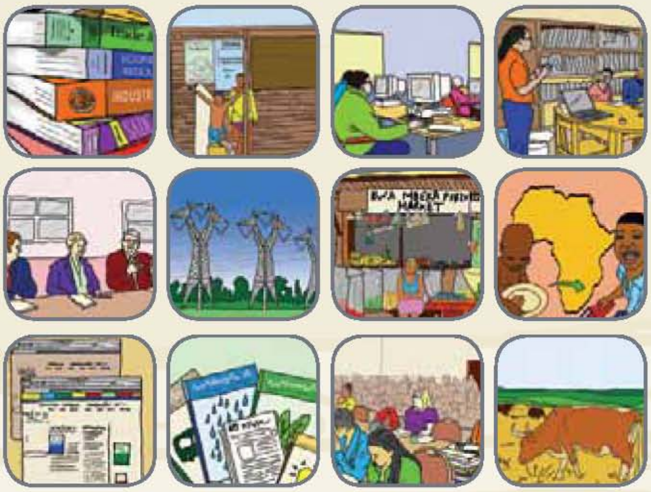
TRADE & INDUSTRIAL POLICY STRATEGIES

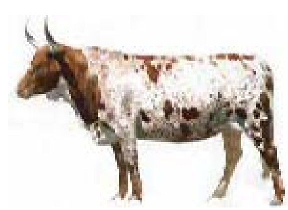


TIPS Small Grant Scheme Research **Paper Series 2009**

Economic Policy in Turbulent Times

Michael Parusel and Nicola Viegi

May 2009



indigenous **growth**

Economic Policy in Turbulent Times

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May 2009

Abstract

This paper employs the Bernanke-Gertler-Gilchrist "financial accelerator" model to study current economic conditions in South Africa. Given the turbulent financial market conditons we investigate the optimal monetary policy response as well as the potential role fiscal policy might play.

As typical in the literature, we find that monetary policy should not deviate from a standard Taylor policy rule that principally targets inflation. The optimality of the Taylor, however, depends on the hypothesized degree of integration between the financial sector and the real economy. Finally, we find that fiscal policy plays a significant role in stabilizing the economy.

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1 Introduction

These are turbulent times - indeed. The United States (U.S.) economy is expected to contract by 1.6 percent in 2009, following a lackluster performance of 1 percent growth in gross domestic product (GDP) in 2008. Similarly the group of advanced economies is forecasted to post a negative real GDP growth rate of 2.0 percent in 2009 (IMF, 2009).[1]

The U.S. housing market has depreciated by twenty-four percent between the peak in June 2006 and October 2008 and further depreciations are expected. Similarly, the S&P 500 U.S. stock market index has retreated by 45.2% since its peak in May 2007. Especially hard hit are financial institutions with exposure to the U.S. securitization market. In its recent update of the Global Financial Stability Report the International Monetary Fund (IMF) estimates that total losses may amount to $2.2 trillion, revised upwards from $1.4 trillion (IMF 2009a). A distinct trademark of the current financial crisis is that losses are incurred at a global level and are in no way restricted to certain regions.

Monetary policy across the industrialized world has responded vigorously to the looming crisis. For example, the U.S. Federal Reserve Bank has lowered interest rates to a band between 0 and 0.25 percent and has started to pursue unconventional methods, such as buying medium to long-term bonds, to further reduce long term interest rates.

In addition, national governments have activated fiscal stimulus packages to stimulate aggregate demand. The German parliament, for instance, already passed the second fiscal stimulus, amounting to €50 billion, in January 2009. This was after it became apparent that the first one would not suffice. In the U.S., president Obama and the Democratic Party have drawn up an expenditure plan of approximately $850 billion to rejuvenate the domestic economy.

After a period in which South Africa and other emerging markets seemed unaffected by the financial turmoil, the crises has finally hit with a vengence. On the back of record commodity prices, strong domestic demand fuelled by public infrastructure programs and a favorable international economic environment, South Africa's economy expanded by 5.1% (5.0) in 2007 (2006). Far into the first half of 2008, with South Africa's second quarter growth rate standing at 5 percent[2], the economic and financial community was debating whether emerging markets can decouple from developments in international markets and continue to expand at recent rates.

Yet mid-2008 it became apparent that emerging markets' economic activity was slowing down too. Commodity prices and share prices peaked in May 2008 and started to decline from there on. Between May and November 2008 South African equities fell by more than 40 percent. At the same time a re-assessment of risk

[1] The group of advanced economies consists of thirty-one countries. It includes the United States and other major advanced economies, the Euro area, newly industrialized Asian economies as well as other advanced economies such as Australia, Denmark or Switzerland (IMF, 2008).

[2] Although, one has to note, that power outages in the first quarter of 2008, had the effect of shifting some economic activity into the second quarter (SARB 2008a). Thus the growth rate for quarter two probably overstates real economic activity in the economy.

and a "flight to safety" drove up international credit spreads for South Africa[3]. The sovereign risk spread, an indicator of risk perceptions, between South African government debt denominated in U.S. dollars and U.S. treasury bonds of similar six-year maturity widened from a record low of 67 basis points in May 2007, to 242 in February 2008 to 588 basis points in October 2008. Finally South Africa entered officially in recession in the first quarter of 2009.

Overall the current state of the world economy and the conditions South Africa is facing may be summarized in three broad terms: first, credit spreads have widened in response to a re-assessment of risk; second, economic activity in advanced economies is dramatically decelerating and impinging on the demand for South African export products and, thirdly, in line with overall economic conditions share prices have tumbled.

Given the current state of the world, how should South Africa respond to such developments? And prior to the policy response, how should South Africa interpret and evaluate the turmoil in international financial markets and its implications for the real economy? This paper offers some insight into these questions.

In a long-standing tradition, going back to Fisher (1933) and Minsky (1986), it is recognized that the economy is a complex web of financial contracts. In such an economy financial debt plays a central role in explaining the boom-and-bust cycle of the economy we observe today. In this tradition, this paper employs the popular Bernanke-Gertler-Gilchrist (BGG) "financial accelerator"-model, parameterized to fit South African data, to model current economic conditions faced by South Africa and assess potential welfare gains of employing different monetary policy functions. More specifically, the paper aims to establish what the optimal monetary policy response is for South Africa given current market conditions. In addition, we revisit the Minskian theory of Big Government and analyze the role fiscal policy might play in stabilizing the South African economy.

In the next section the role of asset prices and credit in an inherently complex economy is outlined. Section three presents the model and some initial observations. Sections four presents the findings and section five offers some concluding remarks.

2 Asset and Credit Cycles in an inherently complex economy

In order to be able to analyze recent events in international markets and its implications for South Africa, it is necessary to develop a model that integrates the real economy of output, consumption and investment with the financial world of debt finance, risk premia, leverage and share prices.

There is a long-standing tradition in macroeconomics that recognizes that asset price movements and financial innovations, such as mortgage securization in the recent crisis, occur as part of the business and credit cycle. One of the first economists to observe these characteristics of the business cycle was Irving Fisher (1933). In

[3]Signifying the "flight to safety" is that Net Portfolio Outflows recorded R0.9 billions for the first three quarters of 2008 in comparison to a Net Inflow of R104.5 billion for the same period of 2007 (SARB 2008).

his essay on the root causes of the Great Depression he departs from the notion that the economy ever reaches equilibrium. Instead the economy is constantly shocked by new disturbances and by necessity either under- or over-production occurs. Thus Fisher argues that over-indebtedness and deflation are central in explaining the Great Depression. Although "over-investment" and "over-confidence" play a key role in the build-up of imbalances, only once they "beguile its victims into debt" do they have the potential to cause output reductions of the scale of the Great Depression (Fisher, 1933).[4]

During good times, markets are awash with liquidity searching for yield. Investments are made into new or potentially risky instruments which seem perfectly safe during good times, often highly leveraged. The increased demand for assets initiates an upward asset price spiral, where increased investment demand causes higher asset prices, which in turn increase the net worth of companies. The improved balance sheet position of firms enables them to borrow additional funds to invest. Imbalances build up. Once interest rates rise or another exogenous shock occurs, an unwinding of asset positions in a fire-sale manner begins and asset prices begin to fall drastically. As loans are being repaid, deposit currency contracts and the velocity of money slows, causing a fall in prices or deflation. Furthermore deflation will trigger an appreciation of debt in real terms, triggering further asset price depreciations and leading into an accelerating deflation-spiral (Fisher, 1933). Indeed, Bordo (2007) finds that the peak of the credit cycle[5], the upper turning point of the U.S. business cycle, stock market crashes and banking crises closely coincide.

Hyman Minsky (1986), who extends on the ideas of Fisher in trying to explain the cyclical behavior of the business and credit cycle, envisages an economy with complex financial structures and institutions.[6] The cyclical properties of the Minsky economy are established by the relations among profits, capital asset prices, financial market conditions and investment. The demand for capital is determined by their expected future cash flows, thus the possibility of debt finance offers the irreducible speculative element to speculate on future cash flows and financial market conditions.

In periods of tranquility[7] characterized by full employment, endogenous changes to risk perception take place. Heartened by recent successes, bankers and businessmen tend to accept larger leverage ratios whenever full employment is reached. Interest rate spreads are reduced; first slowly, because of the memory of preceding financial difficulties, but as a history of successes is established margins will shrink quickly (Minsky, 1986). To put it differently, current views in regards to financing reflect the opinions of bankers and businessmen about the uncertainties they face. These current views reflect the past and, in particular, the recent past, and how

[4]Gross Domestic Product declined by more than a third between 1929 - 1933 (Friedman and Schwartz, 1963).

[5]The peak of the credit cycle is measured by the spread between the Baa corporate bond rate and the ten-year-Treasury bond rate (Bordo, 2007).

[6]Thereby, Minsky as well as Fisher, explicitly depart from the neoclassical assumption of money-neutrality.

[7]Minsky finds the term equilibrium misleading and defines tranquility as a period of time in which rapid disruptive changes are not taking place, noting, however that tranquility is frequently disrupted by investment booms, accelerating inflation, financial and monetary crises, and debt deflation (Minsky, 1986).

experience is transformed into expectations. A history of successes will reduce uncertainty and lower interest rates spreads. As a result debt financing expands and fuels an investment boom (Minsky, 1986).

In conjunction with financial innovations by the banking sector, "a characteristic of our economy in good times", the economy will try to expand beyond any tranquil full-employment state (Minsky, 1986). Consequently the historic as well as the recent observable boom-and-bust cycles in output,which are intimately linked to the credit cycle, are due to an endogenous change in risk perception as the economy approaches the full-employment state.

Bernanke and Gertler (1989) formalize the idea of endogeneity of risk by focusing on the relationship between net worth of firms and agency costs the commercial bank sector incurs.

Bernanke and Gertler point out that the firm's net worth, defined as the borrowers' liquid assets plus collateral value of illiquid assets less outstanding obligations, is inversely related to banks' agency costs (e.g. screening, accounting and monitoring cost, expected default cost of non-performing loans). During good times the firm has strong cash flows and as a result net worth expands. As the equity stack in the firm increases, the expected cost of default will be decreasing. Accordingly, agency costs are reduced as net worth increases or, inversely, as leverage rises agency cost will tend to rise as well (Bernanke and Gertler, 1989). The intuition is that net worth represents the borrower's own stake in an investment project and serves as a signal to lenders of borrowers' likely incentive to default (Hall, 2001a).

The idea of fluctuating agency cost is captured in the external finance premium. Given the inherent agency problem, that is the lender can not fully ensure that the borrower will act in the lender's best interest, companies have to pay a premium on externally acquired funds over and above the opportunity costs of internal funds - the external finance premium. Therefore external funds will be more expensive than internal finance.

To the extent that net worth will be procyclical, the external finance premium will be countercyclical (Bernanke, Gertler and Gilchrist, 1999). Thereby BGG are able to capture the dynamics of an economy with complex financial markets. In particular the model economy is characterized by a "financial accelerator". An initial rise in net worth, for instance due to optimistic market sentiments on future profitability of the firm, is propagated into the future by lowering the cost of external finance, that is a fall in the external finance premium. The profit-maximizing firm responds to the reduction of the external finance premium by expanding its credit and investment demand as it equates the marginal return on capital to the marginal cost of funds. As a result persistent output effects are generated as increased investment demand takes hold.

Similar approaches to model credit frictions have been presented by Kiyotaki and Moore (1997) and Carlstorm and Fuerst (1997, 2000). However, in recent years the BGG "financial accelerator" model has become the standard model to analyze credit frictions in the economy. Bernanke and Gertler (2001) extend the BGG 1999 model to include bubble processes and analyze optimal monetary policy in the presence of asset price bubbles. Christensen and Dib (2006) and Meier and Muller (2005) test for the quantitative effects and the relative importance of credit frictions using

U.S. data. Fukanaga (2002) and Hall (2001) apply the model to the Japanese and British economy, respectively. Aoki *et al.* (2002) embed credit frictions into the U.K. housing market and study financial accelerator effects within the household sector. Cespedes *et al.* (2004), Elekdag *et al.* (2005) as well as Gertler *et al.* (2003) integrate the financial accelerator into an open economy model. Christiano *et al.* (2004) uses the BGG approach to study the Great Depression.

This paper applies the BGG-model to the South African economy to study the economic consequences of the recent turmoil in international markets. In the next section, the model, including the financial accelerator, will be outlined.

3 The model

Based on earlier research (Bernanke and Gertler, 1989; Bernanke and Gertler, 1995; Bernanke, Gertler and Gilchrist, 1996) BGG 1999 embedded the idea of credit frictions into an otherwise standard dynamic stochastic general equilibrium with sticky prices, following Calvo (1983).

In a world of perfect information credit frictions would play no role and the Modigliani-Miller-theorem of irrelevance would hold (Modigliani and Miller, 1958). However in a world of asymmetric information, agency problems and uncertainty borrower - lender relationships play a key role (Bernanke, Gertler and Gilchrist, 1999). BGG use a costly-state-verification modeling strategy *à la* Townsend (1979) to introduce credit frictions. Specifically, the lender is unable to assess costlessly the outcome of the borrower's investment project. Naturally, the lenders will structure the debt contract in such a way that agency costs of bankruptcy are minimized. In effect, the lender will require a risk compensation for the potential bankruptcy and the associated inevitable loss of financial resources. Thus external finance will be comparatively more expensive than internal. The difference, the external finance premium, is a key variable of the BGG model. It is defined as "the difference between the cost of funds raised externally and the opportunity cost of funds internal to the firm" (Bernanke, Gertler and Gilchrist, 1999).

In general, the entrepreneurs (borrowers) finance the acquisition of physical capital K at price Q in each time period t in two different ways: firstly, they use internal funds, their net worth N, consisting of profits (including capital gains) from previous capital investment or, secondly, they obtain external funds by borrowing amount B.

Higher levels of net worth N mitigate the need for external finance. Thus a greater reliance on internal funds reduces the agency problem and its cost. Therefore higher levels of net worth N are associated with a lower external finance premium. The inverse relationship is key to understanding the financial accelerator.

Apart from the financial accelerator the model is fairly standard. It incorporates households, retailers and entrepreneurs. Households are infinitely lived agents who consume, save, work and hold monetary and non-monetary assets. Retailers purchase the products produced by entrepreneurs in a perfectly competitive market, differentiate them at no cost and sell them to households under monopolistic competition. Profits made in the retail sector are rebated lump-sum to households since they are the ultimate owner of the retail sector. Furthermore it is assumed that retailers change their price with probability $1-\theta$ inducing price inertia into the model. The only non-standard characteristic is that entrepreneurs, who go bankrupt in time t consume their residual equity.

Let lower case variables denote percent deviations from steady state and let upper case variables without time subscripts denote the steady state values. Following BGG (1999) the model below has three exogenous shocks - demand shock e_t^g, technology shock e_t^a and interest rate shock e_t^n. All error terms are i.i.d..

$$y_t = \frac{C}{Y}c_t + \frac{G}{Y}g_t + \frac{I}{Y}i_t + \frac{C^e}{Y}c_t^e \tag{1}$$
$$c_t = -\sigma r_t + c_{t+1} \tag{2}$$
$$c_t^e = n_t \tag{3}$$
$$r_t^k = (1-\upsilon)(y_t - x_t - k_{t-1}) + \upsilon q_t - q_{t-1} \tag{4}$$
$$r_{t+1}^k = r_t - \psi[n_t - (q_t + k_t)] \tag{5}$$
$$q_{t+1} = \phi(in_t - k_t) \tag{6}$$
$$i_t = in_{t-1} \tag{7}$$
$$y_t = a_t + \alpha k_{t-1} + (1-\alpha)h_t \tag{8}$$
$$h_t = \frac{\eta_h}{1+\eta_h}(y_t - x_t - c_t) \tag{9}$$
$$\pi_t = -\lambda x_t + \beta\pi_{t+1} \tag{10}$$
$$k_t = \delta i_t + (1-\delta)k_{t-1} \tag{11}$$
$$n_t = \frac{\gamma RK}{N}(r_t^k - r_t) + r_t + n_{t-1} \tag{12}$$
$$r_t = r_t^n - \pi_t \tag{13}$$
$$r_t^n = \rho r_{t-1}^n + (1-\rho_n)(\nu_b \pi_{t-1}) + e_t^n, \qquad e_t^n \,\tilde{}\, N(0,\sigma_n^2) \tag{14}$$
$$a_t = \rho_a a_{t-1} + e_t^a, \qquad e_t^a \,\tilde{}\, N(0,\sigma_a^2) \tag{15}$$
$$g_t = \rho_g g_{t-1} + e_t^g, \qquad e_t^g \,\tilde{}\, N(0,\sigma_g^2) \tag{16}$$

Equation (1) is the resource constraint for the economy including c_t^e, entrepreneurial consumption. In steady state, parameterized to only constitute a small fraction of total consumption, entrepreneurial consumption is defined by equation (3). Total consumption is determined by the standard Euler equation (2). Investment demand is defined by equation (4), (5) and (6). (5) is the log-linearized version of (**??**). While (4) defines the marginal expected gain from holding capital r_t^k, equation (6) establishes the link between investment i_t and asset prices q_t. (7) is a modelling device to allow for delays in investment - in order to obtain humped-shaped output and investment responses observable in the data. (8) is the log-linearized production function. The labour supply is determined by (9). Equation (10), the Phillips Curve, is derived from the staggered price setting formulation of Calvo (1983). (11) and (12) describe the evolution of the state variable. (11) is the standard formulation for capital accumulation. The growth in net worth is defined by (12). The evolution of net worth depends on the external finance premium, the real interest rate and lagged values of net worth. (13), the Fisher equation defines the real interest rate. Equation (14) outlines the monetary policy rule. The central bank adjusts the nominal interest rate to lagged interest rates and inflation. The policy rule was originally proposed in BGG (1999). In the following section results for different policy functions will be presented. Equations (15) and (16) govern the exogenous autoregressive shock processes: technology and government expenditure.

3.1 Parameterization

All parameters are listed in table A1 in the appendix. The parameterization of the model closely follows BGG (1999) and Fukunaga (2002). However some features of the South African economy are introduced.[8] For the steady state ratios of gross domestic expenditure, South African data for the period 1994 - 2007 was adopted. Please see table 2 for a historic overview.

Furthermore developing countries display certain attributes characteristic to them - higher investment volatility being one of them (Aguiar and Gopinath, 2004). To include this feature into the model the steady-state elasticity of $\frac{I}{K}$ to Q, ϕ, is reduced from 0.25 to 0.18. Another typical feature of developing countries is that consumption is more volatile than output. Due to the fact that households in the BBG model are not credit constrained, they are able to smooth consumption and output displays higher variations than consumption. In future research it would be interesting to add this feature to the model economy to better match empirical findings. Another key variable is the leverage ratio in steady state. BGG (1999) and Fukunaga (2002) use a value of 2 implying a leverage ratio of 0.5. Jansen (2004) finds that for industrial companies listed on the Johannesburg Stock Exchange (JSE) the ratio of equity in relation to total balance sheet approximately conforms to the values chosen by BGG (1999). In addition, the steady-state elasticity ψ of the external finance premium to the leverage ratio is set at 0.05. The parameter can be interpreted as an indicator for bank lending behavior. A more sensitive external finance premium to leverages ratios can indicate a reduced willingness by banks to extend credit (Hall and Wetherilt, 2002). Simulation results will be presented below where the values of χ, ψ and ϕ are varied.

In respect to the remaining parameters the paper closely follows BGG (1999). The quarterly discount rate β is set at 0.99, the depreciation rate is 0.025 per quarter and the probability of price change $(1-\theta)$ is set at 0.25, that is prices will change once a year. The elasticity of labor supply to wage alternations is set to 3.

3.2 Some Initial Observations - Monetary, Demand and Technology Shock

To further familiarize the reader with the model, the subsequent section presents the impulse response functions as well as statistical moments for the model with three exogenous shocks - monetary policy, demand and technology shock.

Table (1) presents standard deviations relative to trend of final consumption, output, investment, inflation and nominal interest rates found in South African

[8] Developing a model with the Financial Accelerator fully calibrated for South African data would necessitate additional research beyond the scope of this dissertation.

Table 1: Historical and simulated Standard Errors

	1960 – 2008	1960 – 1993	1994 – 2008	Model
Final Consumption*	3.49%	3.64%	3.15%	2.33
GDP*	2.88%	3.12%	2.26%	2.35
Capital Formation*	6.46%	7.30%	3.90%	6.43

data[9] and compare it with the one generated by the model (in the last column). Two observations can be made. First, as described in the literature, investment and consumption display higher volatility relative to trend than output (Du Plessis, 2006). Second, in the past decade the volatility of macroeconomic aggregates has been significantly reduced in South Africa. In comparison, table 4 provides a selective overview of the statistical moments of the simulated model with three exogenous shocks. We calibrated the model such that it matches average historical data between 1960 - 2008, in particular it displays a similar degree of investment volatility and output volatility observed in the data.

Figure 1 to 3 present impulse response functions for a monetary, demand and technology shock, respectively. Each figure compares the model results with the financial accelerator activated to the case when it is "turned off". Deactivation of the financial accelerator implies that the external finance premium is no longer sensitive to movements in net worth, that is ψ is set equal to zero.

[Figures 1, 2, 3, here]

In response to a 1 percent nominal interest rate increase, the nominal and real interest rate rise in unison due to price stickiness - causing a fall in investment demand. The steep fall in investment demand necessitates a fall in the price of capital and therefore a reduction in net worth. Given the financial accelerator, the fall in net worth forces an increase in the external finance premium and a further reduction in investment demand. Output only slowly reverts back to steady state and remains below steady state after 12 quarters. The persistence of the monetary shock becomes particularly apparent when comparing the results to the non-financial accelerator model - highlighting the fact that the financial accelerator not only magnifies any shock but also propagates its effects. Net worth, investment and the external finance premium also exhibit relatively larger variances.

Similar patterns can be observed for the demand shock in figure 2. However the technology shock in figure 3 is not well represented by the model. Contrary to expectations, a positive technology shock reduces output relative to when the financial accelerator is deactivated. Net worth is only marginally affected and does not substantially move the external finance premium downwards, quite the opposite, the premium is slightly positive. Only once, the persistence of the shock is increased beyond 0.95, that is the shock becomes virtually permanent, does the financial accelerator the expected dynamics. Figure 4 displays the results for $\rho_a = 0.99$. In contrast

[9] South African Reserve bank data at constant 1995 prices. All variables are in real per capita terms; all variables are in logarithms and have been detrended by the Hodrick-Prescott filter

to figure 3 increases in net worth moves the external finance premium downwards. The decrease in funding cost causes a stronger response in investment and eventually leads to higher output levels.

However, when comparing across the three shocks, the increase in the persistence of the technology shock would imply that over 90% of output and inflation deviations from steady state are due to the technology shock, that is the technology would dominate the other two shocks. Therefore below we will proceed with $\rho_a = 0.87$. The proper capturing of the technology shock in the model demands further research.

To consider how finance affect the economiy in the model we consider different parmetrizations of the financial channels of trasmissions.

Firstly we are interested in evaluating the effect of an increase of the leverage ratio χ from 2 to 3, implying a decrease in the equity share from one-half to one-third. As can be seen in figure 5 the higher leverage ratio magnifies the impact of the financial accelerator. Investment and net worth fall much more sharply and the external finance premium rises decidedly steeper in response to the monetary shock. As a consequence capital stock and output are relatively more depressed. This result is in line with historical experience

[figure 4 here]

Secondly, we consider an upwards shift of the steady-state elasticity of the external finance premium to leverage ψ, to be interpreted as a re-assessment of risk and a higher risk aversion by financial investors (Hall and Wetherilt, 2002). The unwillingness of investors to lend at a given leverage ratio propels the price of capital, that is the external finance premium, upwards. Figure 6 seems to support such an interpretation. The external finance premium is dislocated more than three-times to the 1 percent interest rate shock. As expected, net worth, investment and ultimately output are negatively affected.

[figure 5 here]

4 South Africa - Weathering the Storm

Having presented the log-linearized model above, we now turn to potential ways of how recent events in international and domestic market can be incorporated into the model. Especially, we will contrast various monetary policy functions in respect to which minimizes a quadratic welfare-loss function and assess to what extent fiscal policy might stabilize the South African economy.

4.1 How does it affect South Africa?

Developments in 2007 and 2008 in U.S. financial markets constituted large, exogenous shocks for South Africa. Arguably, global financial and economic conditions can be represented by three independent shocks.

First, uncertainty in financial markets and risk aversion of investors has led to a sustained increase in external finance cost. Thus it can be argued that South Africa is subjected to a sustained increase in the external finance premium.

Secondly, South Africa is faced with a large reduction in external demand. Global economic growth has come to virtual standstill thus reversing recent trends in commodity prices. Platinum prices, for instance, fell from a record high of $ 2,027 per fine ounce in May 2008 to $899 per fine ounce in October 2008. But it is not only the mining sector, constituting over fifty percent of exports, that has been affected. The manufacturing sector has also seen a slow down. The December-issue of the South African Quarterly Bulletin notices that sluggish growth was recorded for motor vehicles and transport equipment, while exported machinery and electrical equipment receded (SARB 2008).

And finally, in line with the fall in commodity prices and reduced profitability outlook of resource-companies as well as the overall slowing of economic activity, the JSE has retreated from recent record levels. The total market capitalization of the JSE declined from R6.3 trillion in May 2008 to R4.4 trillion in October 2008 - a decrease of R1.9trillion or, equivalently, a wealth reduction of approximately seventy percent of the South African nominal GDP (SARB 2008).

In order to integrate the three different shocks into the model, equations (1) (5) and (12) were alternated in the following way:

$$n_t = \frac{\gamma RK}{N}(r_t^k - r_t) + r_t + n_{t-1} - \xi_t \tag{17}$$

$$r_{t+1}^k = r_t - \psi[n_t - (q_t + k_t)] + \Omega_t \tag{18}$$

$$y_t = \frac{C}{Y}c_t + \frac{G}{Y}g_t + \frac{I}{Y}i_t + \frac{C^e}{Y}c_t^e - \Gamma_t \tag{19}$$

$$\xi_t = \rho_\xi \xi_{t-1} + e_t^\xi, \qquad e_t^\xi \sim N(0, \sigma_\xi^2) \tag{20}$$

$$\Omega_t = \rho_\Omega \Omega_{t-1} + e_t^\Omega, \qquad e_t^\Omega \sim N(0, \sigma_\Omega^2) \tag{21}$$

$$\Gamma_t = \rho_\Gamma \Gamma_{t-1} + e_t^\Gamma, \qquad e_t^\Gamma \sim N(0, \sigma_\Gamma^2) \tag{22}$$

Net worth n_t,the external finance premium $(r_{t+1}^k - r_t)$ and output y_t are now subject to the autoregressive shock processes ξ_t, Ω_t and Γ_t, respectively. The calibration can be found in the Appendix. Figure 6 - 8 present the simulation results.

[figure 6, 7, 8, here]

The financial accelerator works in the by now familiar way. In response to the exogenous reduction in net worth, investment declines and the external finance premium rises. Thus capital expenditure is reduced over an extended time period and output remains well below steady-state after twelve quarters.

Similar results are obtained for the shock of the external finance premium in Figure 7, albeit the output response is weaker in comparison to the net worth shock. The two shocks capture and illustrate the effects a change in market sentiments might have. Thereby it allows us to gain an understanding of how financial market conditions may feedback to the real economy. "Risk aversion" and a "Flight to Safety" thus may have significant output implications beyond what can be found in the literature on currency crisis and sudden stops (Edwards, 2004). As an observation on the recent crisis, these results also imply that the U.S. and to a lesser extent the Euro-area and Japan, have a tremendous advantage in that they are perceived to be "safe havens", which in itself is almost absurd since the financial crisis started and continues in these very same countries. The "flight to safety" and especially the flight into treasury bills lowers the external finance premium for these foreign governments and economies, thereby stimulating investment demand and setting the stage for a comparatively faster recovery.

Figure 8 presents the impulse response functions for the demand shock. The decline in output leads to lower inflation and a reduction in the nominal interest rate. The external finance premium jumps upwards as net worth declines and negatively affects investment for an extended time period. However one could argue whether the feedback from the real economy to the financial sector, that is to net worth and external finance premium, is strong enough. Essentially an empirical question, future research should determine the elasticities between the two spheres of the economy. Having presented how the financial crisis might affect South Africa, we now turn to the question of optimal monetary policy.

4.2 Optimal Monetary Policy

The optimality of monetary policy is evaluated below with a quadratic welfare-loss function of the following form :

$$\min W = \sum_{i=1}^{t} \beta^t (y_t^2 + \pi_t^2) \qquad (t = 1, ..., 12) \tag{23}$$

Deviations of output and inflation from steady state are sub-optimal and constitute welfare reductions. Thus the optimal monetary policy seeks to minimize the welfare-loss function.

However, while the goal of monetary policy, the stabilization of output and inflation is widely agreed on, the question of how to achieve these goals in the presence of large asset price movements is hotly debated. One view, promoted by Bernanke and Gertler (2001) and others, is that "changes in asset prices should affect monetary policy only to the extent that they affect the central bank's forecast of inflation". They argue that the recent success of Central Banks in containing inflation lies in the fact that they focus on one single metric only - inflation. Introducing a second target metric, so the argument runs, may for one, introduce public uncertainty and, secondly, produce perverse outcomes in the sense that an aggressive focus on asset prices may have detrimental inflation and output implications (Bernanke and Gertler, 2000).

An opposing view, put forward by Cecchetti et al. (2000), Borio (2005) and Borio and Lowe (2002), is that financial imbalances can build up in a low inflationary

Table 2: Welfare Losses for different Monetary Policy Functions

MP Rules			Welfare Losses for Specific Shocks				
p	**y**	**q**	**Net worth**	**Ext. Fin. Pre**	**Demand**	**Tech**	**Total**
1.5	0.5	0	1.159	0.217	0.924	4.507	**7.008**
0.8	1.5	0	4.779	0.296	**0.557**	**3.563**	9.252
1.1	0	1	0.666	**0.093**	3.226	6.119	10.373
1.5	0	0.5	**0.659**	0.117	3.312	7.580	12.014

environment and the fall-outs from an disorderly unwinding of these imbalances can threaten financial and monetary stability. In light of large potential welfare-losses they argue for a policy of "leaning against the wind", that is the Central Bank should move interest rates in response to bubble-processes in asset markets.

Guided by this literature, we tested various specifications of the Central Bank reaction function. Equation (24) outlines the most general case in the range of all possible functions:

$$r_t^n = \rho r_{t-1}^n + (1 - \rho_n)(\nu_\pi \pi_{t-1} + \nu_y y_t + \nu_q q_t) \tag{24}$$

According to equation (24) the Reserve Bank smooths interest rates and is guided by movements in past inflation π_{t-1}, current output y_t and current capital prices q_t.

Table presents the simulation results for different policy functions. Column one provides an index for simplified referencing. The columns two to five specify the respective policy function. Columns six to eleven indicate the innovation process and the corresponding welfare-loss, while the column "Total Sum" adds the welfare-losses across the six exogenous shocks. Numbers highlighted in bold correspond to the lowest welfare-loss for the relevant shock.

In the case of innovations directly related to the financial accelerator, such as the net worth or external finance premium shock, policy functions with a strong emphasis on the capital price component perform well; in particular a combination of past inflation with $\nu_\pi = 1.5$ (1.1) and current capital prices $\nu_q = 0.5(1)$ do best.

In regards to all other shocks the policy function with parameters $\nu_\pi = 0.8$ and $\nu_y = 1.5$ stabilizes output and inflation most. As expected, the large emphasis on output controls the demand side of the economy very well. However the monetary side is also well controlled for the specification $\nu_\pi = 0.8$ and $\nu_y = 1.5$. In contrast policy functions emphasizing capital prices do comparatively badly in responding to interest rate movements.

The finding that policy functions including capital prices do relatively well in response to financial market dislocations lends some support to the argument of Cecchetti et al. (2000) and others. Nevertheless at the same time, the results highlight the danger of a one-sided policy approach. The total welfare-losses of asset-targeting policy functions, which do best for the two financial market shocks, are almost twice as large as for the typical Taylor-rule with $\nu_\pi = 1.5$ and $\nu_y = 0.5$

Overall the Taylor-rule specification performs best. Although the rule does not excel in stabilizing any specific shock, on average it has the most stabilizing effect. Thus a Central Bank operating under a high degree of uncertainty whether it does

Table 3: Welfare Losses for different Monetary Policy Functions (according to equation (25))

MP Rules			Welfare Losses for Specific Shocks				
p	**y**	**q**	**Net Worth**	**Ext. Fin. Pre**	**Demand**	**Tech**	**Total**
1.5	0.5	0	**1.849**	0.260	0.981	5.419	8.708
1.5	1.5	0.5	3.221	0.154	**0.693**	**4.586**	8.707
1.5	1	0.5	2.699	0.144	0.889	4.861	**8.666**
1.5	1.5	0.5	2.232	**0.126**	1.576	5.502	9.528

observe an asset bubble or not, can always resort to the familiar Taylor-rule policy function and will still manage to perform best on average. Interestingly enough, when looking only at the three first shocks, that is the current macro-economic environment South Africa is faced with, the Taylor-rule still outperforms reaction functions that target asset prices. This is due to the inability of policy functions including capital prices to coherently respond to demand side shocks.

To test the robustness of these results, we modify equation (**??**), as seen below, to magnify the feedback from the real economy to the financial market. Subsequently we re-run the five best performing policy functions and, again, calculate the welfare-loss function.

$$r_t^k = (1-\upsilon)((2) * y_t - x_t - k_{t-1}) + \upsilon q_t - q_{t-1} \tag{25}$$

The results are presented in Table 3.

In comparison to Table 2 the net worth and technology shock display a higher volatility. Interestingly, overall the Taylor-rule is no longer the best performing policy function. Targeting more directly income and asset prices ($\nu_\pi = 1.5$, $\nu_y = 1.5$ and $\nu_q = 0.5$) has now the lowest welfare loss. These results indicate that the appropriateness of a policy function may hinge on of how strong the feedback effects are between the real and financial economy. Essentially an empirical question, the Central Bank may need to determine whether shocks in different asset classes have varying implications for the real economy. Due to specific distributions and sizes of different asset classes the Central Bank may conclude, that it is welfare-enhancing to include asset pricing into its policy function for certain asset classes. Given the assumption that large financial imbalances have built up within the financial system that have strong real economy effects, it may be appropriate to target asset prices. These findings demand further research.

4.3 What role can Fiscal Policy play?

In recent month Central Banks around the world have slashed nominal interest rates in response to the crisis and are fast approaching the zero interest rate boundary. In the case of the U.S. the Federal Reserve fund rate is already near zero. Thus governments are increasingly turning to fiscal stimulus packages to revive their economies. But what impact can fiscal policy have in a complex economy with financial markets? Especially how can fiscal policy be supportive if the shock originates in the financial markets instead of the real side of the economy?

In his book "Stabilizing an Unstable Economy" Hyman Minsky explicitly integrates financial markets into his economic theory and argues that there are three distinct channels of fiscal policy: the income and employment, the budget and the portfolio channel (Minsky, 1986).

The first is the standard textbook income and employment channel. The government demands goods and service and through multiplier effects stimulates economic activity. In Keynesian tradition, the channel implies that, assuming the amounts employed are large enough, the government can spend its way out of the crisis through debt finance.

The second channel, the budget effect, recognizes that all financial flows in the economy must equalize to zero. Assuming the government expands expenditure beyond tax receipts, the budget deficit must show up as a surplus in either the household or the private sector.

Minsky (1986) shows that the U.S. fiscal expansion during the downturn of 1974/1975 had a two-fold effect.

On the one hand, transfer payments, such as unemployment insurance, to the household sector stabilized disposable income and increased the saving rate of the household sector. In fact, for the U.S. downturn of 1973-1975 the total increase in disposable personal income was $247.8 billion, of which 26.3 percent can be accounted for by transfer payments. The jump of the household saving rate, in essence an accumulation of household liquidity, will eventually lead to an increase in consumer spending with a lag.

On the other hand, the budget deficit showed up as an improvement of corporate cash flows. Considering the pyramid of debt the economy is built on, the positive shock to profitability ensured that companies did not have to renege on financial agreements. It validated outstanding debt and thereby helped to avoid a spiral of declining asset prices.

Finally, sizeable fiscal deficits imply that the government has to issue new government bonds. The injection of large amounts of secure and liquid government debt into the financial market leads to a shift in the portfolio of market participants, the portfolio effect. As banks and businesses shift towards government debt, their balance sheets become more liquid and the risk of default decreases, again avoiding a disruptive sale of assets (Minksy, 1986).

An important point Minsky makes when comparing the downturn of 1973 to 1975 to earlier recessions is that the size of government has significantly increased. Constituting approximately 24 percent of Gross National Product, policies taken by the public sector have a large impact on the economy.

In summary, fiscal policies taken by big government may return the economy onto an expansionary path by stimulating aggregate demand as well as by impacting positively on household and corporate balance sheets.

Before discussing the potential effects an expansionary fiscal policy might have for South Africa, one has to point out that the country is in the fortunate position that a lot of infrastructure projects are already planned and are waiting to be executed. Thus the leads and lags of fiscal policy would be decidedly shorter.

To simulate the impact of an expansionary fiscal policy in the model, we endogenize

Table 4: Welfare Losses for Government Policy with different expenditure functions

FP Rule		Welfare Losses for Specific Shocks				
q	**y**	**NWorth**	**Ex Fin Pre**	**Demand**	**Tech**	**Total**
0	4.5	0.491	**0.094**	**0.492**	3.047	**4.235**
4.5	4.5	**0.290**	0.145	0.871	**3.220**	4.589

government expenditure, see equation (26) below. The fiscal stimulus is increased in response to movements in capital prices and output.

$$g_t = -\Theta q_t - \Lambda y_t \tag{26}$$

The inclusion of real as well as financial variables should significantly dampen the response of the economy to exogenous shocks.

Given the structure of the model, we will not analyze the impact of big versus small government, but instead analyze the macroeconomic performance of the economy with a highly active fiscal policy.

To serve as an example, figure 9 compares the response of the economy to a net worth shock with and without an active fiscal policy. Equation (26) is parameterized with $\Theta = \Lambda = 1.5$. Below we will present results for different parameterizations.

[Figure 9 here]

The response of the financial accelerator to the expansionary fiscal policy is quite weak. Net worth and the external finance premium do move in the expected direction, although, they are not significant enough to dislocate investment. Nevertheless, the expansion of government expenditure supports the stabilization of output.

Table 4 presents the welfare-losses for different parameterizations of the model given the Taylor-rule as the monetary policy function. We find that a strong focus on output deviations significantly reduces welfare losses, while an inclusion of capital prices works in the opposite direction. In the case of an innovation in net worth, a government expenditure function including capital prices does stabilize the economy, however, overall it is destabilizing.

Although the findings are broadly in line with the literature, their applicability is limited. Given the fact, that the model does not include a debt-accumulation-mechanism, questions of relative efficiency can not be answered. Ponzi-game schemes are not excluded, thus in principle any shock could be stabilized if the government increases spending far enough. An extension of the model to include the government balance sheet might be an option for future research.

5 Conclusion

Turbulent times continue. At the beginning of February 2009, the IMF revised its estimates of total global financial losses upwards by $800 billion, bringing it up to $2.2 trillion, while at the same time revising GDP growth estimates for 2009 sharply downwards (IMF, 2009). South Africa being somewhat protected from the turmoils in the U.S. financial markets has until recently continued to sustain high economic growth. However since May 2008 GDP growth in Africa's largest economy has slowed.

This paper used the Bernanke-Gertler-Gilchrist "financial accelerator" model to study current economic conditions in South Africa. Emphasizing the implications financial market conditions may have for the real economy, we studied the question of optimal monetary and fiscal policy.

We found that the typical Taylor-rule is the most robust and welfare-loss minimizing policy function. Asset price targeting performs well in response to shocks originating in the financial market, but does badly in stabilizing monetary and demand shocks. Nevertheless, the finding that the Taylor-rule outperforms any other monetary policy regime may hinge on the degree of interconnectivity between the financial and real economy. Assuming a high degree of integration between the two sectors of the economy and thus strong feedback effects, there might be some welfare gains in including asset price targeting into the policy function.

These findings neccessitate further research. It may prove fruitful to empirically explore the links between the real economy and financial markets in South Africa. Such a study should aim to establish the extent to which financial markets empirically impact the real economy. It would also be interesting to amend the model to allow for debt accumulation in order to study efficiency gains of fiscal policy. A third option could involve extending the model to an open economy model and precisely calibrate it for South Africa.

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APPENDICES

Figure 1 - Benchmark Model - Monetary Policy shock

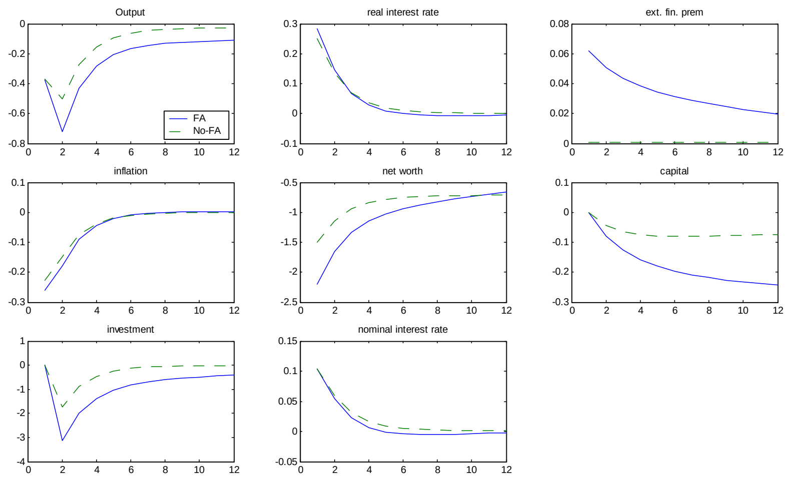


Figure 2 - Benchmark Model - Demand shock

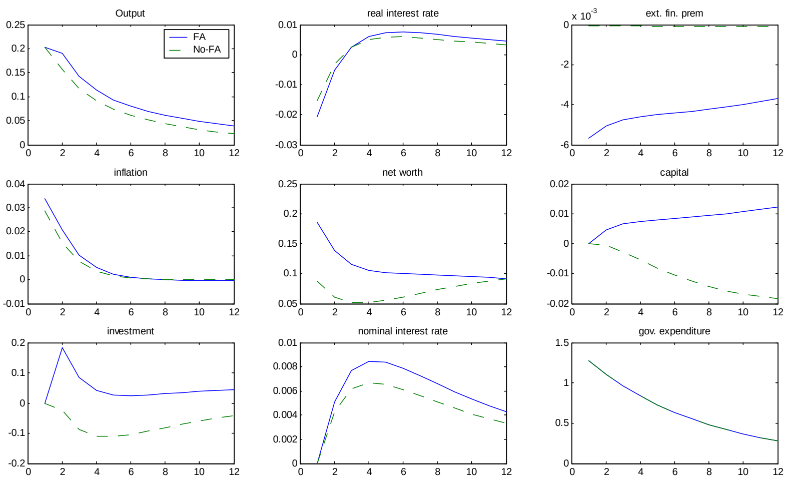


Figure 3 - Benchmark Model - Technology shock

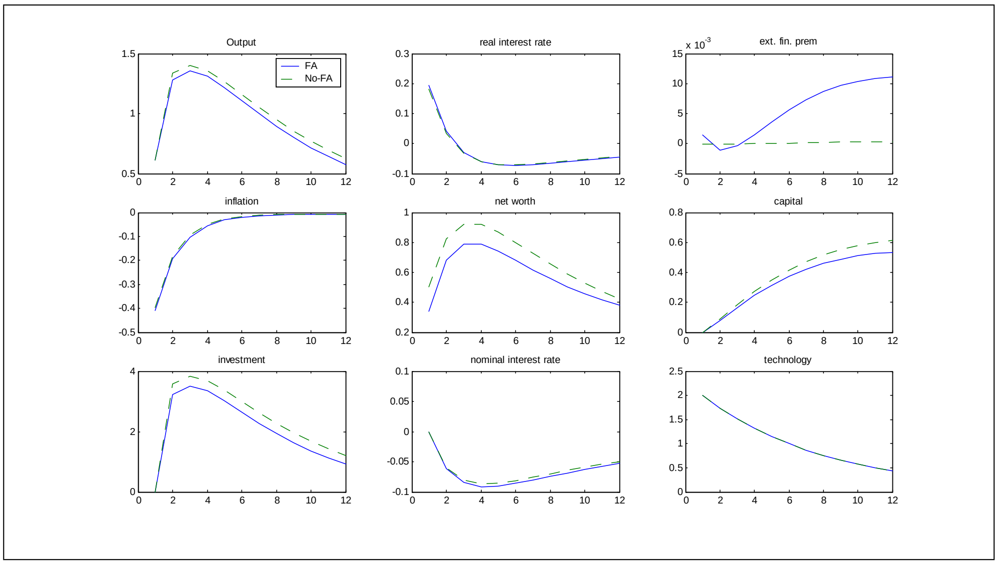
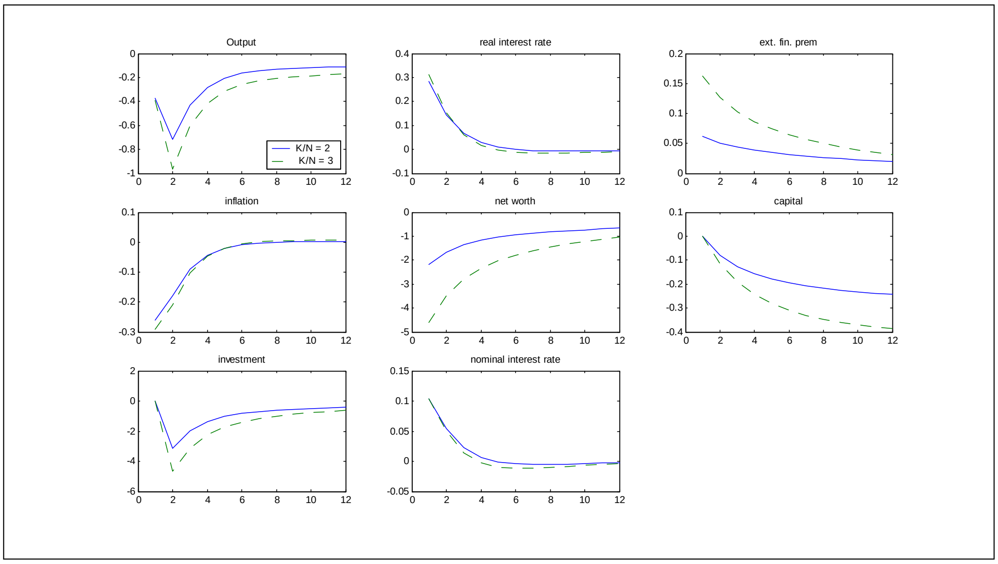
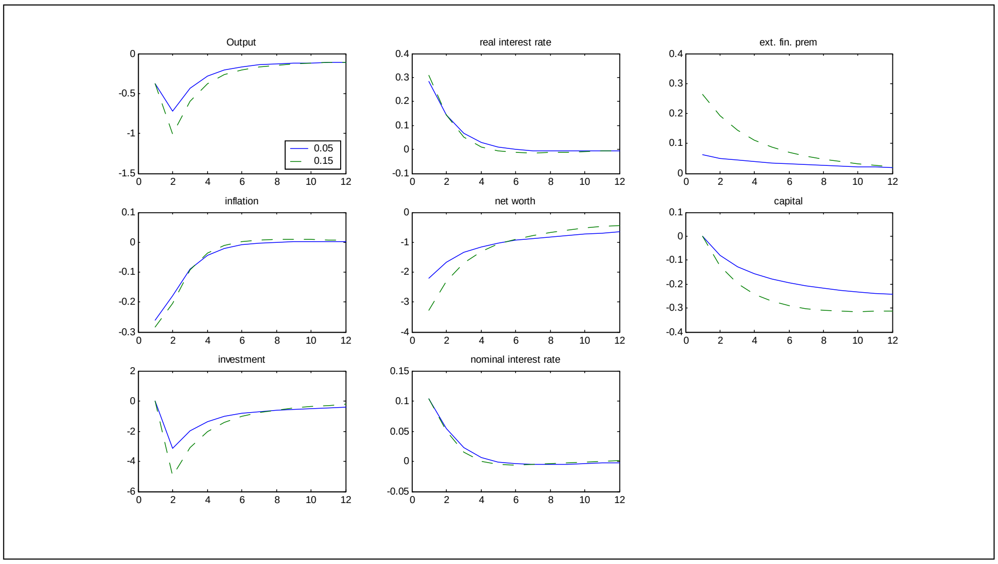

Output
FA
No-FA
real interest rate
ext. fin. prem
x 10^-3
inflation
net worth
capital
investment
nominal interest rate
technology

Figure 4 - Evaluation of varying the parameter: χ[1]



[1]steady state leverage ratio

Figure 5 - Evaluation of varying the parameter: ψ[1]



[1]steady state elasticity of the external finance premium to leverage

Figure 6 - A Net worth shock

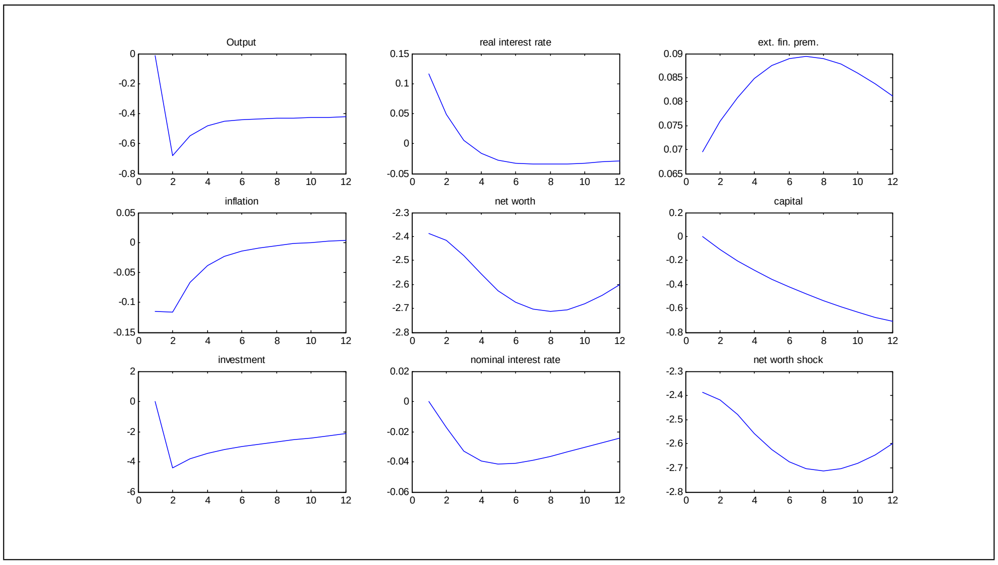


Figure 7 - A shock to the external finance premium

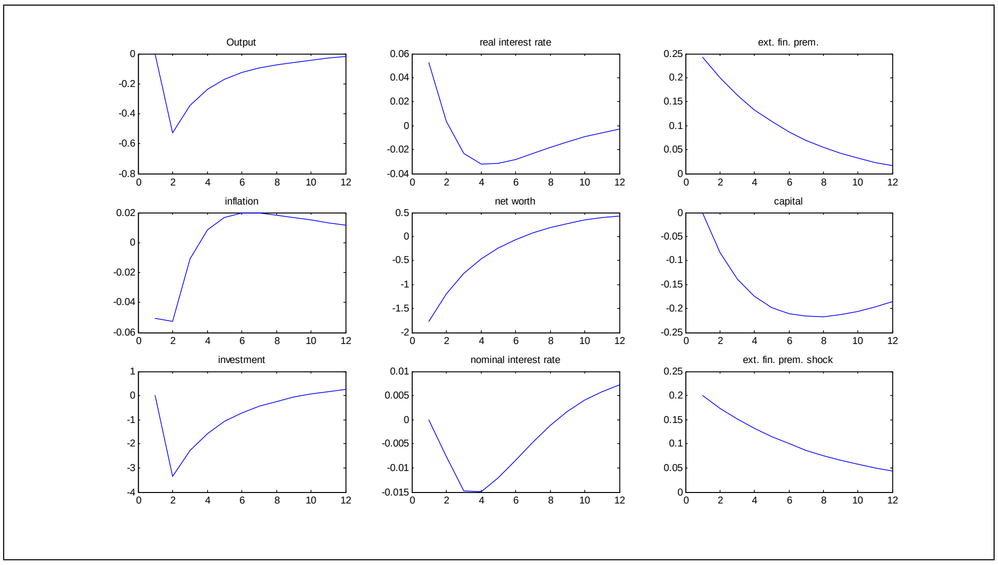


Figure 8 - A demand shock

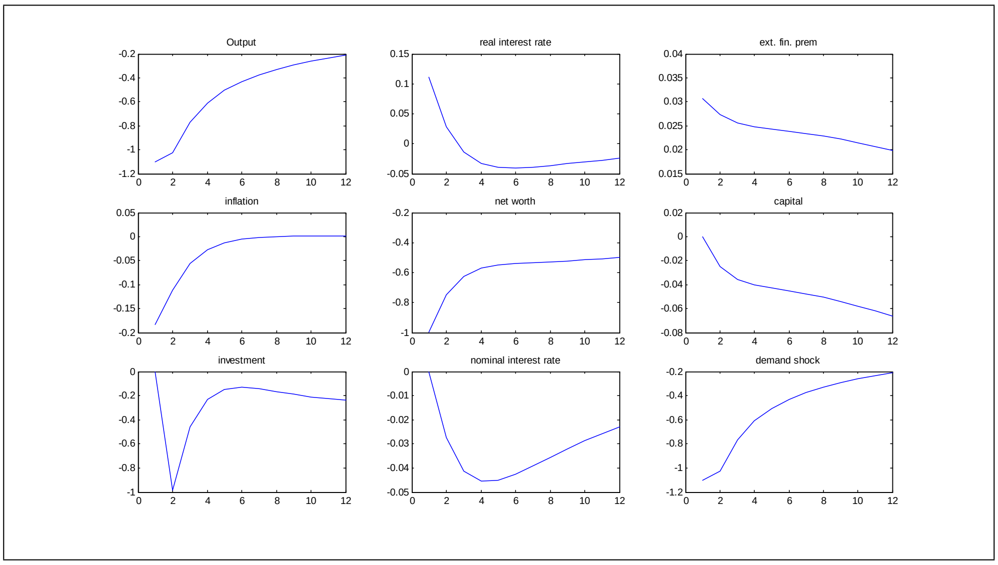
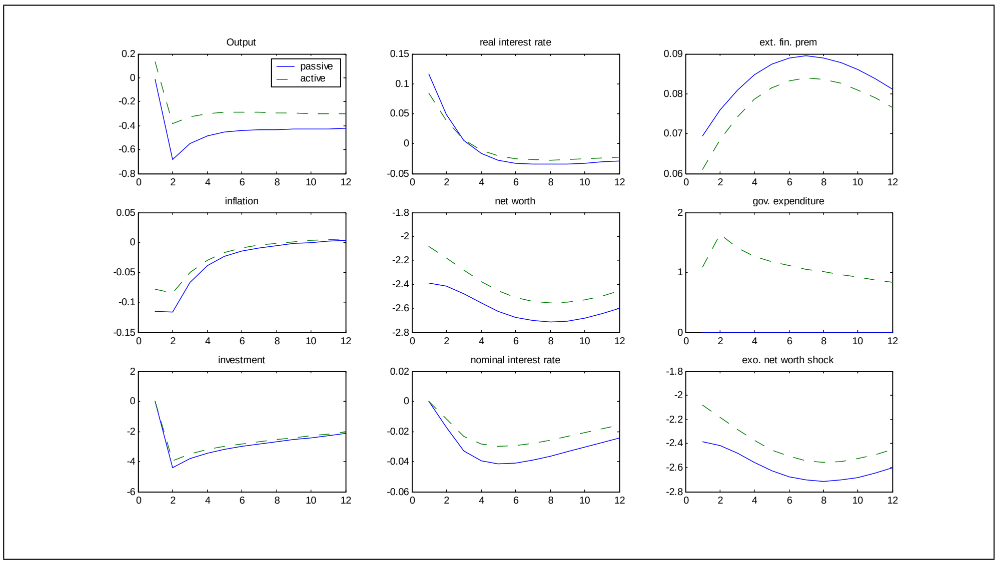


Figure 9 - Net Worth Shock - Active vs. Passive Government



List of Variables

y_t	output	π_t	inflation
c_t	consumption	c_t^e	Entrepreneurial consumption
i_t	investment	r_t^n	nominal interest rate
in_t	delayed investment	r_t^k	real return on capital
q_t	price of capital	r_t	real risk-free interest rate
n_t	net worth	x_t	marginal cost
k_t	capital	h_t	labour input hours
g_t	government	a_t	technology
n_t^e	shock to net worth		
π_t^e	shock to inflation		

Calibration

$\frac{C}{Y}$	0.632	steady-state consumption share in GDP
$\frac{C^e}{Y}$	0.01	steady-state consumption share of entrepreneurs in GDP
$\frac{I}{Y}$	0.169	steady-state investment share in GDP
$\frac{G}{Y}$	0.189	steady-state investment share in GDP
υ	0.955	parameter on marginal product in investment demand
ψ	0.05	steady-state elasticity of ext. fin. prem. to leverage
α	0.35	capital share
χ	2.0	steady state leverage ratio
ϕ	0.18	steady-state elasticity of $\frac{I}{K}$ to Q
γ	0.9728	survival rate of enterpreneurs
η_h	3	elasticity of labour supply to wages
σ	1	consumption elasticity of substitution
δ	0.025	quartely depreciation rate
β	0.99	quartely discount factor
θ	0.75	probability of price change
λ	0.08	$(\frac{1-\theta}{\theta})(1-\theta\beta)$
ρ	0.90	parameter for interest rate smooting in policy rule
ν_p	1.5	parameter in monetary policy rule for price level
χ	2	steady-state ratio of capital to net worth ($=\frac{K}{N}$)
ψ	0.05	steady-state elasticity of the external finance premium to χ
ϕ	0.18	steady-state elasticity of $\frac{I}{K}$ to Q
ρ_a	0.87	AR(1) parameter on technology shock
ρ_g	0.87	AR(1) parameter on government expenditure shock
ρ_Ω	0.87	AR(1) parameter on ext. fin. premium shock
ρ_ξ	0.87	AR(1) parameter on net worth shock
ρ_Γ	0.87	AR(1) parameter on output shock
σ_a	2.0	standard deviation of the technology shock
σ_g	1.275	standard deviation of the government expenditure shock
σ_n	0.104	standard deviation of the monetary policy shock
σ_Ω	0.4	standard deviation of the net worth shock
σ_ξ	0.2	standard deviation of the ext. fin. premium shock
σ_Γ	1.3	standard deviation of the output shock

[1]numbers in bold represent the lowest value for the respective shock
[2] for all policy functions $\rho = 0.9$