South African Reserve Bank
Working Paper Series
WP/19/05

The impact of capital flow reversal shocks in South Africa: a stock- and flow-consistent analysis

Konstantin Makrelov, Rob Davies and Laurence Harris

Authorised for distribution by Chris Loewald

July 2019

South African Reserve Bank

South African Reserve Bank Working Papers are written by staff members of the South African Reserve Bank and on occasion by consultants under the auspices of the Bank. The papers deal with topical issues and describe preliminary research findings, and develop new analytical or empirical approaches in their analyses. They are solely intended to elicit comments and stimulate debate.

The views expressed in this Working Paper are those of the author(s) and do not necessarily represent those of the South African Reserve Bank or South African Reserve Bank policy. While every precaution is taken to ensure the accuracy of information, the South African Reserve Bank shall not be liable to any person for inaccurate information, omissions or opinions contained herein.

South African Reserve Bank Working Papers are externally refereed.

Information on South African Reserve Bank Working Papers can be found at
http://www.resbank.co.za/Research/ResearchPapers/WorkingPapers/Pages/WorkingPapers-Home.aspx

Enquiries

Head: Economic Research and Statistics Department
South African Reserve Bank
P O Box 427
Pretoria 0001

Tel. no.: +27 12 313-3911
0861 12 SARB (0861 12 7272)

The impact of capital flow reversal shocks in South Africa: a stock- and flow-consistent analysis

Konstantin Makrelov[1]
Rob Davies[2]
Laurence Harris[3]

Abstract

South Africa's economy has a very well-developed financial sector and high reliance on capital flows. We employ a micro-founded and stock- and flow-consistent model in the tradition of Backus et al. (1980) to study the impact of capital flow reversal shocks on the South African economy. The model provides for a richer representation of institutional balance sheets than existing models do. The financial sector's behaviour in the model draws on the recent theoretical frameworks of Borio and Zhu (2012) and Woodford (2010), which highlight the relationship between bank capital, the risk-taking behaviour of the financial sector, lending spreads and economic activity. We specify a dynamic adjustment model of household expectations with properties that differ from the way in which expectations are formed in both stock- and flow-consistent as well as dynamic stochastic general equilibrium (DSGE) models. Household expectations resemble bounded rationality. The financial accelerator mechanism operates through the balance sheets of all institutions in the economy. The results indicate larger impacts compared to previous studies. We find that, even in the absence of large foreign currency-denominated liabilities, a reversal in capital flows can affect the domestic economy through its impact on domestic liquidity, on the risk-taking behaviour of the financial sector, and on the demand for assets. The negative effect can be exacerbated if the shock changes the expectation formation process of agents.

Keywords: stock-and-flow consistent, financial dynamics, capital flows, South Africa, computable general equilibrium

JEL classification: C68, D53, D58, E44, F42, F47

[1] Lead Economist, South African Reserve Bank, and corresponding author (konstantin.makrelov@resbank.co.za)
[2] Professor of Economics, School of Finance and Management, SOAS, University of London (lh@soas.ac.uk)
[3] Research Fellow, School of Finance and Management, SOAS, University of London

1. Introduction[4]

This paper examines how financial sector dynamics affect the economic impact of a capital flow reversal shock in South Africa. The country has high reliance on capital inflows and foreign debt is mostly rand denominated. The emphasis is on how a capital flow reversal shock transmits through the financial sector and how the presented model can incorporate discontinuity in economic behaviour.

The reasons for capital flow reversals include both domestic and global factors, with perceptions of risk being an increasingly important driver (Ahmed and Zlate 2014; Brafu-Insaidoo and Biekpe 2014; Forbes and Warnock 2012; Rey 2015; Rothenberg and Warnock 2011).[5] Recent research indicates that the risk-taking channel of monetary policy identified by Borio and Zhu (2012) is a major driver of capital flows.[6] More expansionary monetary policy in the US reduces the risk premiums and borrowing costs for global banks, leading to higher capital flows into emerging markets and more favourable financial conditions (Anaya, Hachula, and Offermanns 2017; Baskaya et al. 2017; Bräuning and Ivashina 2017; Bruno and Shin 2015; Byrne and Fiess 2016; Chari, Stedman, and Lundblad 2017). Risk perceptions are also key to the theoretical model developed by Blanchard et al. (2010). They link risk perception, balance sheets and capital flow movements.

The importance of risk taking in driving capital flows is illustrated in empirical studies, which find that attitude to risk is a major driver of the probability of capital flow reversals. While 'host country' domestic factors such as credit extension, economic overheating and currency overvaluation are important for capital flow reversal, global factors and, in particular, changes in risk preferences are playing an increasingly important role. Eichengreen and Gupta (2016) and Ghosh, Ostry, and Qureshi (2016) find that an increase in risk aversion significantly raises the probability of a sudden stop.[7]

The impact of increased risk aversion, especially in the case of sudden stops, can be severe, including banking and sovereign debt crises with large output and employment losses (Cavallo et al. 2015; Eichengreen and Gupta 2016; Magud and Vesperoni 2015; Reinhart and Reinhart 2008).[8] The effect can be long-lasting as the impact on investment is strong and negative, largely due to a deterioration in financial conditions (Joyce and Nabar 2009).

---

[4] The authors would like to thank an anonymous referee and participants at seminars at the National Treasury, SARB and SOAS, University of London.

[5] Sarno, Tsiakas, and Ulloa (2016) find that global factors such as US interest rates and global risk aversion explain close to 80% of the variation in global bond and equity flows.

[6] For South Africa, earlier studies find the interest rate, inflation differentials, exchange rate movements, political risk, the real GDP growth rate, the depth of capital markets, the effectiveness of law and order, and the government deficit as important drivers of capital flows (Ahmed, Funke, and Arezki 2005; Fedderke and Liu 2002; Wesso 2001). Aron, Leape, and Tomas (2010) find that risk aversion is a significant driver of both equity and overall flows, and that good performance by the US stock market leads to higher flows into South Africa. The latter results, according to these authors, represent a global liquidity effect driven by higher profitability. Hassan (2015) links capital flows, in particular bond flows, to carry-trade opportunities (conditions characterised by a relatively high interest rate differential and low volatility).

[7] At the same time, a period of higher-than-average flows, the so-called 'capital bonanza', also increases the probability of a capital reversal and a financial crisis as it tends to create excessive lending (Caballero 2016; Reinhart and Reinhart 2008).

[8] Reinhart and Reinhart (2008) provide a short review of the different definitions of sudden stops used in the literature. Episodes of a sudden stop generally refer to a sudden and large decline in capital flows, which is accompanied by a significant increase in some measure of the external cost of funding (Calvo, Izquierdo, and Mejia 2004; Cavallo and Frankel 2008).

Capital flow reversal shocks and the more extreme sudden stops can represent a threshold point or discontinuity driven by the continuous deterioration of some economic indicators. Calvo (2003) presents a framework which generates a low-growth or a high-growth equilibrium. The point of discontinuity is defined by a critical debt value, which is related to a production parameter. Any shock that causes the economy to move beyond the critical debt value leads to a sudden stop. At that point, the current account shifts to zero, creating a discontinuity[9]

The impact of capital flow reversal shocks on the economy depends on the share of consumption expenditure on non-tradables, which prevents the instantaneous adjustment of the current account to the decline in capital flows. A fall in the consumption of non-tradables and the associated real devaluation increase the share of non-performing loans and bankruptcies. This effect is amplified by the presence of foreign currency-denominated debt with short maturities, which may require refinancing (Calvo 1998). Higher shares of foreign currency loans to the non-tradable sector and lower levels of trade openness exacerbate the situation as the tradable sector cannot provide a cushion against the fall in aggregate demand and the deterioration in balance sheets (Calvo, Izquierdo, and Loo-Kung 2006). Under these conditions, monetary policy and fiscal policy interventions to stimulate domestic demand are likely to worsen the impacts (Calvo 1998).

Such effects of a capital flow reversal shock may be exacerbated by a transmission mechanism that includes the risk-taking channel and a financial accelerator mechanism (Bernanke, Gertler, and Gilchrist 1999). In this case, the foreign sector is the lender and the domestic economy is the borrower. In expansionary phases, an increase in capital inflows reduces domestic credit constraints and increases lending. This, in turn, increases asset prices and capital gains, and improves the net worth of domestic institutions, encouraging further inflows.[10] In a second-round effect, this translates into further improvements in net worth. Unlike the standard (closed economy) financial accelerator mechanism, movements in the currency can reinforce the financial accelerator mechanism. Higher capital inflows lead to an appreciation of the currency, improving the balance sheets of those firms whose debt is denominated in foreign currency. This, along with higher asset prices, encourages higher inflows (Brunnermeier et al. 2012).[11] A reversal in capital flows starts a process which works the opposite way, with the exchange rate and asset prices exacerbating credit constraints. Asymmetric information and moral hazard problems in the banking sector increase, and foreign funders become more likely to pull their funds out (Goldstein and Turner 1996; Mishkin 1996). Companies engage in distress sales, driving down asset prices, encouraging further capital outflows and exchange rate depreciation, and setting off a downward spiral (Joyce and Nabar 2009). In this case, the depreciation of the currency, which is expected to stabilise the economy through its impact on competitiveness, may increase the

[9] Changes to expectations are a driver of capital flows. Sudden changes to investor expectations about the sustainability of government debt, the exchange rate peg or foreign currency-denominated debt trigger capital outflows and sudden-stop dynamics (Calvo, Izquierdo, and Talvi 2003).

[10] A number of studies provide evidence for a link between capital flow and asset prices. See, for example, the International Monetary Fund (IMF (2010, 2013a) and Sá, Towbin, and Wieladek (2011).

[11] While the exchange rate plays a smaller role in countries that have a fixed exchange rate, the financial accelerator mechanism remains important. Magud and Vesperoni (2015) find that countries with fixed exchange rates have stronger credit extension associated with large capital inflows and create more foreign liabilities. In addition, the fixed exchange rate prevents the adjustment between the tradable and non-tradable sectors, which generates larger output losses than in economies characterised by a flexible exchange rate.

output losses through its impact on the net worth of firms with short-term foreign currency-denominated liabilities (Blanchard et al. 2010).

Balance sheet dynamics are central to the negative effects associated with a capital flow reversal or an extreme sudden-stop situation (Calvo, Izquierdo, and Loo-Kung 2006; Calvo, Izquierdo, and Mejia 2004). Mishkin (1999) argues that a reversal in capital flows has large economic impacts only if it affects the balance sheets of economic agents, and in particular the balance sheets of banks.

The effect that changes in risk and/or risk aversion have via the financial accelerator mechanism is dependent on the level of financial development. The level of financial development can have both positive and negative effects on the probability and the size of the impact associated with capital flow reversals. In the presence of a global shock, countries with less developed financial sectors experience outflows, while those with more developed financial sectors tend to attract inflows (Mendoza, Quadrini, and Ríos- Rull 2009; Farhi, Caballero, and Gourinchas 2008; Ju and Wei 2011). In countries with a high level of financial development, the financial sector continues to provide liquidity as the economic cycle turns (Aghion, Bacchetta, and Banerjee 2004). Banks are more likely to take on insurance against a banking crisis and to be better at screening borrowers (Dell'Ariccia and Marquez 2004; González and Ranciere 2005). Rajan (1994) argues that higher levels of financial development improve bank supervision, which in turn creates better incentives for bank managers and less risk taking during good times.[12]

Higher levels of financial development, however, are also likely to increase the level of debt and equity flows, which, unlike foreign direct investment, are likely to lead to capital flow reversal and sudden-stop episodes (Caballero 2016; Forbes and Warnock 2012; Jongwanich and Kohpaiboon 2013).[13] Higher levels of financial development can also attract cyclical flows associated with monetary policy decisions in advanced economies (Bräuning and Ivashina 2017). This destabilising impact may reflect the fact that debt and equity flows are more dependent on the creditworthiness of domestic firms than foreign direct investment (Aghion, Bacchetta, and Banerjee 2004). High levels of financial development have made it easier for economies to diversify across small shocks, but they have also exposed them to large systemic shocks, which generate significant movements in asset prices (Rajan 2005).

Despite the importance of the financial sector in driving capital flows and in the transmission mechanism of capital flow reversal shocks, the existing literature on reversal episodes generally lacks a model of such financial dynamics. Mendoza (2006) reviews several small dynamic stochastic general equilibrium (DSGE) models which rely on a debt-deflation mechanism and credit constraints to generate large negative economic impacts in response to sudden-stop episodes. Similarly, Fornaro (2015) develops a small general equilibrium model with rational expectations, nominal wage rigidities, and a financial accelerator mechanism based also on Fishers debt deflation. An exchange rate depreciation reduces the collateral constraint by increasing output, which mitigates the negative impacts associated with a sudden stop. The foreign debt accumulated does not affect the net worth of the consumer or the economy. This seems to contradict the impacts identified in empirical

[12] Empirically, Aghion et al. (2009) and Loayza et al. (2006) provide support for these models.

[13] A key limitation in this analysis is whether the definition of 'foreign direct investment' affects the results. Portfolio flows become foreign direct investment at some threshold point as the stake purchased in a company becomes significant. If this point is low, it becomes difficult to distinguish between foreign direct investment and portfolio flows.

literature. Ottonello (2013) develops a similar model but with a collateral constraint linked to the value of collateral in the form of tradable and non-tradable income and debt denominated in foreign currency units. In this case, an exchange rate depreciation creates a trade-off between the level of unemployment and the degree to which the credit constraint is binding. While these models tend to generate a financial accelerator mechanism, the financial sector is not modelled explicitly and there is no consistent stock-flow accounting.

A different but related strand of DSGE models aims to study portfolio allocation between foreign and domestic assets, and how this generates capital flows. These models also have no financial sector or balance sheet dynamics (Devereux and Sutherland 2009; Tille and van Wincoop 2010).

DSGE models have been criticised for their representation of the financial sector including the modelling of financial frictions and relationships such as financial development and trade. The models are linear and thus cannot capture the boom and bust dynamics that characterise the financial sector. Heterogeneous and systemic risks are not captured (Borio and Zhu 2012; Duca and Muellbauer 2014). Moreover, balance sheet dynamics are either not considered or considered only for the balance sheet of a representative bank. But, as Calvo, Izquierdo, and Mejia (2004), Eggertsson and Krugman (2012), and Borio and Zhu (2012) argue, disaggregated balance sheet dynamics are important for studying the impacts of capital flow reversal shocks, fiscal policy, and the general risk behaviour of agents in the economy.

Some macro-prudential liquidity stress-testing tools, such as the model developed by Neagu and Racaru (2013), do capture detailed balance sheet dynamics and have been used to study the impact of capital flow reversal on the banking sector. While the financial dynamics in that framework address some of the criticisms raised against DSGE models, the model lacks real economy dynamics and is unable to identify the impacts on employment and output.

We study the impacts of capital flow reversal shocks in a model which explicitly models the financial flows and balance sheets in an economy. Specifically, we develop a small general equilibrium model that builds on Devarajan and Go (1998) and is stock- and flow-consistent in the tradition of Backus et al. (1980) and Godley and Lavoie (2007). The model has several financial instruments and institutions. Consumption and production behaviour is micro-founded in agents' inter-temporal optimisation, allowing us to capture how changes in preferences, technology and resource constraints affect outcomes. Prices exhibit a degree of stickiness, and there is a monetary policy reaction function based on a Taylor rule. These features are similar to the New Keynesian DSGE models but, unlike the DSGE models, ours is not stochastic.

Two important features of our model make it different from the traditional stock- and flow-consistent models and DSGE models. First, our analysis of financial sector behaviour is based on modern theories of financial transmission mechanisms developed in the wake of the 2008 global financial crash, with modifications appropriate for application to South Africa (Borio and Zhu 2012; Woodford 2010).[14] Second, we specify a dynamic adjustment model of household expectations, which resembles bounded rationality.

[14] In the model developed by Woodford (2010), the lending spread is a function of financial sector institutions' capital. Raising the level of capital is costly, and leverage is limited by regulatory requirements. Shocks that impair the capital of an institution (a bank or, more generally, a financial intermediary) or that create leverage ratio regulatory requirements

The effects of a capital flow reversal shock in our model are larger compared to other studies evaluating the impact of capital flow reversal on the South African economy. Smit, Grobler, and Nel (2014) find small impacts on South Africa. Frankel, Smit, and Sturzenegger (2008) find a similar impact, which is sensitive to the monetary policy response. A higher repurchase rate (repo rate) exacerbates the impact. They justify the muted impacts by South Africa's small holding of foreign currency-denominated debt with short maturities, which is not modelled explicitly. The econometric models used in the analysis have no financial dynamics.[15,16]

We generate a larger impact as the outflow of foreign savings still reduces the availability of savings in the domestic economy, lowers the level of intermediation, and pushes loan spreads up and asset prices down. Even in the absence of large stocks of foreign currency-denominated debt, a capital flow reversal shock does have an impact on the domestic economy through its impact on liquidity and demand for domestic financial assets.[17]

We also illustrate how our framework handles discontinuity in expectations by shortening the household optimisation period. The simulation illustrates the role of expectation formation in amplifying capital flow reversal shocks. Household expectations change from model-consistent (over 10 periods) to more myopic in the presence of a large negative shock. For example, if a reduction in lending is accompanied by the bursting of a property price bubble, households' ability to smooth consumption is reduced and, in our model, household savings rise, causing the shock's impact on domestic demand to be significantly larger.[18] Households become more uncertain and, even in the absence of bankruptcy, they reduce expenditure.

The structure of the paper is as follows. The next section provides a short overview of South Africa's recent external capital flows. This is followed by section 3, which presents the model. Section 4

---

translate into higher lending spreads and lower volumes of lending and economic activity. Borio and Zhu (2012) also link the capital of the financial sector to bank behaviour. Breaching the minimum capital threshold is costly for a bank. In the face of a possible breach, banks will take defensive action to avoid the high costs, which will affect the availability and pricing of funding extended to customers. The economic cycle changes the strength of this effect, as probability of default, valuations, and the perception of risk change. In turn, this shifts the relative position of banks' capital to the regulatory threshold and affects bank behaviour. The accelerator effects in both models are driven by the relationship between capital and economic activity. Higher economic activity reduces the probability of default and the perception of risk, and improves valuations. This reduces lending spreads, which encourages further improvements in economic activity.

[15] The IMF (2013b) also emphasises the likely impact of capital flow reversal on South Africa as a result of US monetary policy normalisation. However, the IMF does not provide quantitative estimates of the economic impact. It argues that South Africa is likely to see a large outflow due to its twin deficits, but there are also mitigating factors such as government debt that is almost entirely denominated in rand terms and is mostly long-term.

[16] A few studies look at the impacts of a sudden stop in a sample of countries, including South Africa. However, they do not provide specific impacts for South Africa (Calvo, Izquierdo, and Mejia 2004; Cavallo et al. 2015; Joyce and Nabar 2009; Reinhart and Reinhart 2008). These studies tend to argue that the impacts tend to be larger than those identified by Frankel, Smit, and Sturzenegger (2008) and Smit, Grobler, and Nel (2014), especially if the sudden stop is accompanied by a banking crisis.

[17] This links our analysis to the recent literature on whether capital inflows are contractionary or expansionary. See, for example, Blanchard et al. (2016).

[18] During the 2008 global financial crisis, Estonia, Latvia and Lithuania experienced capital outflows and the bursting of a property bubble. Their GDP contracted by 20% on an annualised basis in the first half of 2019. The impacts were somewhat exacerbated by the presence of currency board arrangements, which encouraged the inflows of capital into these countries and the creation of a property bubble by creating a false sense of stability. In addition, the currency board arrangements prevented the currencies from adjusting to the widening current account deficits and increased the vulnerability of the economies as capital flows reversed (Hübner 2011).

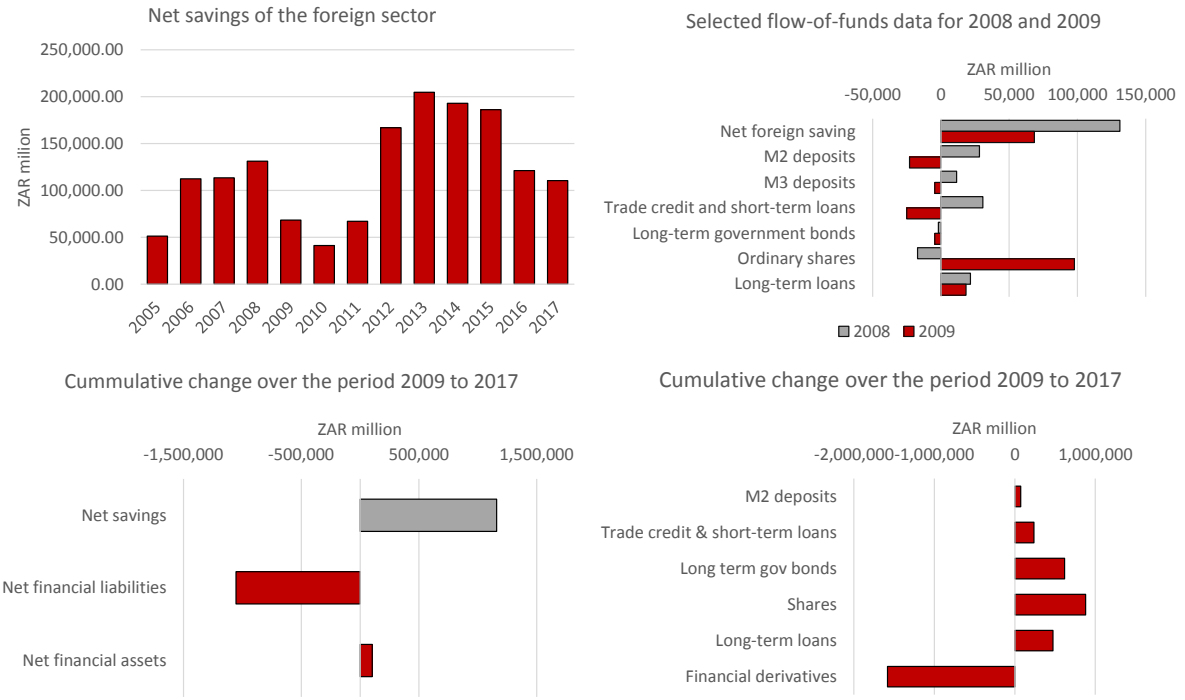
presents the data employed in the analysis, while section 5 discusses the calibration strategy. The results are presented in section 6, and section 7 concludes with some policy implications based on the analysis.

2. South African external capital flows

Our analysis is based on the South African economy with its well-developed financial sector. The Global Competitiveness Report 2018 ranks South Africa 18th in terms of its level of financial sector development.[19] The South African rand is the 20th most-traded currency globally, and the country has one of the highest market-capitalisation-to-GDP ratios.[20]

South Africa's deep and liquid financial markets support economic development and facilitate funding for both private and public institutions. This indicates that an analysis of the macroeconomic shocks in the South African context needs to consider financial sector behaviour.

Figure 1: Adjustment to lower net foreign savings



Source: South African Reserve Bank

The structurally low levels of domestic savings in South Africa have led to the country placing high reliance on foreign savings. This has increased South Africa's vulnerability to capital flow volatility.[21] While South Africa has a relatively low level of foreign currency-denominated debt (just over 20% of GDP), foreign capital flows are an important contributor to asset prices and borrowing cost movements, and thus influence domestic institutions' decisions to accumulate assets and liabilities.

[19] The report is available at https://www.weforum.org/reports/the-global-competitveness-report-2018.

[20] See the Bank for International Settlements Triennial Central Bank Survey, available at https://www.bis.org/statistics/d11_3.pdf.

[21] This section builds on the historical analysis of South African capital flows presented in Smit, Grobler, and Nel (2014).

The flow-of-funds data produced by the South African Reserve Bank (SARB) provide information on foreign saving inflows and their allocation to various financial instruments.

Net foreign saving inflows slowed down significantly between 2008 and 2009 as the global financial crisis hit South Africa (Figure 1). As central banks in advanced economies embarked on unconventional monetary policy, net saving inflows accelerated into South Africa. The inflows slowed down again over 2016 and 2017 as policy uncertainty increased in South Africa and central banks in advanced economies started to reverse some of the unconventional monetary policy interventions.

The reduction in capital inflows from 2008 to 2009 and from 2016 to 2017is significant, constituting a capital flow reversal shock to the economy. The top-right panel of Figure 1 indicates that the adjustment in net foreign savings in 2009 took place mainly through deposits, short-term loans and shares. The increase in shareholding may reflect carry-trade opportunities (see Hassan (2015)). The average repo rate in 2008 was 11.6% compared to 8.4% in 2009, while the JSE All-Share Index declined by 13.0% in 2009. The combination of lower equity prices, a weaker rand and good dividend payouts may have created expectations of higher future returns among foreign investors.

The bottom two panels of Figure 1 present cumulative gross flows. The bottom-left panel indicates that there has been a significant decline in the net financial liabilities of the foreign sector over the period. These are the foreign assets of South African residents. This likely reflects capital value losses but also a return of South African assets as the currency depreciated. Foreign saving inflows recorded a large increase over the period. There were also large compositional changes in the foreign sector holding of South African financial assets. Over the period from 2009 to 2017, the foreign holding of long-term government bonds, shares and long-term loans recorded a significant increase. Financial derivatives include instruments such as options and swaps. The negative value reflects that, at maturity, the value of the derivative instrument (calculated as the net value of all transactions) falls as the instrument is exercised.

The outcomes suggest that capital flow reversal has an important impact through the financial sector and asset prices. The foreign sector affects bond and equity markets as well as the money multiplier through its impact on loan extension and direct deposits into the financial system. It can cause credit constraints to tighten. Assessing the impact of capital flow reversal shocks requires tracing the impacts through the financial sector.

Our framework tries to capture these relationships. We have several institutions. Households' interest in retirement and life funds is a liability for the financial sector. In turn, the financial sector purchases bonds and equities. Apart from the financial sector, the foreign sector is a large purchaser of local bonds in our framework. The demand for specific assets is a function of the economic environment, relative returns and price changes affecting the balance sheets of institutions. The framework also captures the specific flows of interest and dividend income associated with the stock of bonds, bank deposits and equities.

3. Model

The model dynamics build on the simple computable general equilibrium model developed by Devarajan and Go (1998) and incorporate elements of DSGE models as well as stock and flow models in the tradition of Backus et al. (1980) and Godley and Lavoie (2012). The model also incorporates elements of the theoretical models developed by Borio and Zhu (2012) and Woodford (2010).

Our focus in this section is on the financial side of the model Devarajan and Go (1998) provide a detailed description of some of the real economy relationships. Makrelov et al. (2018) provide a detailed model description and discussion of all the equations.

Six types of institutions (agents) make real and financial decisions:

- the representative household;
- the representative firm (non-financial corporation);
- the representative financial corporation;
- government;
- the reserve bank (central bank); and
- the rest of the world.

Financial instruments are grouped in five categories: equities, loans, cash and deposits, bonds, and other. The different agents meet in the financial, product and factor markets.

Financial behaviour in our framework is based on flow-of-funds dynamics. In every period, agents experience a change in their financial wealth resulting from their decisions to save and invest, accumulate net liabilities (sources of funds), and changes to the equity price.[22] Financial wealth and any changes in it are held in portfolios comprising agents' preferred combinations of the financial instruments from the categories that are available to them. The asset demand specification for the financial and foreign sectors is based on a Tobin asset demand function (Backus et al. 1980; Godley and Lavoie 2012; Tobin 1982).

Our assumptions about expectations are different from those of mainstream DSGE models. The household has model-consistent expectations (similarly to DSGE models) within each period. However, the ability of the representative household to foresee the future is limited to 10 periods (2.5 years)[23] and the formation of expectations can vary between periods. This renders the model suitable for analysing non-linearities such as 'sudden stop' shocks. Newly formed expectations can be introduced, for example by shortening or increasing the optimisation period, or by changing the value of coefficients or the structure of equations between periods. As the household solves for each period, new information about the economy becomes available, which is incorporated into the next period's optimisation. Our expectation formation resembles bounded rationality (Simon 1955, 1982). The choice of bounded rationality, over behavioural norms as in the traditional stock and flow models or rational expectations as in DSGE models, is based on experimental research, which indicates that agents exhibit bounded rationality (Assenza et al. 2014; Hommes 2011; Roos and Luhan 2013).

The data used in the calibration of the model are a series of financial macro SAMs and institutional balance sheets over the period 2002 to 2012 and National Accounts data for South Africa. The choice of period reflects the introduction of inflation targeting and the immediate period after the 2008 global financial crisis characterised by large negative output gaps. Our approach of real sector parameters

[22] These changes in financial wealth are used to build financial Social Accounting Matrices, which represent real and financial transactions and ensure flow consistency. The approach is described in section 4.

[23] The assumption of 10 periods reflects the period that monetary shocks take to dissipate in an economy and the inflation expectations period generally targeted by central banks. We have assumed that this period also reflects the household expectation horizon.

closely follows the approach outlined by Devarajan and Go (1998). The substitution elasticities are based on the recent estimates for South Africa produced by Kreuser, Burger, and Rankin (2015) and Saikkonen (2015).

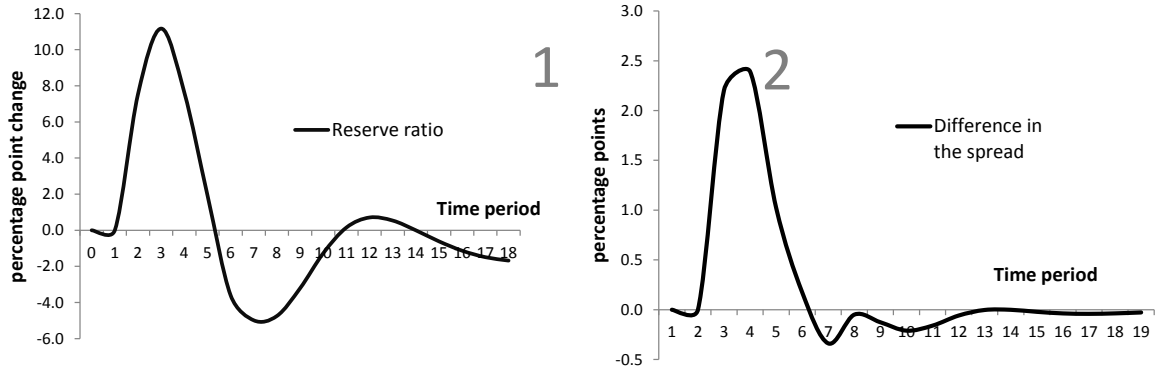
The coefficients for the asset demand function are based on those used by Godley (1996) and Godley and Lavoie (2012). The coefficients reflect a stronger response of equity and bonds to changes in relative prices. Our strategy here is to utilise the coefficients generated by other studies, bearing in mind the limitations of this approach, or to get some sense of the relationship through simple econometric estimates, which are further calibrated in the model to generate a consistent baseline.

The model fits well annual growth data, but there are deviations on the quarterly growth rates. The average quarterly growth rate from the beginning of 2009 to the end of 2011 is 0.6% compared to 0.55% in the model. As the model solves beyond 2012, deviations from the baseline increase.

4. Results

We simulate the impact of a decline in net foreign savings by 2% of GDP over four quarters and explain the transmission mechanism in our stock- and flow-consistent model. We compare the result from the main simulation with a scenario where the capital flow reversal shock changes the household expectations from model-consistent to more myopic. This aims to show how discontinuity in the behaviour of households affects the results, and illustrates the ability of our framework to capture discontinuous behaviour, which characterises sudden-stop behaviour.

Figure 2: Interest rate spread and reserve ratio



Source: Model simulations (quarterly data)

The reversal in foreign saving flows reduces liquidity in the domestic market and requires the rebalancing of investment and domestic savings in order to maintain the equilibrium. In addition, following the mechanisms identified by Borio and Zhu (2012) and Woodford (2010), there is an increase in the probabilities of default and the perception of risk, and deterioration in valuations and the net worth of the financial sector, leading to lower levels of intermediation and higher lending spreads. The banks' cash reserve ratio in our model jumps, reducing the money multiplier and the supply of loans by the financial sector (panel 1 in Figure 2). The reduction in the supply of loans

increases the spread over the repo rate, and the loan rate rises.[24] This is depicted in panel 2 of Figure 2. The trend reflects the initial fall in foreign saving inflows and the subsequent recovery.

The increase in the reserve ratio is also driven by the fall in the value of financial sector assets, which is explained below.

An increase in the nominal loan rate translates into a higher real rate. This effect is strengthened by a fall in inflation and inflation expectations relative to the baseline (panel 1 in Figure 3). The output response dominates the exchange rate impact on inflation. The higher real rates affect the economy in several different ways:

1. Firstly, investment falls across all institutions, which helps to rebalance savings and investment.
2. The increase in the real rates negatively affects aggregate demand and the demand for factors of production, which decreases utilisation in the economy and, thus, production.
3. The demand for loans decreases, thus decreasing the sources of funding available for investment in real and financial assets.
4. Interest income increases.

Table 1: Impact on real expenditure

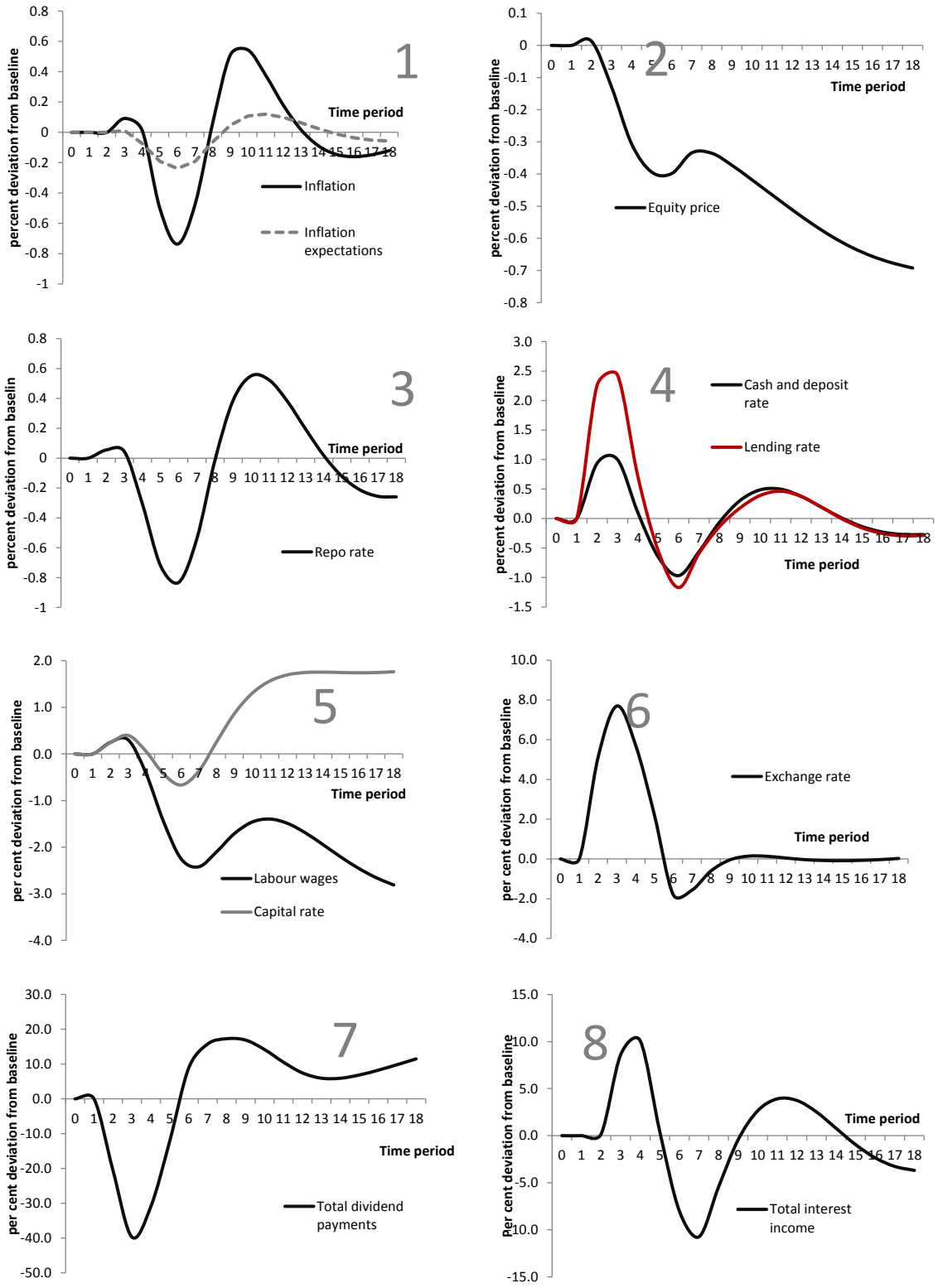
	Impact	
Per cent deviation from baseline	t+1	t+10
Household expenditure	-2.43	-0.67
Investment		
Non-financial firms	-3.81	-3.88
Other institutions	-4.11	-4.14
Exports	0.25	-0.97
Imports	-4.74	-0.96
GDP	-0.48	-0.97

Source: Model simulations (quarterly data)

Table 1 shows the impact on investment at 1 period (t+1) and 10 periods (t+10) after the shock. Investment by non-financial firms is initially 3.8% lower, and it is 3.9% lower in the outer years despite the recovery in net foreign savings. This result is in line with the long-term impacts on investment found by Joyce and Nabar (2009). This decline reflects the permanent decline in the equity price relative to the baseline (panel 2 Figure 3 below). The fall in the equity price relative to the baseline reflects an expectation of lower inflation initially and lower growth in money supply, but, more importantly, the medium-term effect is driven by a permanently lower stock of capital and lower levels of capacity utilisation compared to the baseline.

[24] This mechanism is also in line with the empirical findings in Rey (2015).

Figure 3: Impacts on rates and prices



Source: Model simulations (quarterly data)

Exports and imports follow the expected trends as the reduction in foreign savings translates into a depreciation of the exchange rate (see panel 6, Figure 3).[25] The decline in imports is significantly larger than the increase in exports. It reflects not only the depreciation in the currency, but also the significant decline in aggregate demand.

The response is dependent on the assumed elasticities in the Constant Elasticity of Substitution and Armington functions. As the flow of foreign savings normalises and the exchange rate depreciation is reversed, the level of exports declines compared to the baseline while the level of imports recovers but remains below the baseline level. The normalisation of imports also reflects a recovery in household consumption in the outer years. As in Smit, Grobler, and Nel (2014), the main adjustment is through imports, which reduces the overall negative effect on GDP.

The lower inflation and lower utilisation of resources reduce the repo rate through the Taylor rule specification. This, in turn, reduces the real policy rate, and helps to alleviate some of the pressures from the increase in the real lending rates.

The savings of the financial and non-financial sectors increase by reducing dividend payments (panel 7 in Figure 3). Total dividend payments are close to 40% lower compared to the baseline, which negatively affects the income of all institutions, particularly the income of households. This decline in dividend income is offset somewhat for some institutions by an increase in interest income (panel 8, Figure 3). For the representative household, however, the combination of lower dividend income and higher interest expenditure reduces its ability to save and consume.

Factor income also declines as capacity utilisation declines. Figure 3 shows divergent trends in capital and labour wages. We assume full employment. The labour force increases but economic activity is lower than in the baseline, and labour wages must fall in order for labour to be absorbed. In the case of capital, the effect is more positive over the entire horizon. This reflects the fall in investment and the slower pace of capital accumulation in the scenario.

Table 1 indicates that the immediate impact on household consumption is large and negative. However, as foreign savings normalise, household consumption recovers marginally. There are several forces that affect household behaviour. On the one side, household income falls as explained above, which translates into lower consumption. On the other side, the fall in the equity price and the lower provision of loans make it more difficult for the household to achieve its wealth target. The household needs to save more and consume less in order to compensate for the fall in the sources of funding and to achieve its desired level of future wealth and consumption. The lower level of expected inflation mitigates this impact somewhat in the short run as the household is targeting real wealth.

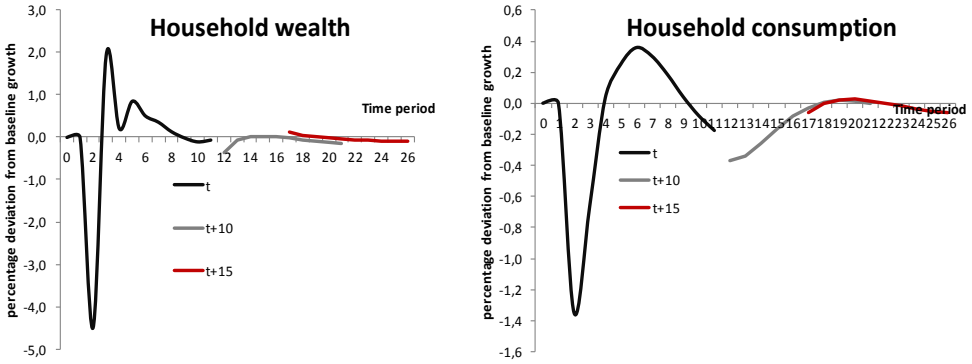
Figure 4 presents household optimisation behaviour at three points in time: the time the shock takes place (t), 10 periods after the shock (t+10), and 15 periods after the shock (t+15). The largest differences in growth rates are in period t. At time t, the economy is faced with a sudden shock, and household wealth falls. The household must consume less and save more in order to achieve its target

[25] The exchange rate is modelled following the approach in Devarajan and Go (1998). In their model, if the real exchange rate is fixed, foreign savings need to adjust, and if the real exchange rate is flexible, then foreign savings are exogenous. In our model, we have exogenous foreign savings and a flexible real exchange rate. An exogenous reduction in capital flows generates an exchange rate response to ensure that the current account is in line with the new level of foreign savings.

level of wealth. Household consumption declines due to lower income and fewer sources of funding, but there is also a greater need to save in order to achieve its target level of wealth. The growth rates in the simulation are significantly lower initially. The household, however, expects that the simulation growth rates will rise and eventually exceed those in the baseline given the cyclical structure of the economy and the likely response of monetary authorities to the shock. The stronger growth rate of financial wealth in the outer years of the optimisation period allows households to consume more. At this point, households cannot see that the capital flow reversal shock continues for four more quarters. This expectation of future improvements lowers the impact of capital flow reversal on household consumption in period *t*. It allows households to smooth their consumption.

By period *t+10*, households face lower equity prices and the expected recovery in period *t* has not taken place. Household consumption growth is lower in order to maintain the growth in real financial wealth close to the baseline. By period *t+15*, the growth rates in the baseline and the simulation are very similar for household consumption and wealth compared to the baseline. However, in level terms, household wealth and household consumption are permanently lower as the temporary credit constraint on the economy has reduced the stock of financial wealth compared to the baseline.

Figure 4: Household optimisation behaviour



Source: Model simulations (quarterly data)

In the next tables, we present the impact on the stocks of assets and liabilities, and we explain the impacts at period *t*+3.

The financial wealth held by the foreign sector in South Africa is affected mainly by a fall in savings and a depreciation in the currency. A decrease in foreign saving inflows reduces the purchases of South African financial assets by the foreign sector. The exchange rate increases the local currency value of foreign currency-denominated assets held by domestic institutions (these are liabilities for the foreign sector). The depreciation in the currency increases the value of bonds as well as cash and deposit liabilities relative to the baseline. We assume that their value is fixed in foreign currency units. The stocks of foreign loans and equity assets held by domestic residents are linked to domestic output. Lower domestic output and a weaker domestic currency discourage domestic institutions from increasing their holding of foreign equities and loans.

Table 2: Changes to the holding of financial assets

	Assets			
Deviation from baseline	Equities	Bonds	Cash and deposits	Loans
t+3				
Reserve Bank	-0.4	2.0	0.0	0.0
Financial sector	-0.7	5.4	-1.7	-2.9
Non-financial sector	-0.4	0.0	-1.6	-0.3
Households	-2.0	0.0	-2.2	0.0
Government	-0.4	0.0	-1.8	-0.1
Rest of the World	-19.3	-12.6	-22.5	-14.6

Source: Model simulations (quarterly data)

The foreign sector holding of South African financial assets declines across the board as the sources of funding and, in particular, the inflows of foreign savings decline. The decrease in the holding of bonds is smaller compared to the other asset classes, which reflects their higher relative return.[26]

Table 3: Changes to the holding of financial liabilities

	Liabilities			
Deviation from baseline	Equities	Bonds	Cash and deposits	Loans
t+3	0	0	0	0
Reserve Bank	-0.4	0.0	-1.9	6.4
Financial sector	-1.4	0.0	-2.9	0.0
Non-financial sector	-10.3	0.0	0.0	-2.5
Households	0.0	0.0	0.0	-2.9
Government	-0.4	1.9	0.0	-2.2
Rest of the World	-4.8	2.2	2.2	-4.5

Source: Model simulations (quarterly data)

It is this higher relative return on bonds that also encourages the financial sector to increase its holding of bonds (Table 2). It can also reflect some form of a flight to safety as bonds are associated with a lower risk of default. This impact works through the Tobin asset-demand function, which drives the demand for assets for the financial and foreign sectors.

The lower levels of cash and deposits received by the financial sector affect the financial accelerator mechanism in our framework. The extension of loans is lower because the financial sector chooses to hold more reserves, but also because the level of cash and deposits declines relative to the baseline. In addition, this negative effect on financial wealth is compounded by a decline in equity liabilities, driven by the slower creation of equity assets by households as well as the lower equity price. The loans extended to the financial sector experience no change. There are two effects that determine the impact on the demand for loans by the financial sector. Higher loan rates discourage borrowing, but higher interest income encourages borrowing. Overall, the pool of funds generated from the sources of

[26] Stocks where a change is not recorded reflect the fact that the asset or liability instrument is modelled exogenously or that the institution does not hold the particular asset or liability.

funding and available for investment is lower relative to the baseline, despite the higher levels of net savings. All asset holdings for the sector, except bonds, decline.

The non-financial sector also funds its financial wealth through net savings, loans and equity sales. While savings increase initially, the lower demand for equities (due to their lower return) and lower levels of economic activity lead to a significant reduction in the equity liability for the sector (Table 3). At the same time, the higher loan rate and lower income decrease the demand for loans. The equity and loan effects offset the positive impacts from higher savings. The financial wealth available for investing declines, which leads to a decline in the holding of assets across the board.

The decline in the cash and deposits holding of the household reflects lower income, which offsets the impact of higher cash and deposit rates. The fall in the transaction demand for money is higher than the increase in the demand for money as a store of value. The decline in financial wealth translates into a lower demand for equities on the asset side. The decline in the value of assets also reflects the fact that the representative household has achieved lower levels of wealth in the previous periods. The household's anticipation of a recovery in the economy, based on its model-consistent expectations, has led to smoother consumption and lower savings l in the initial periods of the optimisation horizon.

Government maintains its levels of spending, which translates into higher issuance of bonds given its falling income. The increase in bond issuance is also driven by the fall in the other sources of funds, such as loans. In terms of our specification, the decline in loan liabilities relative to the baseline is driven by the higher borrowing costs and the lower income of government. The marginal decrease in government equities, both on the asset and on the liability sides, reflects the lower equity price as the quantity of equities is modelled exogenously.[27] Similarly to the other institutions, the decrease in the sources of funding (liabilities) is matched by a decline in the uses of funding (assets).

The central bank sees a large increase in interest income as loan rates and cash and deposit rates rise. This increases the demand for loans as a source of funding, raising the financial wealth of the central bank and translating into higher purchases of bonds. Our assumption is that any increase in the financial wealth of the central bank translates into a greater holding of bonds. The stocks of all the other assets are assumed to be exogenous.[28]

Below we outline the changes in net financial wealth, measured as the difference between the stock of financial wealth and the stock of financial liabilities divided by nominal GDP. The results indicate that the net financial position of the country improves as a result of a reversal in capital flows. This is not surprising, as the assets of the foreign sector are denominated in rand terms in our framework, whereas the liabilities (the foreign assets of the domestic sector) are denominated in foreign currency units. The domestic economy benefits from the depreciation in the currency. At the same time, the decline in foreign savings reduces the sources of funding and the stock of assets held by the foreign sector relative to the baseline.

In our framework, which is stock- and flow-consistent, a deterioration in the net wealth of one sector must be matched by improvements in the net wealth of other sectors. In this case, the improvement takes place mainly through the balance sheets of the financial and non-financial sectors, which increase

[27] Government equity liabilities reflect our aggregation of financial instruments. 'Other loan stock and preference shares' were classified as equities.
[28] The change in equities reflects the fall in the equity prices and not in the stock of equities.

savings to offset the fall in foreign savings. For the financial sector, this effect is temporary. For the non-financial sector, the impact carries throughout the simulation period. The more permanent effect for the non-financial sector is explained by the higher net savings in the outer years, which are driven by permanently lower levels of investment.

Table 4: Changes to net financial wealth

Net financial wealth	Impact	
change as percent of GDP	t+1	t+10
Reserve Bank	0.0	0.0
Financial sector	1.1	0.3
Non-financial sector	3.4	4.2
Households	0.2	0.7
Government	-0.4	0.0
Rest of the World	-4.3	-5.2

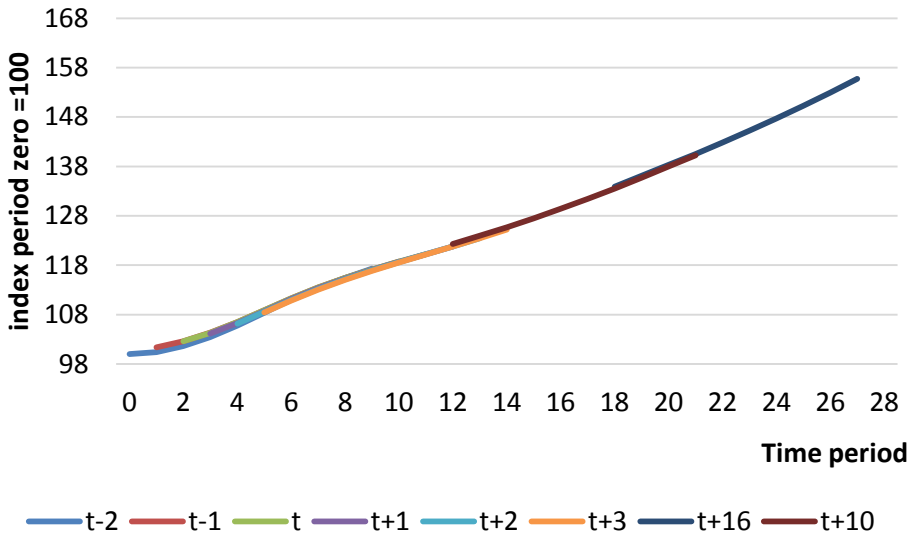
Source: Model simulations (quarterly data)

The impact on domestic demand is similar to the mild scenario of Smit, Grobler, and Nel (2014). However, our shock is significantly smaller, almost half as large. Our transmission mechanism is significantly different and assumes the amplifying effects of the financial sector, which in our framework work through the balance sheets of all the institutions in the economy. The results are relatively small compared to international experiences, as South Africa has a relatively low stock of foreign currency-denominated debt. This also minimises the probability of a capital flow reversal shock causing a banking crisis. However, our analysis indicates that, even in the absence of foreign currency-denominated debt, the financial sector has an important role in promulgating shocks through the economy.

In our analysis so far, we have assumed that there is no structural change in the behaviour of institutions in response to the capital flow reversal shock. A structural change reflects a discontinuity linked, for example, to bubble bursting. General equilibrium models are continuous models and cannot handle catastrophe theory-type dynamics. The nature of our framework, however, allows us to introduce such dynamics. While we cannot change the behaviour *within* periods as the household optimises, we can change behaviour *between* periods.

In response to a negative shock, the household shortens its optimisation period. It tries to achieve its target wealth sooner as the future looks more uncertain. Household expectations become more myopic. The simulation aims to capture the break in expectations described by Harris (1979). This is also in line with economic literature, which shows that agents switch between different forecasting rules and excess volatility can be explained by these changes (Grandmont 1998; Hommes 2011; Roos and Luhan 2013).

Figure 5: Consumption path in the base

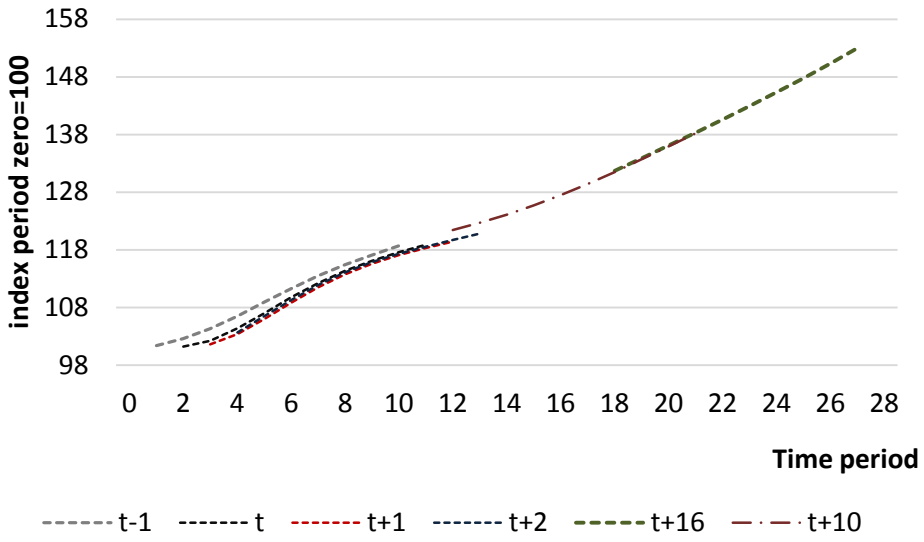


Source: Model simulations (quarterly data)

In Figure 5, we present the baseline consumption path indexed to 100 in period zero. Household optimisation, which starts at period zero, is labelled as *t-2*. Figure 5 shows that the consumption paths overlap over the solution period.

The shock takes place in the second period. The optimisation path labelled t in Figure 6 has shifted to the right, reflecting that households need to save more and consume less. This path reflects the growth rates depicted in Figure 3.

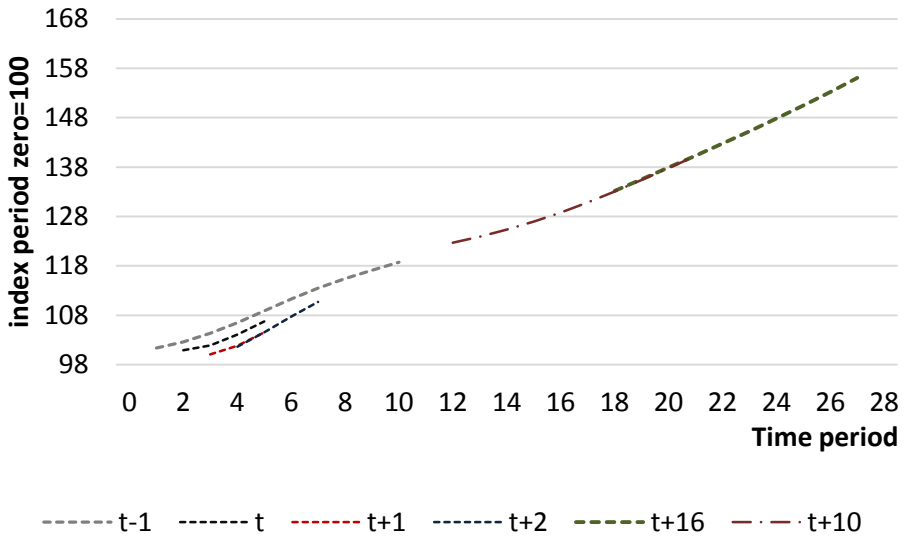
Figure 6: Consumption path following a reversal in capital flows without a change in the household optimisation horizon



Source: Model simulations (quarterly data)

The optimisation in the next period (*t+1)* follows on *t*. As the outer periods of the optimisation horizon are reached, the path of household consumption gets closer to the path set in period *t-1*. The shift in the optimisation path is also affected by the household anticipating a recovery in the economy, as was highlighted earlier. This leads to a lower adjustment in household consumption expenditure in the initial periods of the optimisation horizon. The outer-year optimisation paths, labelled *t+10* and *t+16*, are close to the baseline path.

Figure 7: Consumption path following a reversal in capital flows with a change in the household optimisation horizon



Source: Model simulations (quarterly data)

In the second simulation, we introduce discontinuity by changing household expectations from model-consistent to more myopic. The shock leads to households shortening their optimisation horizon, thus trying to achieve their target wealth over a shorter period of time. The results are presented in

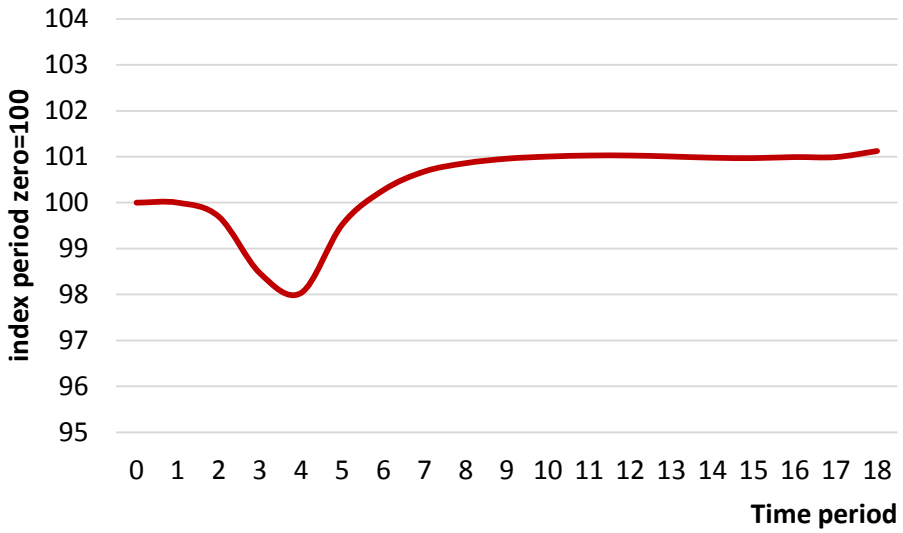
The optimisation in the next period (t+1) follows on t. As the outer periods of the optimisation horizon are reached, the path of household consumption gets closer to the path set in period t-1. The shift in the optimisation path is also affected by the household anticipating a recovery in the economy, as was highlighted earlier. This leads to a lower adjustment in household consumption expenditure in the initial periods of the optimisation horizon. The outer-year optimisation paths, labelled t+10 and t+16, are close to the baseline path.

Figure 7. The shock is introduced by assuming that, in the period when the shock takes place, households reduce their horizon to three periods while trying to achieve the same level of financial wealth. The optimisation horizon reverses gradually as the shock is reversed.

The results show a larger shift to the right. The impact on consumption is larger, reflecting that the household saves more, which is a function of its expectations. Now, it cannot foresee a recovery in the economy and it has a shorter period of time to achieve its wealth target. The sudden change in expectations and the consequent behaviour of the household exacerbates the negative effects associated with the capital flow reversal shock. This is shown in Figure 8, which plots the ratio of

consumption under simulation two to simulation one, indexed to 100 in the base year. The ratio depicted declines initially as consumption under this simulation is lower compared to simulation one (with less myopic expectations). The impact shows a larger decline in household consumption over the period associated with the capital flow reversal shock. The trend shows recovery as capital flows normalise and the optimisation period moves gradually from 3 periods back to 10 periods. In the outer years, household consumption in simulation two is slightly higher relative to simulation one as income is relatively higher. The higher levels of savings in the initial periods of simulation two provide for a higher stock of assets, which generates relatively higher interest and dividend income in the outer periods.

Figure 8: Ratio of consumption under simulation two to simulation one



Source: Model simulations (quarterly data)

While in the first simulation household consumption was 2.4% lower relative to the baseline in period *t*+1, now it is almost 4% lower. The higher savings by households, however, reduce some of the negative effects on investment associated with the reversal in foreign savings. Liquidity, proxied by growth in cash and deposits, is higher compared to simulation one, which reduces the negative impact on the financial sector's reserve ratio. This leads to a lower loan rate and higher investment compared to simulation one.[29]

[29] The results are sensitive to the size of coefficients, particularly the ones driving financial behaviour. This is a similar finding to that of Adam and Bevan (1998). Smaller β- coefficients in equation 4 reduce the response of the reserve ratio to changes in the repo rate or the balance sheet of the financial sector. The money multiplier in our framework becomes less sensitive to the economic cycle. This effect, however, depends on the elasticity of loan demand to lending rates. A more inelastic relationship requires larger lending spread changes to equilibrate the model supply and demand of loans, which amplifies the impact of economic shocks. Similarly, a more inelastic response of the demand for bonds to the bond yield in the Tobin asset demand function leads to larger shifts in bond yields in order to incentivise the foreign and financial sectors to purchase bonds.

5. Conclusion

Our main conclusion is that, even in the absence of a large stock of foreign currency-denominated debt, a capital flow reversal shock can still generate a sizable impact. A reduction in capital flows decreases liquidity in the domestic market and increases the need to raise the level of domestic net savings. Financial sector perceptions of risk increase, which encourages the sector to hold more reserves and reduces the supply of loans. This pushes up the lending spread and reduces the equity price. Economic activity declines. The real economy effects feed back to the financial sector through the balance sheets of all institutions, creating a financial accelerator effect.

The results can be significantly larger if there is a change in the expectation formation process of households. We introduce a discontinuity in our framework, which worsens the real economy impacts and increases volatility. As indicated before, such discontinuity can be linked, for example, to a property bubble bursting.[30]

Our analysis indicates that, even in the absence of large foreign currency-denominated liabilities, capital flow reversal shocks still affect the domestic economy through their impact on financial markets and possibly through expectations in the economy.

Despite a fall in the repo rate, in our model the loan rate increases as the spread jumps following the decline in foreign savings. This creates a policy dilemma, particularly for savings-constrained economies such as South Africa's. A decline in the repo rate can exacerbate the foreign savings outflow by reducing the real risk-adjusted interest rate differential, which has a contractionary impact on the economy. If the economy has foreign currency-denominated liabilities, the stronger depreciation will worsen the economic impacts. Policy actions need to consider these trade-offs.

[30] While we have chosen to introduce discontinuities in the solution process by changing the household expectation formation, there are also other ways to introduce them. These include changes to the functional specification of the model as well as to some of the parameters.

6. References

Adam, Christopher S, and David L Bevan. 1998. *Costs and benefits of incorporating asset markets into CGE models: Evidence and design issues* (Institute of Economics and Statistics, University of Oxford).

Aghion, Philippe, Philippe Bacchetta, and Abhijit Banerjee. 2004. 'Financial development and the instability of open economies', *Journal of Monetary Economics*, 51: 1077-106.

Aghion, Philippe, Philippe Bacchetta, Romain Rancière, and Kenneth Rogoff. 2009. 'Exchange rate volatility and productivity growth: The role of financial development', *Journal of Monetary Economics*, 56: 494-513.

Ahmed, Faisal, Norbert Funke, and Rabah Arezki. 2005. 'The composition of capital flows: Is South Africa different?', *IMF Working Paper Series*.

Ahmed, Shaghil, and Andrei Zlate. 2014. 'Capital flows to emerging market economies: A brave new world?', *Journal of International Money and Finance*, 48, Part B: 221-48.

Anaya, Pablo, Michael Hachula, and Christian J Offermanns. 2017. 'Spillovers of US unconventional monetary policy to emerging markets: The role of capital flows', *Journal of International Money and Finance*, 73: 275-95.

Aron, J, J Leape, and L Tomas. 2010. "Portfolio flows; Exchange rate policy and capital markets in South Africa." In *CSAE Conference: Economic Development in Africa*.

Assenza, Tiziana, Te Bao, Cars Hommes, and Domenico Massaro. 2014. 'Experiments on expectations in macroeconomics and finance.' in, *Experiments in macroeconomics* (Emerald Group Publishing Limited).

Backus, David, William Brainard, Gary Smith, and James Tobin. 1980. 'A Model of U.S. Financial and Nonfinancial Economic Behavior', *Journal of Money, Credit, and Banking*, 12: 259-93.

Baskaya, Yusuf Soner, Julian Di Giovanni, Şebnem Kalemli-Özcan, José-Luis Peydro, and Mehmet Fatih Ulu. 2017. 'Capital flows and the international credit channel', *Journal of International Economics*, 108: S15-S22.

Bernanke, Ben S., Mark Gertler, and Simon Gilchrist. 1999. 'The Financial Accelerator in a Quantitative Business Cycle Framework.' in John B. Taylor and Michael Woodford (eds.), *Handbook of macroeconomics. Volume 1C* (Handbooks in Economics, vol. 15. Amsterdam; New York and Oxford: Elsevier Science, North-Holland).

Blanchard, Olivier J, Hamid Faruqee, Mitali Das, Kristin J Forbes, and Linda L Tesar. 2010. 'The Initial Impact of the Crisis on Emerging Market Countries [with Comments and Discussion]', *Brookings Papers on Economic Activity*: 263-323.

Blanchard, Olivier, Jonathan D Ostry, Atish R Ghosh, and Marcos Chamon. 2016. 'Do Capital Flows Need to Be Tamed? Capital Flows: Expansionary or Contractionary?', *The American Economic Review*, 106: 565-69.

Borio, Claudio, and Haibin Zhu. 2012. 'Capital Regulation, Risk-Taking and Monetary Policy: A Missing Link in the Transmission Mechanism?', *Journal of Financial Stability*, 8: 236-51.

Brafu-Insaidoo, William Gabriel, and Nicholas Biekpe. 2014. 'Determinants of foreign capital flows: The experience of selected Sub-Saharan African countries', *Journal of Applied Economics*, 17: 63-88.

Bräuning, Falk, and Victoria Ivashina. 2017. 'US monetary policy and emerging market credit cycles'.

Brunnermeier, Markus, José De Gregorio, Barry Eichengreen, Mohamed El-Erian, Arminio Fraga, Takatoshi Ito, PR Lane, J Pisani-Ferry, E Prasad, and R Rajan. 2012. 'Banks and cross-border capital flows: Policy challenges and regulatory responses', *Committee on International Economic Policy and Reform*.

Bruno, Valentina, and Hyun Song Shin. 2015. 'Capital flows and the risk-taking channel of monetary policy', *Journal of Monetary Economics*, 71: 119-32.

Byrne, Joseph P, and Norbert Fiess. 2016. 'International capital flows to emerging markets: National and global determinants', *Journal of International Money and Finance*, 61: 82-100.
Caballero, Julián A. 2016. 'Do Surges in International Capital Inflows Influence the Likelihood of Banking Crises?', *The Economic Journal*, 126: 281-316.
Calvo, Guillermo A. 2003. 'Explaining Sudden Stop, Growth Collapse and BOP Crisis: The Case of Distortionary Output Tax', *IMF Staff Papers*.
Calvo, Guillermo A, Alejandro Izquierdo, and Luis-Fernando Mejia. 2004. 'On the empirics of sudden stops: the relevance of balance-sheet effects', *NBER Working Paper Series*, No. 10520.
Calvo, Guillermo A, Alejandro Izquierdo, and Ernesto Talvi. 2003. "Sudden stops, the real exchange rate, and fiscal sustainability: Argentina's lessons." In.: National Bureau of Economic Research.
Calvo, Guillermo A. 1998. 'Capital Flows and Capital-Market Crisis: The Simple Economics of Sudden Stops', *Journal of Applied Economics*, 1: 35-54.
Calvo, Guillermo A., Alejandro Izquierdo, and Rudy Loo-Kung. 2006. 'Relative price volatility under Sudden Stops: The relevance of balance sheet effects', *Journal of International Economics*, 69: 231-54.
Cavallo, Eduardo A., and Jeffrey A. Frankel. 2008. 'Does openness to trade make countries more vulnerable to sudden stops, or less? Using gravity to establish causality', *Journal of International Money and Finance*, 27: 1430-52.
Cavallo, Eduardo, Andrew Powell, Mathieu Pedemonte, and Pilar Tavella. 2015. 'A new taxonomy of Sudden Stops: Which Sudden Stops should countries be most concerned about?', *Journal of International Money and Finance*, 51: 47-70.
Chari, Anusha, Karlye Dilts Stedman, and Christian Lundblad. 2017. "Taper tantrums: Qe, its aftermath and emerging market capital flows." In.: National Bureau of Economic Research.
Dell'Ariccia, Giovanni, and Robert Marquez. 2004. 'Information and bank credit allocation', *Journal of Financial Economics*, 72: 185-214.
Devarajan, Shantayanan, and Delfin S. Go. 1998. 'The Simplest Dynamic General-Equilibrium Model of an Open Economy', *Journal of Policy Modeling*, 20: 677-714.
Devereux, Michael B., and Alan Sutherland. 2009. 'A portfolio model of capital flows to emerging markets', *Journal of Development Economics*, 89: 181-93.
Duca, John, and John Muellbauer. 2014. 'Tobin LIVES: Integrating Evolving Credit Market Architecture into Flow-of-Funds Based Macro-Models.' in, *A flow-of-funds perspective on the financial crisis* (Springer).
Eggertsson, Gauti B., and Paul Krugman. 2012. 'Debt, Deleveraging, and the Liquidity Trap: A Fisher-Minsky-Koo Approach', *Quarterly Journal of Economics*, 127: 1469-513.
Eichengreen, Barry, and Poonam Gupta. 2016. 'Managing sudden stops', *World Bank Policy Research Working Paper Series*, No. 7639.
Farhi, Emmanuel, Ricardo Caballero, and Pierre-Olivier Gourinchas. 2008. 'An Equilibrium Model of Global Imbalances and Low Interest Rates', *American Economic Review*, 98.
Fedderke, J. W., and W. Liu. 2002. 'Modelling the determinants of capital flows and capital flight: with an application to South African data from 1960 to 1995', *Economic Modelling*, 19: 419-44.
Forbes, Kristin J., and Francis E. Warnock. 2012. 'Capital flow waves: Surges, stops, flight, and retrenchment', *Journal of International Economics*, 88: 235-51.
Fornaro, Luca. 2015. 'Financial crises and exchange rate policy', *Journal of International Economics*, 95: 202-15.
Frankel, Jeffrey, Ben Smit, and Federico Sturzenegger. 2008. 'South Africa: Macroeconomic challenges after a decade of success', *Economics of Transition*, 16: 639-77.

Ghosh, Atish R, Jonathan D Ostry, and Mahvash S Qureshi. 2016. 'When Do Capital Inflow Surges End in Tears?', *The American Economic Review*, 106: 581-85.
Godley, Wynne. 1996. 'Money, Finance and National Income Determination: An Integrated Approach', *Levy Economics Institute, The, Economics Working Paper Archive*, No. 167.
Godley, Wynne, and Marc Lavoie. 2012. *Monetary economics: an integrated approach to credit, money, income, production and wealth* (Springer).
Goldstein, Morris, and Philip Turner. 1996. 'Banking crises in emerging economies: origins and policy options', *BIS Economic Paper*, No. 46.
González, Alejandro Gaytán, and Romain Ranciere. 2005. 'Banks, Liquidity Crises and Economic Growth', *Bank of Mexico Working Paper Series*, No. 2005/03.
Grandmont, Jean-Michel. 1998. 'Expectations Formation and Stability of Large Socioeconomic Systems', *Econometrica*, 66: 741-81.
Harris, Laurence. 1979. 'Catastrophy Theory, Utility Theory and Animal Spirit Expectations', *Australian Economic Papers*, 18: 268-82.
Hassan, Shakill 2015. 'Speculative Flows, Exchange Rate Volatility and Monetary Policy: the South African Experience', *South Africa Reserve Bank Working Paper Series*, No. WP/15/02.
Hommes, Cars. 2011. 'The heterogeneous expectations hypothesis: Some evidence from the lab', *Journal of Economic Dynamics and Control*, 35: 1-24.
Hübner, Kurt 2011. 'Baltic Tigers: The limits of unfettered liberalization', *Journal of Baltic Studies*, 42: 81-90.
IMF. 2010. 'Global liquidity expansion: effects on receiving economies and policy response options', *Global Financial Stability Report*, Washington, DC: International Monetary Fund: pp. 119–51.
———. 2013a. 'Global impact and challenges of unconventional monetary policies', *IMF Policy Paper*.
———. 2013b. 'South Africa 2013 Article 4 Concultations', *International Monetary Fund Country Reports*, No. 13/303.
Jongwanich, Juthathip, and Archanun Kohpaiboon. 2013. 'Capital flows and real exchange rates in emerging Asian countries', *Journal of Asian Economics*, 24: 138-46.
Joyce, Joseph P., and Malhar Nabar. 2009. 'Sudden stops, banking crises and investment collapses in emerging markets', *Journal of Development Economics*, 90: 314-22.
Ju, Jiandong, and Shang-Jin Wei. 2011. 'When is quality of financial system a source of comparative advantage?', *Journal of International Economics*, 84: 178-87.
Kreuser, Friedrich, Rulof Burger, and Neil Rankin. 2015. 'The Elasticity of Substitution and Labour Displacing Technical Change in Post-Apartheid South Africa', *Wider Working Paper Series*, No. 2015/101.
Magud, Nicolas E, and Esteban R Vesperoni. 2015. 'Exchange rate flexibility and credit during capital inflow reversals: Purgatory… not paradise', *Journal of International Money and Finance*, 55: 88-110.
Makrelov, Konstantin, Channing Arndt, Rob Davies, and Laurence Harris. 2018. 'Stock and flow consistent macroeconomic model for South Africa ', *UNU-WIDER Working Paper Series*, No. 7/2018.
Mendoza, Enrique G. 2006. 'Lessons from the Debt-Deflation Theory of Sudden Stops', *American Economic Review*, 96: 411-16.
Mendoza, Enrique , Vincenzo Quadrini, and José- Víctor Ríos- Rull. 2009. 'Financial Integration, Financial Development, and Global Imbalances', *Journal of Political Economy*, 117: 371-416.
Mishkin, Frederic S. 1996. 'Understanding financial crises: a developing country perspective', *NBER Working Paper Series*, No. 5600.
———. 1999. 'International capital movements, financial volatility and financial instability', *NBER Working Paper Series*, No. 6390.

Neagu, Florian, and Irina Racaru. 2013. 'Sudden stop of capital flows and the consequences for the banking sector and the real economy', *ECB Working Paper Series*, No. 1591.
Ottonello, Pablo. 2013. 'Optimal exchange rate policy under collateral constraints and wage rigidity', *Mimeo, Columbia University*.
Rajan, Raghuram G. 2005. 'Has financial development made the world riskier?', *NBER Working Paper Series*, No. 11728.
Rajan, Raghuram G. 1994. 'Why Bank Credit Policies Fluctuate: A Theory and Some Evidence', *The Quarterly Journal of Economics*, 109: 399-441.
Reinhart, Carmen M, and Vincent R Reinhart. 2008. 'Capital flow bonanzas: an encompassing view of the past and present', *NBER Working Paper Series*, No. 14321.
Rey, Hélène. 2015. 'Dilemma not trilemma: the global financial cycle and monetary policy independence', *NBER Working Paper Series*, No. 21162.
Roos, Michael WM, and Wolfgang J Luhan. 2013. 'Information, learning and expectations in an experimental model economy', *Economica*, 80: 513-31.
Rothenberg, Alexander D., and Francis E. Warnock. 2011. 'Sudden Flight and True Sudden Stops', *Review of International Economics*, 19: 509-24.
Sá, Filipa, Pascal Towbin, and Tomasz Wieladek. 2011. 'Low interest rates and housing booms: the role of capital inflows, monetary policy and financial innovation', *Bank of England Working Paper Series*, No. 411.
Saikkonen, Liisa. 2015. 'Estimation of substitution and transformation elasticities for South African trade', *Wider Working Paper Series*, No. 2015/104.
Sarno, Lucio, Ilias Tsiakas, and Barbara Ulloa. 2016. 'What drives international portfolio flows?', *Journal of International Money and Finance*, 60: 53-72.
Simon, Herbert A. 1955. 'A Behavioral Model of Rational Choice', *The Quarterly Journal of Economics*, 69: 99-118.
———. 1982. *Models of bounded rationality: Empirically grounded economic reason* (MIT press).
Smit, Ben, Christelle Grobler, and Carmen Nel. 2014. 'Sudden Stops and Current Account Reversals: Potential Macroeconomic Consequences for South Africa', *South African Journal of Economics*, 82: 616-27.
Tille, Cédric, and Eric van Wincoop. 2010. 'International capital flows', *Journal of International Economics*, 80: 157-75.
Tobin, James. 1982. 'Money and Finance in the Macroeconomic Process', *Journal of Money, Credit & Banking (Ohio State University Press)*, 14: 171-204.
Wesso, GERALD R. 2001. 'The dynamics of capital flows in South Africa: an empirical investigation', *South African Reserve Bank Quarterly Bulletin*: 59-77.
Woodford, Michael. 2010. 'Financial Intermediation and Macroeconomic Analysis', *Journal of Economic Perspectives*, 24: 21-44.