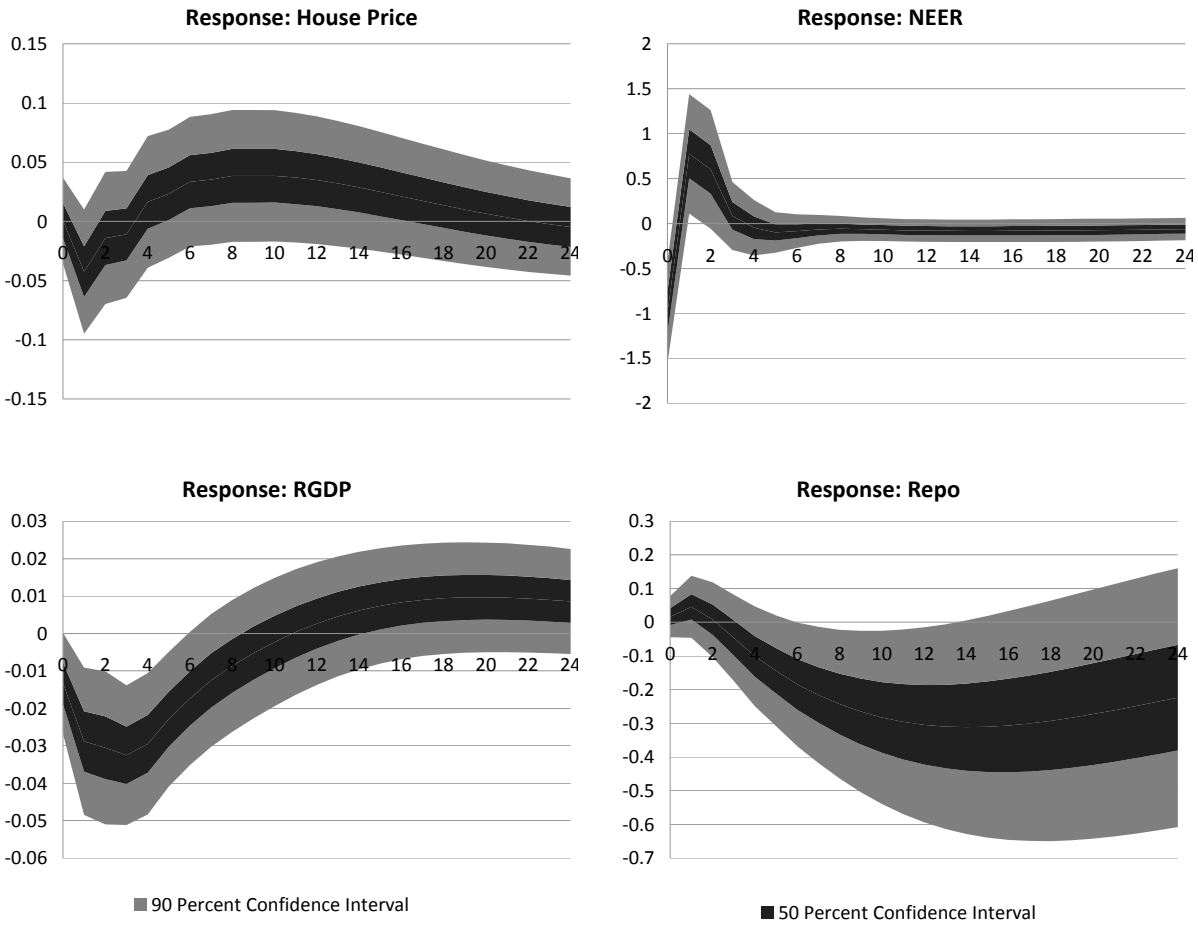
	Domestic Assets	Foreign Assets	Total Assets
Standard Bank	580,555,433.00	280,930,527.00	861,485,960.00
Absa Bank	638,981,567.00	64,257,502.00	703,239,069.00
FirstRand Bank	544,024,839.98	42,702,129.60	586,726,969.57
Nedbank	478,437,644.00	20,024,310.00	498,461,954.00
Total Banking Sector	2,618,882,483.80	521,377,922.37	3,140,260,406.16

Note: Values expressed in thousands of Rand

93. **Next, we estimate the orthogonalized impulse response and the dynamic multiplier functions from the VAR model given in equation (6) in order to measure the transmission of shocks from one sector to another.** First, we analyze the impact of shocks from the financial sector to the real economy by giving a one standard unit shock to the joint default probability of the largest four South African banks, measured by the weighted sum of the individual default probabilities, onto the domestic economy. The resulting path of the domestic variables due to a perceived systemic risk in the South African banks are plotted in Figure 18.[29]

[29] The coefficient estimates of the orthogonalized impulse response function are not unique since they depend on the ordering of the endogenous variables. In this paper, we estimate various impulse response functions based on various Cholesky ordering of the endogenous variables in order to observe whether the response of endogenous variables vary with respect to the choice of variable ordering. However, the coefficient estimates and their standard errors do not vary significantly with respect to the ordering of the endogenous variables in the VAR.

Figure 18. Orthogonalized Impulse Response of Macroeconomic Variables to a Unit increase in the Default Probability of the Largest Four South African Banks



94. **Figure 18 shows that a unit increase in the joint default probability of the South African banks in a given month, reduces the real economic growth rate and causes an initial depreciation of the rand.** As it is shown in Table 15, the size of the financial shock given to the system is equal to a 0.02 percent increase in the solvency risk of the South African banks. Given this shock, exchange rate depreciates immediately and the real growth rate declines at its peak on the third month after the shock.

95. **The response of the change in house prices and the discount rate to a unit shock in joint default probability of the South African banks are rather very opaque.** The initial effects of both response functions are insignificant in the *90* percent confidence interval; and the discount rate responds only six months after the shock.

96. **The peak increase in the solvency risk of the South African banks was realized during October 2008, and the joint default probability of these banks increased to 0.25 percent on average in this month.** In order to see the impact of extreme financial events on the domestic economy, we increase the size of the shock from 0.02 percent to 0.25 percent. Given this shock, as presented on Table 15, the nominal effective exchange rate

depreciates by 10 percent in the same month; and the real GDP declines by 0.35 percent (or by 4.2 percent at annualized monthly rate) at its peak The orthogonalized impulse response functions indicates that the transmission of shocks from the financial sector is large onto the exchange rate and sizeable on the real economic growth.

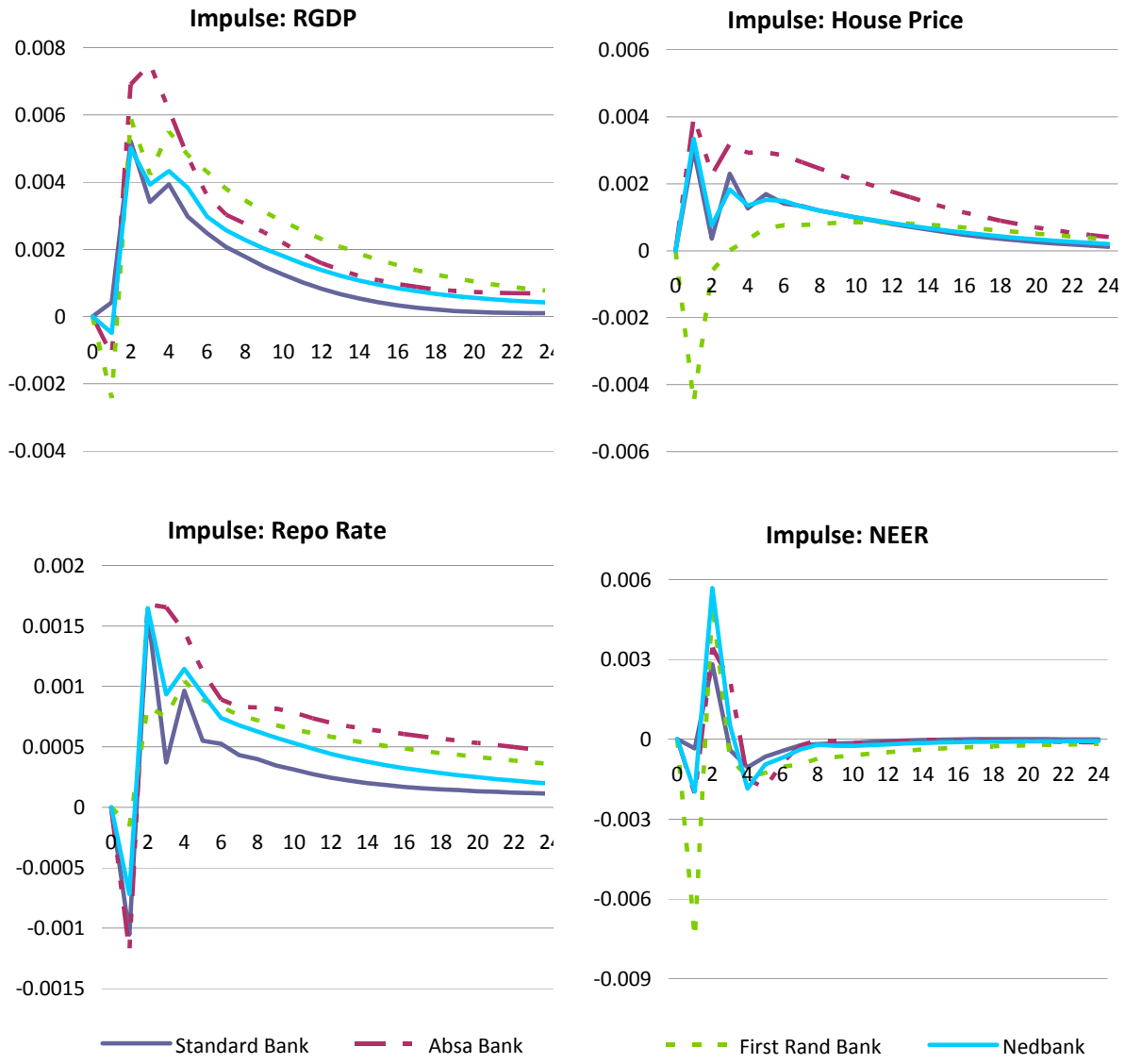
Table 15. Size of financial shocks and the Response of Domestic Variables

Response	Size of Shock	Peak Month (after shock)	Bank Response (at peak)
NEER	0.02	0	-0.9762 *** (0.3430)
RGDP	0.02	3	-0.0325 *** (0.0113)
Past Peak Rise in Default Probability (October 2008)			
NEER	0.25	0	-10.3951 *** (0.3430)
RGDP	0.25	3	-0.3459 *** (0.0113)

Note: Standard errors are provided in parantheses.

97. **Further, Figure 18 indicates that the shocks from the financial sector to the real economy pass faster through the exchange rate and slower through real economic growth.** As shown in this figure, an increase in the solvency risk of the South African banks causes a nominal depreciation of Rand immediately and largely, possibly through the increased risk sentiment of the foreign investors, and this immediate reaction reverses in the following month -through a nominal appreciation of Rand- as the solvency risk dies out; and the impact on the nominal exchange rate returns back to its equilibrium by the second month after the shock on the financial sector. Whereas on the real economy, it takes much longer for the economic growth to react, and it reacts in much smaller magnitude; and the growth returns back to its equilibrium rate much slower.

Figure 19. Orthogonalized Impulse Response of Larger Banks' Default Probability to the Changes in Real GDP, House Prices, Discount Rate and NEER



98. **Next, we measure the transmission of shocks from the real economy onto the financial sector by giving a unit shock to various macroeconomic variables and measuring the response of each bank to that shock over time.** Figure 19 provides South African banks' impulse response functions for the shocks imposed on the [endogenous] domestic macroeconomic variables; and Figure 20 plots banks' dynamic response functions for the shocks forced on the [exogenous] external variables.

99. I**mpulse response functions plotted on Figure 19 and 20 show that there is uniformity across banks' responses to domestic and external shocks.** Excluding a few cases for FirstRand Bank, the largest banks of South Africa tend to react similarly to

macroeconomic shocks. For example, as provided in Figure 19, a unit decrease in real economic growth rate increases default probability of all four banks after the second month of this shock.

Table 16. Peak Orthogonalized Impulse Response of Larger Banks' Default Probability to the Changes in Real GDP and House Prices

	Type of Shock	Size of Shock	Peak Month (after shock)	Bank Response (at peak)	Past Peak Shock[1]	Bank Response	Largest Realized Monthly DP
Standard	RGDP	-0.0869	2	0.0052 ***	-0.5582	0.0335	0.2427
		(0.0059)		(0.0019)			
Absa		-0.0852	3	0.0075 ***		0.0491	0.3649
		(0.0058)		(0.0032)			
FirstRand		-0.0756	2	0.0059 ***		0.0435	0.4258
		(0.0052)		(0.0029)			
Nedbank		-0.0876	2	0.0050 **		0.0320	0.3158
		(0.0060)		(0.0026)			
Standard	House Price	-0.2212	3	0.0023 ***	-0.9562	0.0099	0.2427
		(0.0151)		(0.0011)			
Absa		-0.2207	3	0.0032 *		0.0138	0.3649
		(0.0151)		(0.0018)			
FirstRand		-0.1899	1	-0.0045		--	0.4258
		(0.0130)		(0.0035)			
Nedbank		-0.2223	1	0.0033		--	0.3158
		(0.0152)		(0.0032)			

Note: Standard errors of the OIRF coefficients are provided in parantheses.

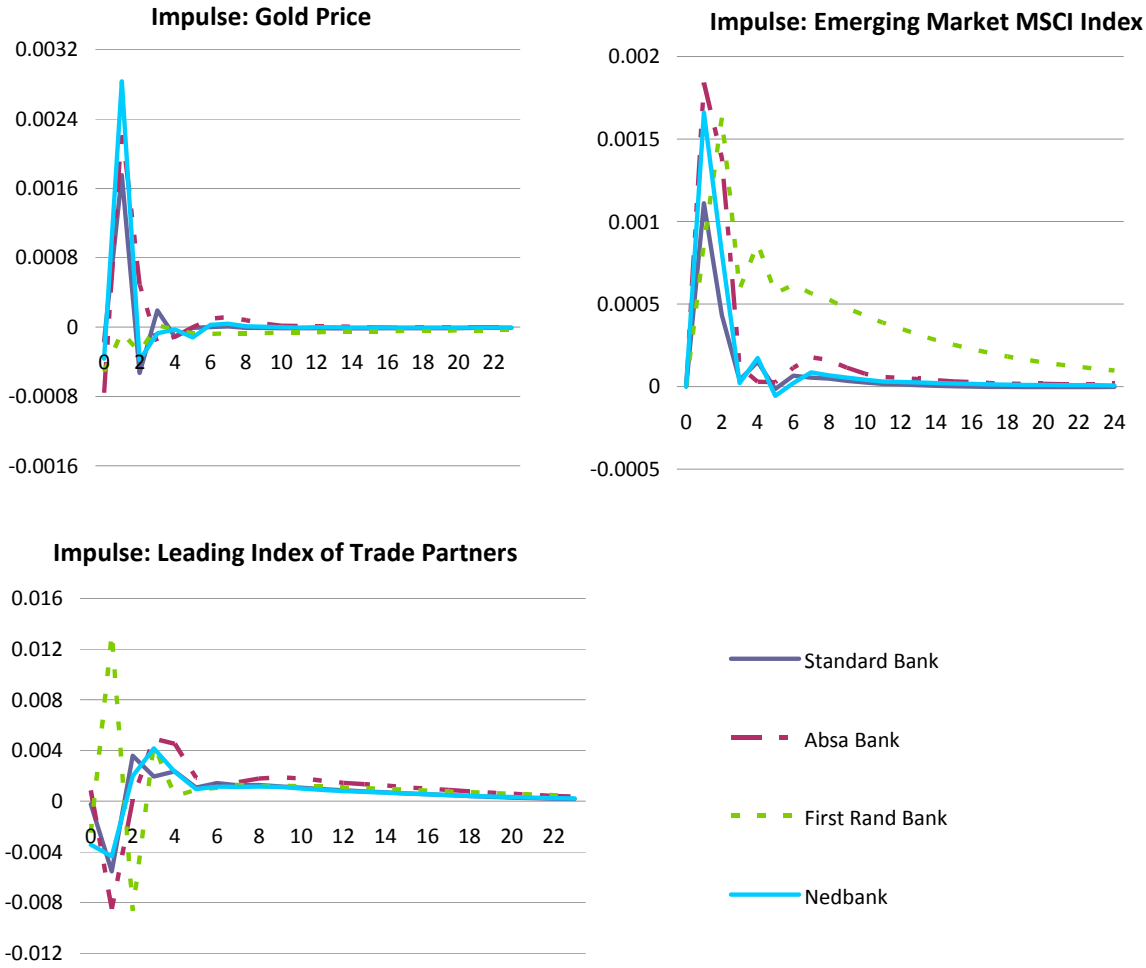
1: Past peak negative shock to RGDP was at February 2009 and to house price was January 2009 .

100. **Bank solvency risk increases when there are negative shocks to economic growth.** As it is shown in Figure 19, one standard unit decline in economic growth rate increases default probability of all large banks by around 0.006 percent. As it is shown in Table 16, the size of this shock is around 0.08 percent. When we increase the size of the negative economic growth shock to 0.56 percent (or to 6.5 percent annualized monthly rate), which was observed during the first quarter of 2009, bank solvency risk deteriorates further. However, the rise in the default probability of these banks –to around 0.03 percent- is quite limited when compared to the peak of the realized monthly default probability of these banks during the global financial crisis. As shown in Table 16, the default probabilities peak only to the range of one eight to one tenth of the realized monthly peak in the default probabilities of these banks during the October 2008-February 2009 period.

101. **Declining house prices increase bank's risk structure; however these effects are less significant in magnitude**. As shown in Figure 19; one standard unit decrease in house prices increases default probability of the largest South African banks–except FirstRand Bank immediately. However, looking at Table 16; one can see that the significance of these orthogonalized response functions are quite weak. Only Standard Bank responds significantly to a decline in house prices at the 90 percent confidence interval; however its

response is quite small in magnitude. Default probability of Standard Bank increases to only [around 0.01 percent] one twenty-fourth of its peak monthly default percentage, which is 0.24 percent, when house prices are shocked by the highest realized decline in South Africa during the 2000s –house prices declined the most by 0.96 percent during January 2008.

Figure 20. Dynamic Response of Larger Banks' Default Probability to the Changes in the Trading Partners, Gold Prices, and MSCI Index for Emerging Markets



102. **Rising policy rate tend to raise bank's risk structure; however, with less significance.** Looking at Figure 19, one can see that a standard unit increase in the repo rate leads to a rise in the default probability of all large banks in South Africa. However, these responses are not significant at the 90 percent confidence interval.

103. **The changes in the exchange rate does not lead to any significant changes in South African banks' solvency risk.** The flexible exchange rate system and the lower ratio of foreign denominated bank assets (Table 14) may be counted as some of the factors reducing the exchange rate to play a plausible risk in the South African banking system.

Table 17. Peak Dynamic Response of Larger Banks' Default Probability to the Changes in the Gold Prices, and EMSCI Index

	Type of Shock	Peak Month (after shock)	Bank Response (at peak)	Past Peak Shock[1]	Bank Response
Standard	Gold Price	1	0.0018 *** (0.0007)	-11.0132	0.0193
Absa		1	0.0023 *** (0.0010)		0.0255
FirstRand		0	-0.0005 (0.0011)		--
Nedbank		1	0.0028 *** (0.0009)		0.0312
Standard	EMSCI Index	1	0.0011 *** (0.0004)	-32.1579	0.0357
Absa		1	0.0018 *** (0.0006)		0.0592
FirstRand		2	0.0016 *** (0.0006)		0.0524
Nedbank		1	0.0017 *** (0.0006)		0.0534

Note: Standard errors of the dynamic multiplier coefficients are inside parantheses.

1: Past peak negative shock to gold price was at August 2008 and for EMSCI October 2008.

104. **Banks respond significantly to increased risk in gold prices and MSCI emerging market stock index.** Dynamic responses of banks' solvency risk to external shocks are plotted on Figure 20. As shown in this figure, one percent decline in the monthly change in gold prices and the MSCI index of the emerging market economies increase default probability of the South African banks one month after the shock. When we shock gold prices at its peak historical rate -11 percent decline was realized during August 2008-, default probability of South African banks increase around 0.2-0.3 percent (Table 17). This response is around one tenth of the past realized peak in the default probability of these banks. Similarly, when we shock the MSCI index with an amount equal to its past peak value—32 percent decline in MSCI index was realized during October 2008—default probabilities increase to a range around 0.04–0.06 percent (Table 17). This is by far the largest response of bank solvency risk compared to any other domestic and external macroeconomic shocks to the system. Nevertheless, compared to the past realized peaks in their default probabilities, the rise in solvency risk due to a shock in emerging market stock index is also quite limited in magnitude—shocks amount to only one sixth of the past peak solvency risk (Table 17).

D. Conclusion

105. **This paper studies the links between the financial sector and the macroeconomy by utilizing from two analysis.** First is the contingent claims analysis. This methodology is utilized in order to measure the solvency risk of South African banks based on market-based default probabilities of these banks. The results from this analysis indicate that the solvency risk in South African banks increased during the recent financial turmoil, nevertheless, the perceived risk for the South African banks are much reasonable compared to its pears operating in developed economies.

106. **Second, the paper combines the default probability of the South African banks with various macroeconomic variables through a vector autoregression model in order to assess the risks between the financial sector and the real economy.** The analysis from this section reveals that the risks from the real economy to the financial sector in South Africa are significant but of limited magnitude. Banks respond to changes in the economic growth rate; and to the changes in the external economy; i.e., Emerging Market Stock Index and the gold prices. Regarding the risks from the financial sector to the real economy, a perceived risk in the South African banking system causes a significant nominal depreciation of the exchange rate and a sizeable decline in economic growth rate.

APPENDIX I. DATA

107. **In this paper, we use three sets of data.** These three sets of data are essential to calculate the implicit asset value and the distance to default measure of a bank; the probability of default of a bank; and the impact of shocks from the real sector to the financial and vice versa.

108. **First, in order to calculate the implicit value of bank assets and the distance to default measure, we need two sets of information: default barrier and bank equity.** Default barrier is the current debt obligations of a bank that need to be fulfilled, and as frequently used in the literature, we approximate it by the sum of short term and half of long-term liabilities.[30] Bank deposits are obtained from the South African banks' balance sheet, and they are available in monthly frequency on the South African reserve bank website.[31] Equity values are obtained through the stock market assessment of the South African banks, and this data is available in daily frequency in the Bloomberg database.

109. **Second, as an alternative to our own calculations of the market value of bank assets and the distance to default measure, one can also use the expected default frequency (EDF) credit measure of the Moody's KMV database.** The EDF credit measure is the probability of the event "default" happening. For example, an EDF credit measure of one percent is the probability that, on average, one out of hundred firms with EDF of one percent will default in a given time period. The advantage of the use of this data is that it is very practical: it basically lets the user skip step one of this analysis by providing the default probabilities of banks. However, the disadvantage is that it is a black-box measure and the user cannot observe the exact model, the parameters and the data set used in the estimations of the EDF credit measure.

110. **Third, in order to measure the impact of macroeconomic variables on the default probabilities, or vice versa, we need macroeconomic data.** These data are collected from the online database provided by the South Africa Reserve Bank on its website. The frequency of data changes from weekly to annual according to the variables of interest.

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[30] Half of long-term liabilities is a conventionally used proportion in the CCA literature; however, one can also use any proportion around 0.5.

[31] The banking authorities in South Africa changed the accounting system from Basel I to Basel II; and the data reported by January 2008 is reported under the Basel II accounting requirements.

APPENDIX II. CONTINGENT CLAIMS ANALYSIS

111. **The contingent claims analysis is based on the option pricing literature,[32] where the value of the financial derivative, such as a call option, is calculated with respect to the value of its underlying asset, such as a common stock.** As an example, the payout of a European call option will depend on the value of the common stock on the termination day of the contract, and the derivative holder will exercise the option if the stock price is in excess of the strike price of the option.

112. **The contingent claims analysis in our framework links the market value of bank assets to its equity value.** First, we will start by utilizing from the traditional accounting methodology to establish the link between a bank's equity and assets, and then we will move to the option pricing models to calculate the implied market value and the volatility of a bank's assets.

113. **According to the traditional T-accounting system, one can relate the asset value of a bank to the sum of its liabilities and equity, which is given by equation (1) below.**

$$A(t) = E(t) + L(t) \tag{1}$$

114. **Bank liabilities possess risk that in the case of default, some of the debt holders will not receive full payment.** We could model this expected loss, the amount that debt holders would lose in case of a bank default, as an implicit put option, $P(t)$, which is equal to the difference between risky bank liabilities, $L(t)$, and the default-free value of bank liabilities, which is equivalent to the default barrier of a bank, $DB(t)$. If the market value of a bank's assets falls below this level, then the bank defaults. The dynamics of a default-free bank liability can be modeled like a bond which yields the risk-free interest rate of r. Then, we can express the risky bank liability $L(t)$ as follows.

$$L(t) = DBe^{-r(T-t)} - P(t) \tag{2}$$

115. **In relation to our analysis, the contingent claims analysis links the equity value of a bank, which is modeled as a call option, to the asset value of that bank, which is the underlying security.** Then, equity can be expressed as the following stochastic function $E\left[t, A(t)\right]$, where t denotes time, and A stands for assets. In this model $A(t)$ follows a

[32] The CCA approach relies on the efficient markets assumption that the equity markets reflect all information available at a given point in time. In other words, the market assesses the stock price of company given its expected profit structure, its stand with respect to its competitors, business and macroeconomic environment and etc.

geometric Brownian motion[33] with drift μ_A and volatility σ_A with the following stochastic diffusion process:

$$dA = A\left[\mu_A dt + \sigma_A dW\right] \tag{3}$$

In equation (3), dW stands for a Wiener process with mean zero and variance one.

116. **The option pricing literature states that the value of equity depends on the dynamics of asset value over time; and we can model it based on the diffusion process of assets.** Applying Itô's lemma[34] to the equity value of a bank, one can write the partial differential equation of the equity price dynamics as follows.

$$dE(t, A) = \frac{\partial E}{\partial t} dt + \frac{\partial E}{\partial A}\left(\mu A dt + \sigma A dW\right) + \frac{1}{2}\frac{\partial^2 E}{\partial A^2}\sigma^2 A^2 dt \tag{4}$$

117. **The Black-Scholes-Merton model asserts that for a risk-free portfolio, the partial differential equation of equation (4) can be written as following.**

$$\frac{\partial E}{\partial t} dt + \frac{\partial E}{\partial A}\mu A + \frac{1}{2}\frac{\partial^2 E}{\partial A^2}\sigma^2 A^2 = rE \tag{5}$$

118. **The CCA approach models bank equity as a contingent claim, because its value depends on the value of bank assets and the default-free value of bank liability, which is equivalent to the strike price of an option.** The argument is as follows. The stockholders of a bank have a contingent claim on the residual value of a bank's assets, which is equal to the value of total assets minus debt. However, equity is a junior claim, meaning that in the case of default, when the market value of a bank's assets is less than its debt obligations, then the equity holders cannot receive any positive amount. Then, we can model equity as the following call option, where

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[33] The geometric Brownian motion of a process X can only have positive values, which is the relevant case for modeling the dynamics of a bank's assets, as assets can only have positive values.

[34] A variable X follows an Itô process if its stochastic differential equation is given by:

$$dX = \mu(t, X)dt + \sigma(t, X)dW$$

Itô's lemma states that a function $f(t, X)$ follows an Itô process, when the variable X follows an Itô process, and $f(t, X)$ is once differentiable in t, and twice in X. Then the dynamics of $f(t, X)$ is given by the following process:

$$df(t, X) = \frac{\partial f}{\partial t} dt + \frac{\partial f}{\partial X} dX + \frac{1}{2}\frac{\partial^2 f}{\partial X^2}\sigma^2(t, X)dt\,.$$

$$E = \max\left[A - DB, 0\right] \tag{6}$$

119. **Equation (1) tells us that the value of a bank's equity is equal to the value of its assets, denoted by A, minus the current debt obligations of that bank, or the default point, denoted by DP, if the bank can generate enough cash to cover its current debt obligations, in other words $A \geq DB$; if not, it is equal to null.**

120. **Imposing the boundary condition given by equation (6) at time T will provide us the closed form solution to the partial differential equation given in equation (5).** This can be expressed as the following, in equation (7).

$$E = AN\left(d_1\right) - DBe^{-rT}N\left(d_2\right) \tag{7}$$

$$\text{Where, } d_1 = \frac{\ln\left(\frac{A}{DB}\right) + \left(r + \frac{1}{2}\sigma_A{}^2\right)T}{\sigma_A\sqrt{T}}$$

$$d_2 = d_1 - \sigma_A\sqrt{T}$$

121. **In equation (7), r is the risk-free interest rate; T is the time to maturity of the risk-free debt, DB; $N(d)$ is a cumulative probability distribution function for a standard normal variable; and σ_A is the standard deviation of a bank's assets.** A is the current market value of the underlying asset – namely, the bank assets, and DB (the default-free value of bank liabilities) is the strike price of the put option.

122. **As derived by Itô's lemma, the relationship between the volatility of a bank's assets and the volatility of its equity is given by the following equation:**

$$E\sigma_E = A\sigma_A N(d_1) = A\sigma_A \frac{\partial E}{\partial A} \tag{8}$$

123. **The difference between the CCA approach and option pricing is in terms of estimating the unknowns. In the CCA approach, one actually knows the equity information, through bank capitalization data, but not the asset value or the implied asset volatility.** The option pricing equations (7) and (8) then provide a system of equations which let us calculate the implied asset value and volatility by forward iterating.

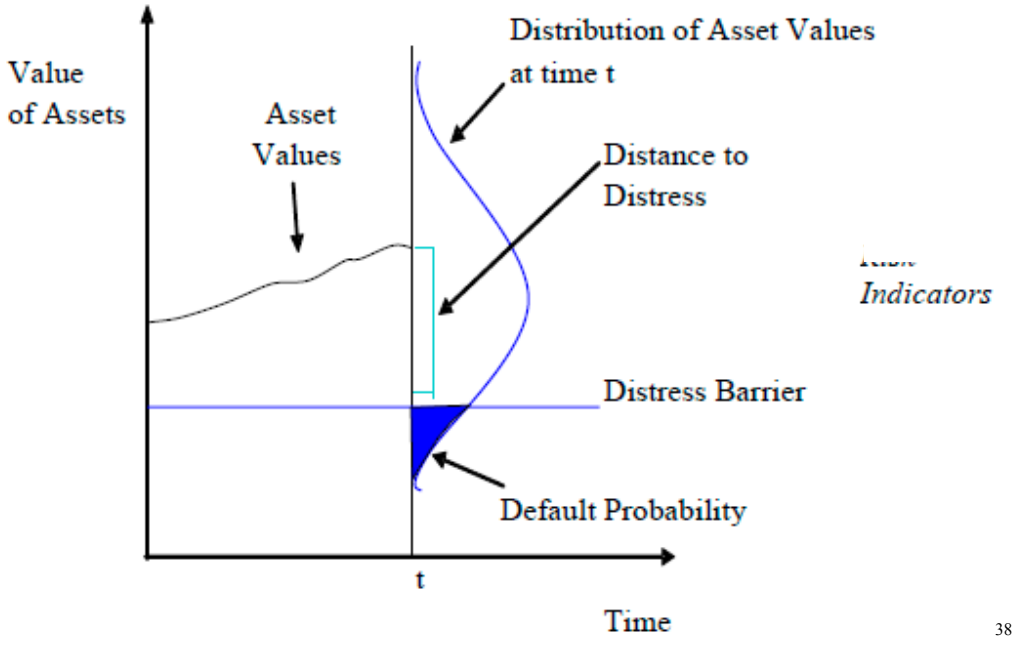
124. **The distance to default measure is defined as the distance between the logarithm of the asset values and the logarithm of the risk-free liabilities of a bank, normalized by the standard deviation of its assets; and it shows how many standard deviations is the bank away from defaulting on its debt.** Then, for a risk-free debt of maturity T, we can measure it by the ratio of d_2, given in equation (7), to the volatility of a bank's assets, σ_A. In other words, distance to default is measured by:

$$DD = \frac{\ln\left(\frac{A}{DB}\right) + \left(r - \frac{1}{2}\sigma_A^2\right)T}{\sigma_A\sqrt{T}} \tag{9}$$

125. **The probability of default on the other is measured by calculating the cumulative distribution function of N(-DD)[35] by relying on risk-neutral pricing.[36]** As an example, if a bank is two standard deviations away from defaulting on its one year maturing debt, then its probability of default is equal to 2.28 percent as $N(-2) = 0.0228$. The probability of default increases as the market leverage[37] of a bank or the volatility of the market value of bank assets increase.

126. **Figure 21 below provides a simple presentation of the linkages between the book value of bank assets, the implicit asset value and the distance to default.**

Figure 21. Distribution of Bank Asset Over Time



38

[35] Many of the financial and econometric text books provide tables that compute N(.).

[36] Note that distance to default measure also eliminates the problem that the probability distribution of asset values is not lognormal, because the distance to default measure is normalized by the volatility of the asset values.

[37] Market leverage, as defined in the Moody's KMV data base, is the ratio of risk-free debt (or the default point) to the market value of a company's assets.

[38] Adapted from Gray and Jones (2006).

Table 18. Vector Autoregression Coefficient Estimates for Standard and Absa Bank

	Standard Bank					Absa Bank				
	Eq (1) DP	**Eq (2)** RGDP	**Eq (3)** House Price	**Eq (4)** NEER	**Eq (5)** Repo Rate	**Eq (1)** DP	**Eq (2)** RGDP	**Eq (3)** House Price	**Eq (4)** NEER	**Eq (5)** Repo Rate
RGDP										
Lag 1	0.00	0.81***	-0.44	-0.49	0.80	0.03	0.79***	-0.47	-0.73	0.79
	(0.03)	(0.12)	(0.32)	(4.95)	(0.52)	(0.05)	(0.12)	(0.32)	(4.98)	(0.52)
Lag 2	-0.07**	0.05	0.02	4.44	0.77	-0.11**	0.01	-0.09	4.17	0.81
House Prices	(0.03)	(0.13)	(0.33)	(5.19)	(0.55)	(0.05)	(0.12)	(0.33)	(5.24)	(0.55)
Lag 1	-0.01	0.10**	0.90***	-0.42	-0.01	-0.02	0.10**	0.90***	-0.61	-0.01
	(0.01)	(0.04)	(0.11)	(1.79)	(0.19)	(0.02)	(0.04)	(0.11)	(1.81)	(0.19)
Lag 2	0.01	-0.07	0.02	0.81	-0.19	0.01	-0.07	0.02	1.03	-0.19
NEER	(0.01)	(0.04)	(0.11)	(1.77)	(0.19)	(0.02)	(0.04)	(0.11)	(1.79)	(0.19)
Lag 1	0.00	-0.00	-0.00	0.12	-0.02	0.00	-0.00	0.01	0.13	-0.02
	(0.00)	(0.00)	(0.01)	(0.16)	(0.02)	(0.00)	(0.00)	(0.01)	(0.16)	(0.02)
Lag 2	-0.00	-0.00	0.01	-0.13	-0.02	-0.00	-0.00	0.00	-0.12	-0.01
Repo Rate	(0.00)	(0.00)	(0.01)	(0.14)	(0.01)	(0.00)	(0.00)	(0.01)	(0.14)	(0.01)
Lag 1	0.00	-0.01	0.03	0.20	0.92***	0.00	-0.01	0.02	0.29	0.93***
	(0.01)	(0.03)	(0.07)	(1.05)	(0.11)	(0.01)	(0.02)	(0.07)	(1.06)	(0.11)
Lag 2	-0.01	0.01	-0.04	0.32	0.09	-0.01	0.01	-0.04	0.23	0.09
DP	(0.01)	(0.03)	(0.07)	(1.08)	(0.11)	(0.01)	(0.03)	(0.07)	(1.09)	(0.11)
Lag 1	-0.25**	-0.22	-0.29	45.67**	0.52	0.22*	-0.04	0.26	23.88*	-0.28
	(0.11)	(0.46)	(1.20)	(18.73)	(1.98)	(0.11)	(0.29)	(0.77)	(12.14)	(1.28)
Lag 2	0.03	0.09	1.10	25.99	-0.66	-0.13	-0.58**	-1.22	9.24	0.49
Trade Partner Ind.	(0.12)	(0.47)	(1.24)	(19.30)	(2.04)	(0.11)	(0.28)	(0.76)	(11.95)	(1.26)
Lag 1	0.00	0.00	0.05	0.32	-0.11	-0.00	0.01	0.07	0.19	-0.13
	(0.01)	(0.02)	(0.06)	(0.99)	(0.10)	(0.01)	(0.02)	(0.06)	(0.98)	(0.10)
Lag 2	0.01	0.01	0.17***	1.73*	0.01	0.01	-0.00	0.14**	1.85*	0.03
Gold Price	(0.01)	(0.02)	(0.06)	(1.00)	(0.11)	(0.01)	(0.02)	(0.06)	(1.00)	(0.11)
Lag 1	0.00	-0.00	-0.01	-0.09	-0.01	0.00	0.00	-0.01	-0.07	-0.01
	(0.00)	(0.00)	(0.01)	(0.12)	(0.01)	(0.00)	(0.00)	(0.01)	(0.12)	(0.01)
Lag 2	-0.00***	0.00	0.01	0.05	-0.01	-0.00**	0.00	0.00	0.05	-0.01
Emerging MSCI	(0.00)	(0.00)	(0.01)	(0.11)	(0.01)	(0.00)	(0.00)	(0.01)	(0.11)	(0.01)
Lag 1	-0.00***	0.00	-0.00	0.14**	0.00	-0.00***	0.00	-0.00	0.13*	0.00
	(0.00)	(0.00)	(0.00)	(0.07)	(0.01)	(0.00)	(0.00)	(0.00)	(0.07)	(0.01)
Lag 2	-0.00*	0.00	-0.00	0.04	0.00	-0.00*	0.00	-0.00	0.04	0.00
	(0.00)	(0.00)	(0.00)	(0.07)	(0.01)	(0.00)	(0.00)	(0.00)	(0.07)	(0.01)
Constant	0.07***	0.05	0.28	-8.01**	-0.38	0.09***	0.10	0.39*	-7.89**	-0.41
	(0.02)	(0.08)	(0.20)	(3.14)	(0.33)	(0.03)	(0.08)	(0.20)	(3.18)	(0.33)
Observations	107	107	107	107	107	107	107	107	107	107
aic	-0.156	-0.156	-0.156	-0.156	-0.156	0.683	0.683	0.683	0.683	0.683
sbic	1.968	1.968	1.968	1.968	1.968	2.807	2.807	2.807	2.807	2.807

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 19. Vector Autoregression Coefficient Estimates for First Rand Bank and Nedbank

	FirstRand Bank					Nedbank				
	Eq (1) DP	**Eq (2)** RGDP	**Eq (3)** House Price	**Eq (4)** NEER	**Eq (5)** Repo Rate	**Eq (1)** DP	**Eq (2)** RGDP	**Eq (3)** House Price	**Eq (4)** NEER	**Eq (5)** Repo Rate
RGDP										
Lag 1	0.02	0.75***	-0.22	0.64	0.87	0.02	0.81***	-0.45	-1.30	0.80
	(0.05)	(0.11)	(0.28)	(5.47)	(0.57)	(0.04)	(0.12)	(0.32)	(4.97)	(0.52)
Lag 2	-0.09*	-0.04	-0.30	3.95	0.86	-0.08*	0.05	-0.02	4.68	0.78
House Prices	(0.05)	(0.11)	(0.27)	(5.30)	(0.55)	(0.04)	(0.13)	(0.34)	(5.25)	(0.55)
Lag 1	0.02	0.09**	1.03***	0.88	0.00	-0.02	0.10**	0.90***	-0.44	-0.01
	(0.02)	(0.04)	(0.10)	(2.02)	(0.21)	(0.01)	(0.04)	(0.12)	(1.81)	(0.19)
Lag 2	-0.02	-0.06	-0.11	-0.33	-0.20	0.01	-0.07	0.02	0.80	-0.19
NEER	(0.02)	(0.04)	(0.10)	(1.99)	(0.21)	(0.01)	(0.04)	(0.11)	(1.79)	(0.19)
Lag 1	0.00	-0.00	0.00	0.08	-0.02	0.00	-0.00	0.00	0.10	-0.02
	(0.00)	(0.00)	(0.01)	(0.16)	(0.02)	(0.00)	(0.00)	(0.01)	(0.16)	(0.02)
Lag 2	-0.00	-0.00	0.01	-0.16	-0.02	-0.00	-0.00	0.01	-0.13	-0.02
Repo Rate	(0.00)	(0.00)	(0.01)	(0.14)	(0.01)	(0.00)	(0.00)	(0.01)	(0.14)	(0.01)
Lag 1	0.00	-0.01	0.02	0.39	0.92***	0.00	-0.01	0.03	0.31	0.92***
	(0.01)	(0.02)	(0.05)	(1.06)	(0.11)	(0.01)	(0.03)	(0.07)	(1.06)	(0.11)
Lag 2	-0.00	0.00	-0.03	0.13	0.10	-0.01	0.01	-0.04	0.21	0.10
DP	(0.01)	(0.02)	(0.06)	(1.10)	(0.11)	(0.01)	(0.03)	(0.07)	(1.09)	(0.11)
Lag 1	0.03	-1.13***	-3.08***	14.65	1.07	-0.08	-0.01	-0.12	24.01*	0.45
	(0.09)	(0.20)	(0.50)	(9.74)	(1.01)	(0.11)	(0.33)	(0.88)	(13.79)	(1.45)
Lag 2	0.33***	-0.04	2.31***	14.61	0.15	-0.05	-0.03	-0.09	20.62	-0.18
Trade Partner Ind.	(0.12)	(0.27)	(0.69)	(13.33)	(1.38)	(0.11)	(0.33)	(0.88)	(13.78)	(1.45)
Lag 1	0.00	-0.01	-0.03	-0.25	-0.11	0.00	0.00	0.06	0.10	-0.11
	(0.01)	(0.02)	(0.05)	(1.04)	(0.11)	(0.01)	(0.02)	(0.06)	(0.99)	(0.10)
Lag 2	-0.01	0.00	0.17***	1.99**	0.03	0.01	0.00	0.16**	1.76*	0.02
Gold Price	(0.01)	(0.02)	(0.05)	(1.00)	(0.10)	(0.01)	(0.02)	(0.06)	(1.00)	(0.11)
Lag 1	0.00	0.00	-0.00	-0.09	-0.01	0.00	-0.00	-0.01	-0.08	-0.01
	(0.00)	(0.00)	(0.01)	(0.12)	(0.01)	(0.00)	(0.00)	(0.01)	(0.12)	(0.01)
Lag 2	0.00	0.00	-0.00	0.06	-0.01	-0.00***	0.00	0.01	0.04	-0.01
Emerging MSCI	(0.00)	(0.00)	(0.01)	(0.11)	(0.01)	(0.00)	(0.00)	(0.01)	(0.11)	(0.01)
Lag 1	-0.00	0.00	0.00	0.11	0.00	-0.00***	0.00	-0.00	0.14**	0.00
	(0.00)	(0.00)	(0.00)	(0.07)	(0.01)	(0.00)	(0.00)	(0.00)	(0.07)	(0.01)
Lag 2	-0.00***	0.00	-0.00	-0.01	0.00	-0.00*	0.00	-0.00	0.04	0.00
	(0.00)	(0.00)	(0.00)	(0.07)	(0.01)	(0.00)	(0.00)	(0.00)	(0.07)	(0.01)
Constant	0.06*	0.15**	0.35**	-8.23**	-0.49	0.07***	0.05	0.32	-7.74**	-0.40
	(0.03)	(0.07)	(0.17)	(3.37)	(0.35)	(0.03)	(0.08)	(0.20)	(3.16)	(0.33)
Observations	107	107	107	107	107	107	107	107	107	107
aic	0.249	0.249	0.249	0.249	0.249	0.542	0.542	0.542	0.542	0.542
sbic	2.372	2.372	2.372	2.372	2.372	2.665	2.665	2.665	2.665	2.665

Standard errors in parentheses

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

Table 20. Vector Autoregression Coefficient Estimates for the Largest Four Banks

	Largest Four Banks				
	Eq (1)	**Eq (2)**	**Eq (3)**	**Eq (4)**	**Eq (5)**
	DP	RGDP	House Price	NEER	Repo Rate
RGDP					
Lag 1	0.02	0.76***	-0.52	0.48	0.83
	(0.03)	(0.12)	(0.32)	(5.01)	(0.53)
Lag 2	-0.07**	0.01	-0.06	5.01	0.81
House Prices	(0.03)	(0.12)	(0.33)	(5.17)	(0.55)
Lag 1	-0.01	0.10**	0.92***	-0.09	-0.02
	(0.01)	(0.04)	(0.11)	(1.80)	(0.19)
Lag 2	0.00	-0.07	0.00	0.51	-0.18
NEER	(0.01)	(0.04)	(0.11)	(1.78)	(0.19)
Lag 1	0.00	-0.00	-0.00	0.09	-0.02
	(0.00)	(0.00)	(0.01)	(0.15)	(0.02)
Lag 2	-0.00	-0.00	0.01	-0.12	-0.02
Repo Rate	(0.00)	(0.00)	(0.01)	(0.14)	(0.01)
Lag 1	0.00	-0.01	0.04	0.24	0.92***
	(0.01)	(0.02)	(0.07)	(1.04)	(0.11)
Lag 2	-0.01	-0.00	-0.05	0.34	0.10
DP	(0.01)	(0.03)	(0.07)	(1.08)	(0.11)
Lag 1	-0.05	-0.86**	-2.16**	36.97**	0.90
	(0.10)	(0.38)	(1.01)	(15.92)	(1.69)
Lag 2	0.30***	-0.31	0.55	22.98	0.02
Trade Partner Ind.	(0.11)	(0.40)	(1.08)	(17.06)	(1.81)
Lag 1	-0.00	-0.00	0.03	0.12	-0.11
	(0.01)	(0.02)	(0.06)	(0.99)	(0.11)
Lag 2	0.01	0.00	0.18***	1.89*	0.02
Gold Price	(0.01)	(0.02)	(0.06)	(0.99)	(0.11)
Lag 1	0.00	0.00	-0.01	-0.10	-0.01
	(0.00)	(0.00)	(0.01)	(0.12)	(0.01)
Lag 2	-0.00**	0.00	0.01	0.06	-0.01
Emerging MSCI	(0.00)	(0.00)	(0.01)	(0.11)	(0.01)
Lag 1	-0.00***	-0.00	-0.00	0.14**	0.00
	(0.00)	(0.00)	(0.00)	(0.07)	(0.01)
Lag 2	-0.00**	0.00	-0.00	0.04	0.00
	(0.00)	(0.00)	(0.00)	(0.07)	(0.01)
Constant	0.06***	0.12	0.40*	-9.17***	-0.44
	(0.02)	(0.08)	(0.21)	(3.27)	(0.35)
Observations	107	107	107	107	107
aic	-0.0843	-0.0843	-0.0843	-0.0843	-0.0843
sbic	2.039	2.039	2.039	2.039	2.039

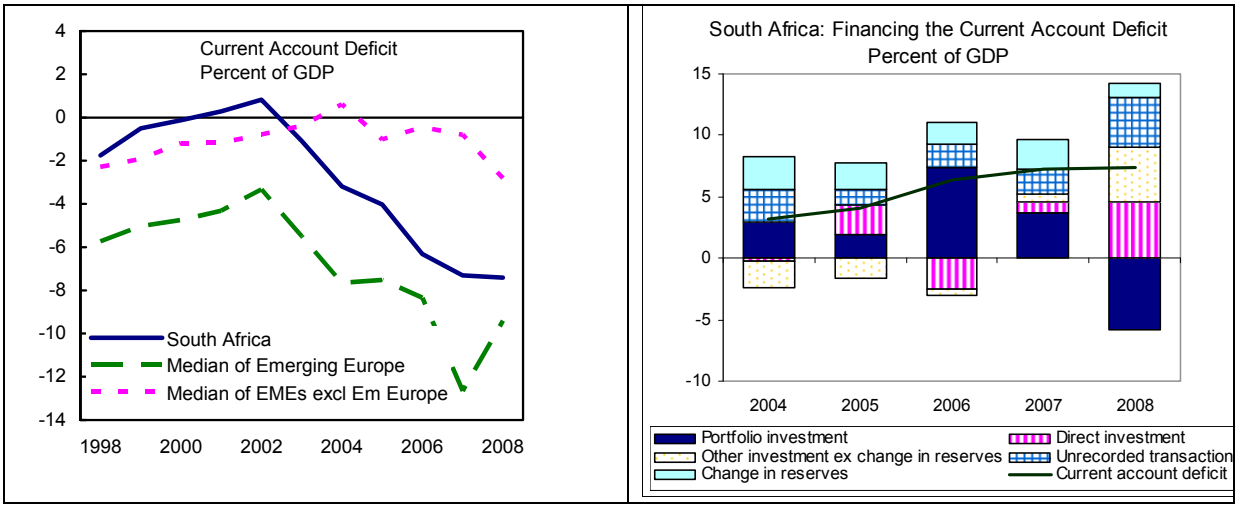
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

V. South Africa and Other Emerging Markets: Response to the Global Financial Crisis[39]

In 2009 net private capital flows to emerging markets (and developing) countries are expected to be significantly lower than the substantial inflows of recent years.[40] While global market conditions have improved following the bout of turbulence at the end of 2008, the outlook remains challenging for emerging markets. With a relatively high current account deficit, high degree of integration with global financial markets, and moderate reserve cover, South Africa is not immune from a further slowdown or sudden stop in capital flows. This note looks at the response of emerging markets to previous capital account crises and during the current crisis; and considers the implications for South Africa.

A. South Africa External Financing and Risks

127. **South Africa's current account deficit remains high relative to other emerging markets.** South Africa's current account deficit of 7.4 percent of GDP in 2008 compares to a median of just over 2 percent of GDP for other emerging markets (excluding emerging Europe). Financing through FDI has been relatively low at around 1 percent of GDP over the past ten years compared to around 3 percent of GDP in other EMEs and it has been focused on mergers and acquisitions which tends to be more volatile than greenfield FDI.[41] Instead, external financing has been heavily concentrated on portfolio flows and in particular equity flows (errors and omissions have also been positive and large). In 2008 the negative contribution of portfolio flows was driven by outflows in Q4 during a period of global market turbulence.



[39] Prepared by Alison Stuart.

[40] World Economic Outlook April 2009 and Update July 8, 2009; Global Financial Stability Report Market Update, July 8, 2009.

[41] In 2008 direct investment was boosted by the acquisition of the remaining shares in a South African motor vehicle manufacturing company by its foreign parent company.

128. **Portfolio inflows have been volatile.** The tables below show that the volatility of portfolio inflows and equity flows, in particular, has been high in absolute terms and relatively high when compared with other emerging markets (the bottom two panels show the standard deviation normalized by the mean) and relative to GDP. The volatility of South Africa's equity flows which form the bulk of capital inflows have increased over time possibly driven by domestic factors, portfolio rebalancing (see Section III on equity flows and monetary policy), and global factors.

The Volatility of Capital Account Inflows 1995-2008

Volatility of Capital Account Inflows 1995-2008
Standard Deviation

	Total Inflows	Portfolio Inflows	o/w debt securities	o/w equity securities
Brazil /1	26.19	11.19	7.55	7.22
Turkey	19.80	5.32	4.34	1.90
Poland	14.81	4.74	4.47	1.05
Thailand	11.14	2.94	1.36	2.51
Mexico	9.71	6.49	6.38	2.30
South Africa	***8.69***	***7.65***	***2.99***	***5.40***
Chile	6.32	1.06	0.82	0.76
Hungary	5.32	4.12	3.46	2.06
Colombia	4.68	0.43	…	0.43

"/1 A spike up in 2007 capital inflows followed by the end 2008 turmoil added substantially to the measure of volatility for Brazil.

Volatility of Capital Account Inflows 1995-2008
As a Percent of GDP
Standard Deviation

	Total Inflows	Portfolio Inflows	o/w debt securities	o/w equity securities
Thailand	6.71	1.60	0.85	1.18
Hungary	3.86	3.51	3.09	1.46
Chile	3.57	1.03	1.02	0.77
South Africa	***3.43***	***3.92***	***1.73***	***2.72***
Poland	3.11	1.58	1.50	0.44
Turkey	3.07	1.28	1.08	0.36
Brazil /1	2.01	1.10	0.94	0.52
Colombia	2.89	0.25	…	0.25
Mexico	1.09	1.49	1.36	0.38

"/1 A spike up in 2007 capital inflows followed by the end 2008 turmoil added substantially to the measure of volatility for Brazil.

Volatility of Capital Account Inflows 1995-2008
Standard Deviation normalized by mean 1/

	Total Inflows	Portfolio Inflows	o/w debt securities	o/w equity securities
Thailand	2.22	1.60	8.36	1.50
Turkey	0.95	1.65	2.13	1.61
Poland	0.84	1.66	1.69	4.78
Colombia	0.80	1.91	…	1.91
Brazil 2/	0.78	1.31	1.93	1.55
South Africa	***0.76***	***1.32***	***2.24***	***1.21***
Hungary	0.65	…	4.25	-2.22
Chile	0.64	0.84	0.99	1.73
Mexico	0.47	1.47	1.70	3.51

1/ Where the mean is close to zero the data is reported as missing.

/2 A spike up in 2007 capital inflows followed by the end 2008 turmoil added substantially to the measure of volatility for Brazil.

Volatility of Capital Account Inflows
As a percent of GDP 1995-2008
Standard Deviation normalized by mean 1/

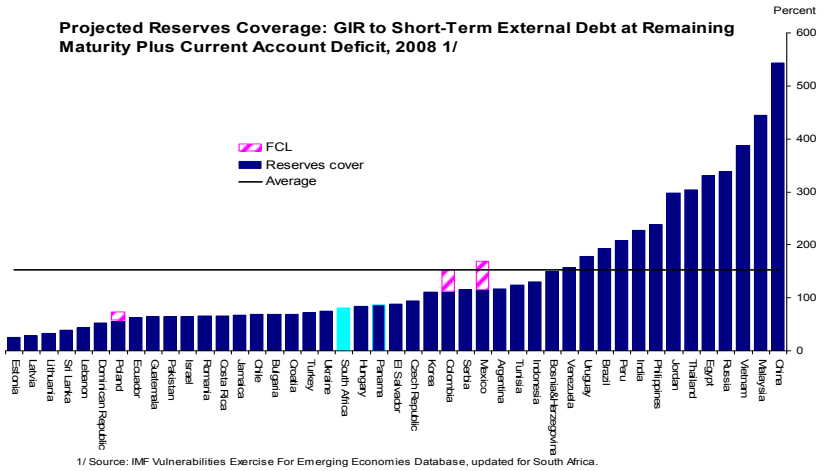
	Total Inflows	Portfolio Inflows	o/w debt securities	o/w equity securities
Thailand	3.40	1.52	…	1.13
Colombia	0.69	1.73	…	1.73
Turkey	0.64	1.63	1.99	1.49
South Africa	***0.57***	***1.21***	***2.41***	***1.08***
Brazil /2	0.53	1.21	2.54	0.96
Poland	0.49	1.24	1.31	…
Hungary	0.38	5.83	2.35	-2.04
Chile	0.37	1.03	0.98	1.92
Mexico	0.35	2.38	2.93	2.33

1/ Where the mean is close to zero the data is reported as missing.

2/ A spike up in 2007 capital inflows followed by the end 2008 turmoil added substantially to the measure of volatility for Brazil.

129. **The volatility of capital flows raises the issue of whether South Africa could be vulnerable to a sudden reversal of flows in the face of further global market turbulence.** While inflows have resumed recently, a sudden reversal remains a notable risk for the following reasons:

- Developments in 2008 Q4 demonstrated that—along with other emerging markets—South Africa could be potentially vulnerable to capital outflows. South Africa's exporters have faced a sharp decline in external demand and weak commodity prices and if the contraction of G3 demand is deeper or more persistent than currently expected then that would pose a downside risk to the current account. Reserve cover is relatively tight when compared to short term debt at remaining maturity plus the current account deficit (at 81.3 percent in 2008 and projected at 81 percent in 2009). It is also on the low side compared to other emerging markets—including other inflation targeters.



1/ Source: IMF Vulnerabilities Exercise For Emerging Economies Database, updated for South Africa.

- However there are some mitigating factors. First, the widening of the current account deficit in recent years was driven by strong domestic demand growth and a relatively lackluster performance of exports. The slowdown in the domestic economy is likely to help narrow the current account deficit together with a fall back in income payments.

- Second, financing concerns have recently receded with the appreciation of the rand, a narrowing of spreads (see table) and a resumption of portfolio inflows. This is further demonstrated by the successful issuance of a 10 year Eurobond for $1.5bn on May 19 (with a spread of 375 basis points over U.S. Treasuries).

Selected Emerging Markets
Change in EMBI Spreads vs Sept 12 2008

	Basis point change as of		
	1/31/09	3/31/09	6/30/09
South Africa	***168***	***147***	***18***
EMBIG	299	300	93
Turkey	154	191	9
Brazil	137	152	14
Mexico	185	215	58
Colombia	224	238	54
Poland	186	194	85
Hungary	253	390	223

Source: IMF, Global Markets Monitor.

- Third, given the high proportion of rand-denominated capital flows and the floating exchange rate, external investors share the costs of adjustment if there are pressures on capital flows.

130. **Given the possibility that South Africa could be subject to financing pressures, the following sections of the paper look at past experience and policy responses to capital account pressures and current policy measures being taken by other emerging markets.**

B. Past Crises and Policy Reactions

131. **All of the previous crises are characterized by a sudden reversal in capital flows reflecting sharp changes in investor confidence.** However, the factors accounting for the reversals in capital flows differed, as did the policy response:

- East Asia 1998: vulnerabilities were predominantly in the financial and corporate sector.
- Mexico 1995: a risky debt management strategy was a key driver of the crisis.
- Turkey 2001 and Brazil 1997–1999: debt sustainability and fiscal policy were concerns.[42]

132. ***The dynamics of the crises*** were as follows. Sharp changes in market confidence prompted very sudden reversals in capital flows accompanied by overshooting of the exchange rate. Where there were underlying balance sheet weaknesses and where public finances were weak (with high levels of public sector debt and fiscal deficits), this exacerbated the scale of crisis, complicated stabilization post crisis, and limited the scope for policy maneuver.[43] Even where there was large scale official financing, there were large economic adjustments stemming from balance sheet effects and the interruption of other financing flows. For example, in East Asia balance sheet vulnerabilities were heightened by the effect of exchange rate depreciation on unhedged foreign currency exposures and this significantly added to insolvencies. This meant that the recessions following crisis lasted longer than expected at the onset of the crisis.

Policy responses

133. **Exchange rates and monetary policy—there have often been changes in monetary policy and exchange rate regime.** Exchange rate movements often significantly overshot estimates of equilibrium levels and movements in exchange rates were associated with a switch in exchange rate regime and search for a new nominal anchor—for example Brazil introduced inflation targeting. In other countries, such as Turkey, fiscal dominance precluded inflation targeting initially and they relied on a less formal stability objective. Where associated with a banking sector collapse, sometimes monetary policy is eased first (e.g. Indonesia) but then tightened later.

134. **However, in the aftermath of a crisis choosing a sound monetary policy framework alone has not been sufficient to restore stability.** Instead, it has often been accompanied either by the provision of external financing support (e.g. Mexico 1995) or

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[42] Ghosh and others (2002).

[43] See C. Collyns and R. Kincaid, 2003, "Managing Financial Crises Recent Experience and Lessons from Latin America," IMF Occasional Paper No. 217.

action to default/reschedule debt Russia (1998) or a combination of external support/ rollover of debt (Korea 1997). At the height of the crisis there is a tension between setting domestic currency interest rates high enough to compensate for the risks of further depreciation and default, and keeping them low enough so that the adverse effects on balance sheets and real activity do not raise the probability of default.

135. **Previous studies by the Fund have looked at whether monetary policy in the aftermath of crises was successful in stabilizing capital outflows and steadying exchange rates or whether policy was too tight (a criticism aimed at IMF programs in Indonesia, Korea and Thailand)**. Ghosh et al conclude that in crises monetary policy (through changes in interest rates) can play a crucial role in restoring confidence, stemming capital outflows and avoiding massive swings in the current account by providing an incentive to hold domestic currency and preventing a sustained increase in inflation. Similarly, the IEO Report on Capital Account Crises, contrasts the early experience of Korea and Brazil, noting that the key element was a clear framework to guide policy in the post stabilization period—they argue that Brazil's switch to inflation targeting was clear whereas in the immediate aftermath of the crisis Korea's policy was not as clearly understood, although subsequently Korea has successfully implemented inflation targeting.[44]

136. **Fiscal policy played different roles in different countries.** Where the root of the crisis was a market perception that large government deficits and high debt were the cause of the problem then they had to be tackled to restore credibility. In addition, fiscal consolidation also helped to share the burden of current account adjustment with the private sector, easing the adjustment process. Fiscal vulnerabilities were clear for Argentina, Brazil, Russia and Turkey. However where debt sustainability was not at the root of the crisis (for example Korea and Thailand) but there were prospective costs from financial restructuring, a mild fiscal adjustment was envisaged initially. However, overly optimistic macroeconomic forecasts meant that adjustment efforts were short-lived and unsuccessful in boosting confidence.

- For *Korea* the IMF recommended allowing the automatic stabilizers work just one month after the program was put in place but the authorities were reluctant to deviate from a balanced budget philosophy.

- In *Indonesia* fiscal targets were relaxed over time but it was difficult to use fiscal policy countercyclically because of the lack of automatic stabilizers and weak capacity to deliver targeted expenditure increases.[45]

137. **Previous studies have found that unnecessary fiscal adjustment from a medium-term perspective may not help boost confidence where the contractionary implications**

[44] The IMF and Recent Capital Account Crises, Independent Evaluation Office, 2003, page 35.

[45] The IMF and Recent Capital Account Crises, Independent Evaluation Office, 2003, page 32.

are large. Instead in circumstances where the starting position of debt is low, and where fiscal tightening was envisaged primarily for signaling purposes then there may be a case for allowing the automatic stabilizers to work and deferring fiscal consolidation in the face of weaker than expected activity—the IEO report noted that fiscal targets were adjusted as evidence of the contraction in output became clear. Similarly, where the addition to the public sector debt burden arises from bank restructuring costs the lesson of previous crises is that it is preferable to allow the automatic stabilizers to work in the short run and to set policy rules to restore a viable debt path over the medium term.

138. **In cases where fiscal tightening was unavoidable the lesson of these crises is that attention needs to be paid to the quality and durability of measures.** Short-term measures should be guided by clear medium term objectives for tax reform and expenditure restructuring. Establishing social safety nets is important to mitigate the effects of recession and the impact on vulnerable groups. Institutional reforms may need to be made to limit fiscal vulnerabilities and allow more effective fiscal responses in a crisis (including revenue administration, budget management, intergovernmental relations and debt management).

139. **In a banking crisis the government may have few fiscal policy options to stem the crisis other than to socialize part of the losses and take on contingent claims.** This was the case in Indonesia, Korea, Iceland, and is necessary when there is a need to honor guarantees (such as from deposit insurance). In these circumstances it is important to ensure that the liabilities taken on by the public sector are consistent with its capacity to absorb them and to take into account the implications for public debt management and sustainability. Exit strategies may also be needed to mitigate moral hazard—for example deposit insurance schemes in some instances were withdrawn over time.

140. **Systemic banking crises. In banking crises the key priority in the early stage of the crisis is to stabilize banking system liabilities by stopping depositor and creditor runs.** The provision of sufficient liquidity is important to protect the payments system. Depending on the cause of the crisis, appropriate policy measures may include some combination of protection for depositors, upfront resolution of clearly insolvent banks, and a comprehensive macroeconomic stabilization package. If these measures are unsuccessful, administrative measures may also be necessary—such as a deposit freeze or capital controls. where capital controls are contemplated, their potential costs need to be carefully weighted against any short-term benefits. Where capital controls are considered the benefits and costs need to be carefully weighed. While capital controls can temporarily reduce pressures they cannot provide lasting protection and may introduce distortions in the long run (and could give rise to rent seeking). Thus, it is equally important to design an exit strategy from such controls over the medium term.

C. Policy Reactions to the Current Global Financial Crisis

141. **Previous crisis episodes provide a number of lessons for the possible policy responses to the current crisis, but there are also a number of differences.**

- First, the global nature of the current shock means that some policy actions to attract more financing (aside from official financing) may not be as effective as they would have been in the past—as capital outflows are to a degree related to global factors rather than necessarily tied to country specific factors.

- Second, the good news is that a number of emerging markets went into the global with policies in a much better shape than in previous years with lower external debt levels, sounder policy frameworks, and better fiscal positions. But that is not the case for all countries, and in Eastern Europe countries that entered the crisis with large current account deficits and which were dependent on capital inflows have been hit hard.

The appropriate policy response to the current global financial crisis depends on the nature of the shock and initial conditions in the country. Some countries have more room to relax policy than others. Thus, countries' policy reactions to the current shock have varied depending on (i) initial conditions; (ii) the relative importance of the channels of the shock (for example commodity exporters, peggers versus floaters, others); and (iii) the type and sources of financing available. In general, the Fund's policy advice has been to ease monetary policy except in circumstances where a loss of confidence in the currency precludes it, and where fiscal space is available, to use expansionary fiscal policy to support activity. However, caution is called for so it is clear that EMEs have a credible exit strategy.

142. **Where emerging markets entered the crisis with strong fundamentals they have eased monetary conditions significantly and employed temporary discretionary fiscal stimulus for 2009 and 2010** (see Annex for a Summary of Selected Emerging Market Policy Responses)**.** Policy interest rates have been cut significantly, for example by 350 basis points in Mexico, 400 basis points in Brazil, and up to 750 basis points in Chile. A number of countries have also introduced measures to ease liquidity conditions. With respect to fiscal policy, the change in the general government balance for G20 emerging markets—which captures both the impact of automatic stabilizers and any discretionary measures—is projected to widen by 5.1 percentage points in 2008 and 2009. Among selected emerging markets the cumulative change in the general government balance ranges from a cumulative widening of 9.4 percentage points in Russia to a cumulative surplus of 0.8 percentage points for Malaysia. Note that these estimates are based on the information currently available and countries are also adapting their fiscal positions and stances as new information becomes available on the scale of the

Growth Performance and Change in Fiscal Position in Selected Emerging Markets

	Growth Performance			Fiscal Response			
	Annual Percentage change		Percentage points	General Govt Balance Percent GDP	Change in General Govt Balance Percentage points		2009-2010
	2008	Proj 2009	Proj Change	2008	Proj 2009	Proj 2010	Cumulative Change
Russia	5.6	-6.5	-12.1	4.3	-9.8	0.4	-9.4
Chile	3.2	-0.7	-3.9	5.3	-9.4	2.0	-7.4
Korea	2.2	-3.0	-5.2	1.2	-4.3	-1.2	-5.5
South Africa	***3.1***	***-2.1***	-5.2	***-0.6***	***-3.6***	***-0.2***	***-3.8***
Colombia	2.5	0.0	-2.5	0.1	-2.9	-0.5	-3.4
Turkey	1.1	-5.1	-6.2	-2.7	-3.2	0.7	-2.4
Mexico	1.3	-7.3	-8.6	-1.8	-1.8	-0.2	-2.0
Indonesia	6.1	3.5	-2.6	-0.2	-2.4	0.6	-1.9
Poland	4.8	-0.7	-5.5	-3.2	-1.1	0.2	-0.9
Hungary	0.5	-6.7	-7.2	-3.3	-0.6	0.1	-0.5
Brazil	5.1	-1.3	-6.4	-2.0	-1.2	1.9	0.7
Malaysia	4.6	-3.5	-8.1	-4.4	-0.4	1.2	0.8

1/ Source: IMF Desk Economists, South Africa Article IV Consultation

economic downturn. The G20 emerging markets have generally adopted a mix of temporary expenditure measures and measures on the revenue side some of which are likely to have permanent effects (Table 23).

143. **Policy responses in countries hit by crises have necessarily been more constrained by difficult initial conditions; in some cases procyclical fiscal adjustment was unavoidable and policies were tailored to respond to the specific shock.** In Hungary which had high external debt levels and foreign currency balance sheet mismatches, the economic program supported by the IMF focused on fiscal consolidation, a banking sector support package and large external financing assistance to minimize the risk of a run on Hungary's debt and currency markets. In Ukraine, policies focused on restoring confidence and financial stability, through dealing with banking sector problems and allowing the exchange rate to float. And in Iceland policies focused in the short term on containing the negative impact of the crisis, stabilizing the exchange rate and bank restructuring; supported over the medium term by fiscal adjustment. In all of these cases policies have also been adapted as it become clear that the scale of the economic downturn was much sharper than first expected.

D. Implications for South Africa.

144. **A comparison of market indicators between September 2008 and June 2009 suggest that South Africa has not been affected by the global financial crisis *disproportionately* relative to other emerging markets—indeed the rand has appreciated more strongly than other currencies since mid-February.** Nevertheless, in times of strain such as October and November 2008 South Africa was affected by the market turmoil, spreads rose markedly, the exchange rate depreciated sharply, and there were capital outflows. This suggests a need for caution with policy changes especially in the context of febrile market conditions. Given past experience, a number of points emerge about South Africa's position relative to other emerging markets.

- The macroeconomic conjuncture is relatively favorable on most measures relative to other emerging markets (Figure 22) with the current account deficit the Achilles heel, and an external debt ratio that is creeping higher partly reflecting the public sector investment program.

- The **floating exchange rate** has been an important safety valve and the extent of the depreciation in the autumn may have helped to stabilize capital outflows (a number of other inflation targeters such as Mexico, Brazil, Indonesia and Korea also experienced sharp movements in their exchange rates over the same period). The lower presence/lesser likelihood of unhedged corporate or household balance sheets in South Africa compared to many other EMEs (particularly in Emerging Europe, for example Hungary). This is a key strength in current conditions and means that South Africa has more scope for the exchange rate to adjust than a number of other economies.

- In an environment where the global shock is leading to deleveraging and where markets are still discriminating between good and poor performers it is more important than ever to maintain **policy credibility** (for example countries with strong policy track records such as Chile have had more room to ease both monetary and fiscal policy in response to the crisis).

    - This suggests that *monetary policy* should be eased cautiously taking into account the impact on market sentiment and capital flows. Good communication of the future direction of policy is likely to be important.

    - Any *fiscal stimulus* needs to be consistent with medium-term sustainability to maintain confidence and to retain access to financing at reasonable terms. While South Africa's public debt ratio is currently relatively low compared to other Emerging Markets, this position may not be maintained given the scale of the public sector infrastructure investment program.

ANNEX: SUMMARY OF SELECTED EMERGING MARKET POLICY RESPONSES

(i) Crisis Prevention—Selected EMEs

Where emerging markets entered the crisis with strong fundamentals they have eased monetary conditions significantly and used temporary fiscal stimulus for 2009 and 2010.

Brazil is in a stronger position than in the past to withstand global turbulence, with a large reserves buffer, moderate current account deficit, and a banking sector that is generally well-capitalized and not overly exposed to currency risk.

- *Monetary Policy.* The central bank has taken measures to address currency and liquidity pressures, with significant cuts in reserve requirements (3.5 percent of GDP) and a broadening of access to the rediscount window. It also eased in January, March, April, and June cutting the policy rates by a cumulative 450 bps, to 9.25 percent, consistent with declining inflationary pressures and slowing growth. Measures have also been taken to support the corporate sector—the central bank sold dollar futures contracts to help affected corporations hedge or unwind their positions, and to help reduce market volatility.

- *Fiscal policy* In 2008 the primary balance recorded a surplus of 4.1 percent of GDP and the overall balance a deficit of 2 percent of GDP. A targeted fiscal stimulus package of 0.6 percent of GDP has been announced for 2009, mainly on the revenue side. The authorities have also announced a plan to provide loans of up to 3.5 percent of GDP over the next two years from the federal government to the state-owned development bank, BNDES, to help finance investment. Brazil also has a $30 billion swap line from the Fed.

Mexico The strengthening of Mexico's policies and policy frameworks over the past decade mean that it is in a position to use countercyclical fiscal policy to respond to the crisis. Monetary policy has been eased. Mexico has a $30 billion swap line from the Fed which it has tapped to provide foreign currency support to corporates (of which $4 billion has been tapped). The Mexican authorities also have a precautionary FCL for $47 billion which they have said they will not draw but which provides insurance against tail risks, and $6.3 billion from the IDB and World Bank .

- *Monetary policy.* The depreciation of the peso limited the scope for monetary easing in the early part of the year and the authorities intervened to steady the exchange rate. Interest rates were cut by 75 bp, to 7½ percent prior to the approval of the FCL. Following the favorable reaction of the markets to the FCL the authorities were able to cut interest rates further. Rates were cut again in response to the swine flu outbreak. In June 2009 the policy interest rate stood at 4.75 percent.

- *Fiscal policy* a fiscal stimulus of about 1½ percent of GDP is expected in 2009 which includes a number of self-reversing measures for infrastructure investment, support to SMEs and housing construction and temporary indirect tax measures.

Chile has adopted the most expansionary set of measures in Latin America.

- *Monetary policy.* Interest rates were cut by 775 basis points from December 2008 to July 2009 to 0.5 percent.

- *Fiscal policy.* A fiscal stimulus package of 2.9 percent of GDP has been agreed comprising a wide range of temporary revenue and expenditure measures.

Colombia

- *Monetary policy* the central bank cut interest rates by 550 basis points between December 2008 and July 2009.

- *Fiscal policy* the authorities' revised fiscal strategy is to allow automatic stabilizers to work in full and give priority to infrastructure and social spending.

- *Financing*. The authorities have proactively secured external financing, including through US$2 billion in bond placements and US$1.95 billion in multilateral loans. The authorities have a (precautionary) Flexible Credit Line of $10.45 billion.

Indonesia

- *Monetary policy.* Interest rates have been cut by a total of 275 bps to 6.75 percent since December.

- *Fiscal Policy*. The government announced a revised fiscal deficit of 2.6 percent of GDP for 2009 that incorporates fiscal stimulus measures of about 1.5 percent of GDP.

- *Financing*. The government has secured a US$5.5 billion contingency loan package from the World Bank, AsDB, Australia, and Japan. It has also extended its currency swap arrangement with Japan.

Korea

- *Monetary Policy.* The Bank of Korea (BOK) cut interest rates by a cumulative 325 basis points to 2.0 percent.

- *Fiscal Stimulus*. Parliament has approved fiscal stimulus measures equivalent to 3.6 percent of GDP in 2009.

- *Financing.* The authorities provided US$55 billion in dollar-won swaps, made available US$100 billion in guarantees on banks' new external debt, and relaxed

conditions for won repos. The authorities secured swap lines from the United States, Japan, and China, with the total equivalent to $90 billion. Out of the US$30 billion under the Fed swap line, US$10 billion have been drawn.

(ii) Crisis resolution countries

Hungary was among the first emerging market countries to suffer from the fallout of the current global financial crisis and was particularly vulnerable to global deleveraging given the extent of securities trading in international markets and non resident holdings of portfolio investments exceeding 50 percent of GDP. Hungary's high external debt levels, which amounted to 97 percent of GDP at end-2007, and significant balance sheet mismatches, negatively affected investor appetite for Hungarian assets. Hungary's economic policies supported by the IMF program focus on:

- *Fiscal consolidation*. With a public debt ratio of 67.4 percent of GDP and a gross external debt ratio of 106 percent of GDP in 2008, tackling Hungary's large public debt, through substantial fiscal adjustment was a key part of the program. The program envisaged a large structural fiscal adjustment of 2½ percent of GDP in 2009 with emphasis on expenditure measures, consistent with the need to reduce the country's large public sector. A rules-based fiscal framework was also introduced. At the First and Second Reviews under the IMF program it was clear that external financing remained difficult and the global downturn was sharper than expected, exacerbating the recession in Hungary (with implications for government revenues). Fiscal consolidation was adjusted to proceed at a slower pace than previously envisaged, while delivering permanent reductions in fiscal spending in the long run.

- *A banking sector support package* to raise capital to ensure the banks are strong enough to weather the economic downturn and resources to finance a guarantee fund for interbank lending. The Hungarian government has also lent FX directly to some banks and the central bank has provided long-term FX swaps to banks.

- *Large external financing* assistance to minimize the risk of a run on Hungary's debt and currency markets, given its large stock of external debt.

- *Monetary policy* was not subject of conditionality under the IMF program. The central bank initially tightened and interest rates were raised by 300 bps in October but were subsequently cut in four stages by a total of 200 basis points. However, concerns remain that overly rapid easing could provoke excessive exchange rate depreciation with knock on effects on the nonfinancial sector's large unhedged foreign currency borrowing.

Ukraine The economy was hit particularly hard by the external demand shock and the decline in demand for commodity exports, in particular steel. Ukraine's access to international capital markets was curtailed sharply, the hryvnia came under heavy pressure, and the credit rating agencies downgraded the country's debt. Concerns about the stability of

the banking system and exchange volatility triggered a deposit run and conversion of domestic currency deposits into cash foreign exchange. Ukraine's government put together a comprehensive package of policies and requested IMF support. The IMF program includes three key goals:

- Help the economy adjust to the new economic environment by allowing the exchange rate to float, maintaining sustainable fiscal finances, phasing in increases in energy tariffs, and pursuing an incomes policy that protects the population while slowing price increases.

- Restore confidence and financial stability (recapitalizing viable banks, and dealing promptly with banks with difficulties).

- Protect vulnerable groups in society (an increase in targeted social spending to shield vulnerable groups).

- Since the adoption of the program the global economic environment has deteriorated markedly, hitting Ukraine harder than expected. This has required a recalibration of economic policies. The IMF team and the authorities revised the program's fiscal target for 2009, taking into account the sharper than expected downturn and the availability of financing.

Iceland In October 2008, triggered by a loss of confidence and fuelled by the financial sector's high leverage and dependence on foreign financing, Iceland's three main banks, accounting for around 85 percent of the banking system collapsed. key asset prices plummeted: the onshore foreign exchange market dried up, the króna depreciated by more than 70 percent in the off-shore market, and the equity market fell by 80 percent. Severe disruptions in the external payments system threatened to quickly spread to the real economy. The objectives of the IMF supported program are:

- To contain the negative impact of the crisis on the economy by *restoring confidence and stabilizing the exchange rate in the near-term*. In the immediate aftermath of the crisis interest rates were raised and capital controls were necessary to help stem capital flight. Some controls (on current account transactions) have been lifted and the Central Bank has cut the policy interest rate to 12 percent and the deposit rate to 9.5 percent.

- *Restructuring of the banking system* to promote a viable domestic banking sector and safeguard international financial relations by implementing a sound banking system strategy that is nondiscriminatory and collaborative. The authorities adopted a new bank old bank approach (similar to the good bank bad bank approach) where the banks were split and the new banks would focus on domestic activity.

- *Safeguarding medium-term fiscal viability* by limiting the socialization of losses in the collapsed banks and implementing a multi-year fiscal consolidation program from 2010.

Table 21. Selected Emerging Markets: Impact of Crisis and Policy Responses Change September 2008 to June 2009

Country	Impact of Global Financial crisis				Policy reaction			
	2009	Change Sept 12 2008 to June 30 2009						
	Growth slowdown	Exchange rate / $	EMBI spread	Equities index	Monetary policy	Fiscal stimulus 2009	Bank Support Measures	Sources of Finance
	pps	Depreciation (minus)	Basis Points	Percent change	basis points	Percent GDP		
Crisis prevention								
South Africa	-2.5	3.6	18	-15.7	-450	2.4 Plus SOE infrastructure program		Eurobond issue
Brazil	-6.4	-8.7	14	-1.8	-400	0.6	Liquidity support	Fed swaps line
Chile	-3.9	-0.7	-14	9.3	-775	2.9	Liquidity support bank recapitalization	
Colombia	-5.2	-4.3	54	1.3	-550	automatic stabilizers	Liquidity support	FCL, bond placement multilareral loans
Indonesia	-8.6	-7.4	97	12.3	-275	1.4	Liquidity and funding support, deposit protection	WB, AsDB, Australia and Japan
Malaysia	-6.4	-2.2	9	3	-150		Deposit protection	
Korea 1/	-5.2	-12.9	47	-5.6	-325	3.6	Liquidity support, removed bad assets, insurance, capital injection	Fed swaps line, swap lines Japan and China
Mexico	-2.6	-19.6	58	-4.8	-350	1.5	Liquidity support	Fed Swaps line, FCL
Poland	-5.5	-26.1	85	-22.2	-225	limited automatic stabilizers	Capital, deposit and interbank guarantee, collateral expanded.	FCL
Russia	-12.1	-18.1	150	-15.6	Jan 2009 raised rates, exchange rate flexibility now increased	Discretionary stimulus 5	Liquidity , public guarantees, bank recapitalization	
Thailand 1/	-5.6	1.9	-31	-8.8	-250	2.5	deposit guarantees	
Turkey	-6.2	-19.5	9	-0.2	-800	0.8	Asset purchases	
Crisis resolution								
Hungary	-8.1	-14	223	-22	-200	Structural spending reform, partial automatic stabilizers	Bank capital enhanced, parent banks commited to provide subsidiaries with capital	IMF, EC, WB
Latvia 1/	-12.7	ERM II	368	-50.7	ERM II	Fiscal tightening-- Budget choices exceptionally difficult, given economic contraction	Restore confidence, parent banks commited to provide subsidiaries with financing	IMF, EC, Commited WB, Bilaterals
Iceland 1/	-11.2	-29.8	381	-87.5	-550	Automatic stabilizers operate 2009, fiscal tightening 2010 onwards	Old/ new bank resolution. Recapitalize new banks	IMF, Nordics, Russia, Poland, Faroe Islands, EC.
Pakistan	-3.5	-6.1	-62	-22.6	no change	Relaxation 2009, financed by extra donor support	Strengthened supervision	IMF, WB, Donor Conference
Ukraine	-10.1	-38.6	601	-6.8	raised 300	Neutral, automatic stabilizers	Bank recapitalization	IMF, WB

Sources: IMF Emerging Markets Monitor, April WEO, Regional Economic Outlooks Asia, Europe, Western Hemisphere. Article IV Consultation Report and Press Releases

1/ CDS spread

Table 22.Growth Performance and Fiscal Policy responses of the G20 and Selected Emerging Markets

G-20 Countries: Change in Fiscal Balances and Government Debt 1/

	2008 (A)	2009 (B)	2008-09 (A+B)
	Fiscal Balance		
Advanced G-20 countries	-2.5	-5.5	-8.0
Emerging market G-20 countries	-0.6	-4.5	-5.1
G-20 countries	-1.8	-5.1	-6.9
	Public Debt		
Advanced G-20 countries	5.8	14.2	20.0
Emerging market G-20 countries	-1.3	2.3	0.9
G-20 countries	3.1	9.8	12.9

Source: IMF Fiscal Implications of the Global Economic and Financial Crisis, and IMF WEO April 2009

1/ General government if available, otherwise most comprehensive fiscal aggregate reported in the WEO. Table reports PPP GDP-weighted averages.

Growth Performance and Change in Fiscal Position in Selected Emerging Markets 1/

	Growth Performance: Annual Percentage change		Growth Performance: Percentage points	Fiscal Response			
	2008	Proj 2009	Proj Change	General Govt Balance Percent GDP 2008	Change in General Govt Balance Percentage points Proj 2009	Proj 2010	2009-2010 Cumulative Change
Russia	5.6	-6.5	-12.1	4.3	-9.8	0.4	-9.4
Chile	3.2	-0.7	-3.9	5.3	-9.4	2.0	-7.4
Korea	2.2	-3.0	-5.2	1.2	-4.3	-1.2	-5.5
South Africa	***3.1***	***-2.1***	-5.2	***-0.6***	***-3.6***	***-0.2***	***-3.8***
Colombia	2.5	0.0	-2.5	0.1	-2.9	-0.5	-3.4
Turkey	1.1	-5.1	-6.2	-2.7	-3.2	0.7	-2.4
Mexico	1.3	-7.3	-8.6	-1.8	-1.8	-0.2	-2.0
Indonesia	6.1	3.5	-2.6	-0.2	-2.4	0.6	-1.9
Poland	4.8	-0.7	-5.5	-3.2	-1.1	0.2	-0.9
Hungary	0.5	-6.7	-7.2	-3.3	-0.6	0.1	-0.5
Brazil	5.1	-1.3	-6.4	-2.0	-1.2	1.9	0.7
Malaysia	4.6	-3.5	-8.1	-4.4	-0.4	1.2	0.8

1/ Source: IMF Desk Economists, South Africa Article IV Consultation

G-20 Stimulus Measures, 2008–10 1/

Measure	Argentina	Australia	Brazil	Canada	China	France	Germany	India	Indonesia	Italy	Japan	Korea	Mexico	Russia	Saudi Arabia	South Africa	Spain	Turkey	UK	US
Expenditure																				
Infrastructure investment	T	T		T	T	T	T	T	T	T	T	T	T		T	T	T		S	T
Support to SMEs and/or farmers				T			T				T	T		T				T		
Safety nets	T	T	T	T	T	T	P	T	T	T	T	T	T	T		T	T	T	T	T
Housing/construction support		T	T	T	T	T	P	T		T	T	T		T		T	T		T	
Strategic industries support				T	T		T			T				T			T	T		
Increase in public wage bill																				
Other		T	T	T	T	T	T	T	T	T	T	T	T	T			T	T	T	T
Revenue																				
CIT/depreciation/incentives 2/		T	P	P			P		P	P	P	P		P				P		P
PIT/exemptions/deductions 3/	P		T	P		T	P		P	T	P	P		P			P	P	P	P
Indirect tax reductions/exemptions 4/	P		T		P	P	P	T	P	T		T					S	T	S	
Other		T								P	P	T						P	P	

Sources: IMF Fiscal Implications of the Global Economic and Financial Crisis, Country authorities; and IMF staff estimates.

Note: T = temporary measures (with explicit sunset provisions or time-bound spending); S = self-reversing measures (measures whose costs are recouped by compensatory measures in future years); and P = permanent measures (with recurrent fiscal costs).

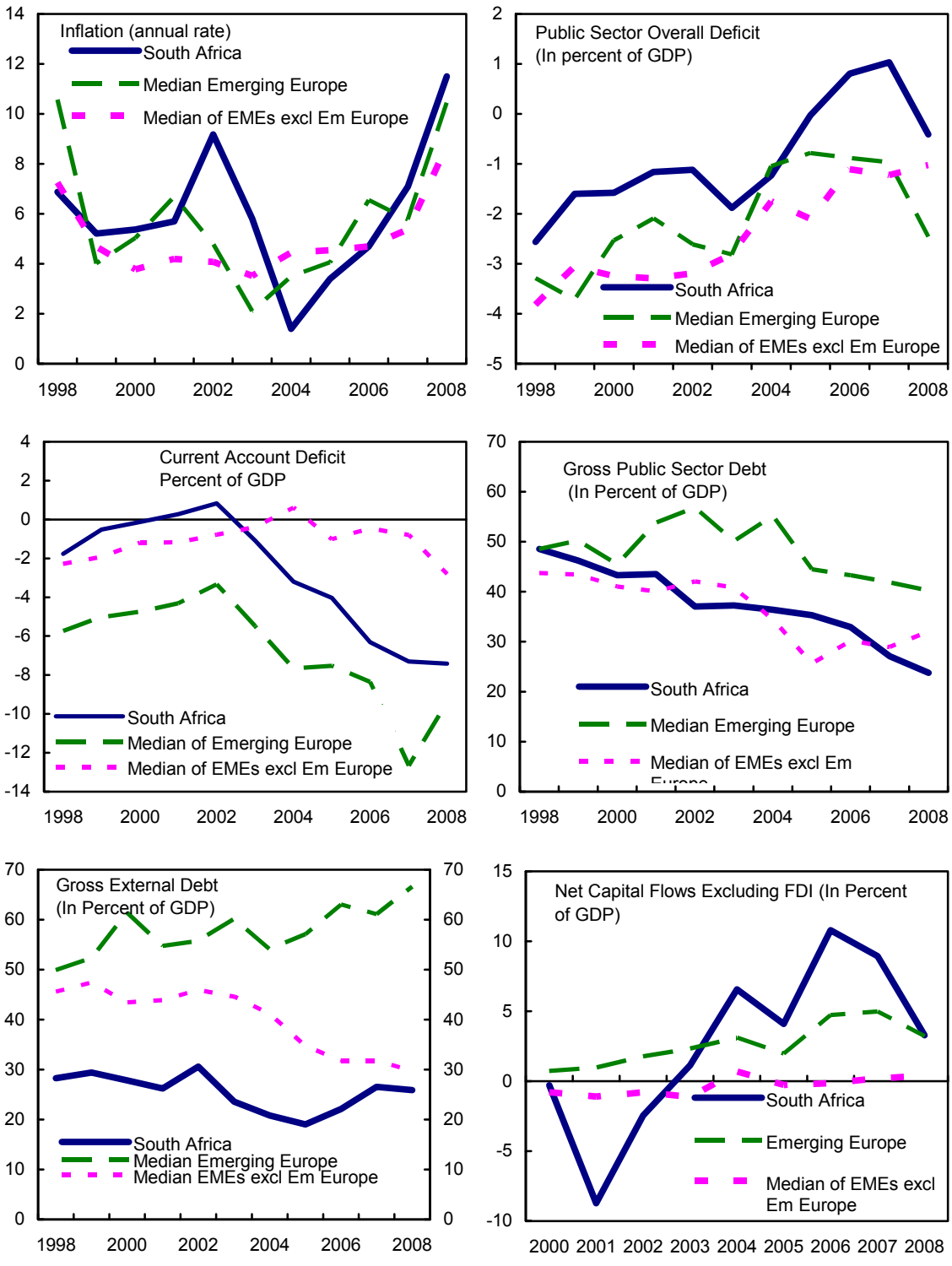
1/ Measures announced through early May 2009.

2/ Some of the corporate income tax (CIT) reductions in Germany, Italy, and Korea are temporary.

3/ Some of the personal income tax (PIT) reductions in Indonesia are temporary. For Spain, some are temporary and some are self-reversing.

4/ The reduction in the value-added tax in the United Kingdom is a temporary measure, but lost revenue will be replaced by restricting personal income tax allowance and increasing income tax for high earners in 2010–11. For India and Italy, indirect tax reductions include a mix of permanent and temporary measures.

Figure 22. South Africa: Macroeconomic Conjuncture Compared to Other EMEs



Source: IMF Vulnerabilities Exercise for Emerging Economies Database.

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