A MODEL OF FINANCIAL SHOCKS AT BANK AND INTERBANK OF IRAN (DSGE)

Abbas Shakeri,
Azam Ahmadian
Professor of Faculty of Economy at Allame TabaTabaee University, Iran
PHD. Student of Faculty of Economy at Allame TabaTabaee University, Iran

Abstract
This paper proposes a fully micro-founded framework that incorporates optimizing banks, into a DSGE model, and evaluates the role of banks and financial shocks in the Iranian business cycles. We assume banks that offer different banking services and interact in an interbank market. Loans are produced using interbank borrowing and drposit. Banks have monopoly power, but cannot set nominal deposit and prime lending rates. The model also includes financial and unconventional monetary policy shocks. The main findings are that: (1) The model captures the key features of the Iranian economy; (2) bank behavior substantially affects credit supply conditions and the transmission of different shocks; (3) financial shocks have significant effects on the Iranian business cycle fluctuations.
Key words: banks, Interbank market, Financial shocks, monetary policy
JEL Classification: E12, E32, E37, E44, G21, G33

1. Introduction

The ongoing global financial crisis underscores the need to develop DSGE models with real financial linkages and an active banking sector. Such a model would allow an empirical evaluation of banks' role and behavior in the transmission and propagation of supply and demand shocks, and an assessment of the importance of financial shocks as a source of business cycles. The banking sector, however, has been ignored in most DSGE models used for policy purposes. Moreover, in the literature, financial frictions are usually modeled on the demand side of the credit market using either the Bernanke, Gertler and Gilchrist (1999) financial accelerator mechanism (BGG, hereafter) or the Iacovello (2005) framework In light of the ongoing financial crisis, real financial linkages have become the focus of attention.

This paper proposes a micro founded framework that incorporates an active banking sector and a credit market into a DSGE model with a financial accelerator a la BGG (1999). The model is calibrated to the Iranian economy and used to evaluate the role of profit-maximizing banks in business cycles and in the transmission and propagation of shocks to the real economy, to assess the importance of financial shocks in explaining macroeconomic fluctuations, and to examine the potential role of unconventional monetary policies (quantitative and qualitative monetary easing) in offsetting the real impacts of the financial crisis.

The paper is related to the following studies: Iacoviello(2005,2011), Gerali an et al (2010), Smits and Wouters(2007), Dib(2012) De walque(2010) and Giri (2014). Our basic model is based on BGG(1999). The key additions to this model are the Supply side of the credit market and an active banking sector.

This paper explain two Phenonenon. First, Banks confront with various risks because they play an important role in the financing. These risks include first the risk of mismatch between assets and liabilities that they will confront a shortage of liquidity and liquidity risk. Banks when confront with shortage liquidity can borrow from the central bank through the credit lines or other banks that have excess fund. Borrowing from the central bank has inflationary effects while the transfer of surplus funds from institutions with excess liquidity to institutions with liquidity shortage will have not an inflationary effect. second banks have credit risk, because firms default their borrowing of banks.

Interbank market is one component of money market where banks and other credit institutions engage in transactions with each other for short-term financing. This market plays two vital roles in new financial systems. The first and most important role is the central bank leading to intervene actively and effectively in the implementation of monetary policy through interest rates. Second, efficient interbank markets, transfer liquidity satisfactory from financial institutions with surplus funds to institutions with deficit funds.

Second, this paper assumes defaults on banking credit and interbank borrowing. because of relationship with the Banks in interbank market and the real economy, any kind of risk a bank can also transfer to other banks and to the real sector. If Borrowing from the interbank market, which is a type of short-term financing, is defaulted, will reduce the bank's credit rating and its credit strength.

So in this article, the default of banking credit and interbank borrowings designed in the context of dynamic stochastic general equilibrium model to study and analyze the real effects. The overall structure of the paper is as follows. Section 2 presents Methodology. Section 3 gives literature review. Section 4 present the model. The parameter estimation represent at section 5.Section 6 present Impulse-response Function. conclusion has discribed at section 7.

2. Methodology

2.1 Banks and Interbank Markets

Banks are a particular type of economic entity, characterized by the provision of maturity transformation to other agents within the economy. This brings with it a particular kind of risk to which any bank is necessarily exposed. This risk consists of the different maturity profiles of the assets and liabilities in its portfolio, since it is usually not possible to match any sudden outows from deposits with inflows from a portfolio of loans.

The management of this phenomenon is a major part of a bank's business. In order to meet expected withdrawals, some proportion of total deposits is kept in the form of reserves (for example as deposits with central banks) and a stock of liquid short term assets is generally kept on the balance sheet. Since reserves generally earn a much lower return than funds invested in other financial assets or loans, there exists a trade-off between safety and profitability.

Reserves are also used by banks to settle transactions between each other as part of normal business. When a depositor of one bank withdraws funds and uses them in a transaction, a different individual will ultimately deposit them with a (potentially) different bank. This requires a transfer of reserve funds from one bank to another. This type of transfer, of which millions occur on any given day, will affect the reserve holdings of individual banks, but would not affect the aggregate stock of reserves. Apart from transactions between the Treasury and the central bank, there are only two forces which may change this aggregate. The first is obvious: if the depositor withdrew the funds and held them in the form of cash without depositing them, there would be a debit from his banks' reserve account, but no credit to any other bank. The total stock would thus have decreased. Of course, the converse process also occurs on a daily basis.

However, the total stock of reserves does not generally change a great deal, since the popular requirement for physical cash is relatively stable. The other force which may change reserve holding, namely the central bank itself, may be more important in that sense. Modern central banks have three different means of injecting or withdrawing reserves from the system. By far the most commonly used are their open market operations, which are in effect auctions aimed at buying or selling reserve funds in order to change the aggregate.

When a bank finds itself in the difficult position of facing a liquidity shock large enough to prompt an immediate requirement for additional reserves, it may also access discount lending facilities. Since these programs charge interest some margin above policy rates and need for them signals some failure in liquidity management, these emergency facilities are used more rarely.

It should be noted then that the interbank market in which banks trade reserve funds do not affect the aggregate stock of reserves. Instead, they can only serve to help banks in their individual reserve management. This implies that there are two sides to any trade in this market. On one hand, those banks which believe that their depositor's liquidity needs will be low for a given period may choose to reduce their holding of reserves without fully committing to lending the funds as illiquid loans into the real economy. On the other, should a bank's estimation turn out to be incorrect, the difference can be made up quickly within the market by borrowing or lending funds and thus balancing the books. Interbank Markets are then credit markets, in structure somewhat similar to any other such market. Although they are of particular importance to the functioning of the monetary system, in principle lending banks face credit risks not dissimilar to those they face when lending to other types of agents in the economy. Although such risks were previously considered to be very low, the financial crisis of 2007/2008 highlighted that their management can be critical to the funding strategy and indeed survival of a large financial institution.(Weltewitz(2009)).

2.2 Recent Theoretical Developments in the Analysis of Interbank Term Structures

Perhaps the closest paper in intention to the proposed thesis is being developed by Heider, Hoerova & Holthausen (2009), who present a model of an interbank market under adverse selection. In keeping with much of the modelling of banks, some proportion of the market in their model suffers a liquidity shock as impatient consumers withdraw their endowments. Banks must decide whether to invest those endowments in a liquid short-term or asset or a risky, illiquid long term alternative. When they face withdrawals, they must then choose whether to liquidate some of their long-term assets or keep them to maturity and instead secure funding for the meantime from other banks. Due to the difference in riskiness between long-term assets (the precise knowledge of which is private), some banks will be willing to lend, while others become borrowers.

Since those banks with a safer asset are assumed to be able to liquidate it at a lower cost, they are the first ones to do so should the interbank interest rate increase beyond a critical value. This gives rise to an adverse selection problem. The authors derive a risk premium, which increases unequivocally as adverse selection becomes a bigger problem, meaning when the expected riskiness of long-term assets increases. Indeed, the authors show that it is possible that the interbank market breaks down entirely, given sufficiently risky assets.

Although this analysis is close in spirit to the one proposed here, its approach is fundamentally different. In Heider et al.'s (2009) paper, interbank markets are defined to have only one maturity. By using the methodology of game theory, it is proposed in this thesis that asymmetric

information and increased perceived riskiness does in fact have an impact across the entire term structure of contracts traded between banks.

One of the more recent applications of screening methods is presented by Acharya & Viswanathan (2008), who introduce asset pricing in their bidimensional loan contract model in which firms pledge collateral to counteract a moral hazard situation in a credit market. Since the authors introduce a delay in asset liquidation when firms fail to repay loans, liquidity shocks can have a contagion effect in their model. As in Bester (1987), credit rationing would occur in a pooling equilibrium and as a result, pledging cash collateral is an optimal strategy, requiring sales of assets by the borrower. By modelling a market for asset sales the authors establish that by posting collateral, not only is rationing weakened, but asset prices are actually more stable than would have been the case otherwise. The relationship between asset pricing and credit markets is obviously a direct link with the proposed research.

Another model of immediate significance to the research question is presented in Freixas & Jorge (2008), which focuses on modeling interbank markets. In particular it makes use of a screening game to explain why a lending channel of monetary transmission may exist. As such it is a model of the interbank market at the core of the broader term structure. In their model, Freixas & Jorge demonstrate a situation in which banks in interbank markets can be rationed, and thus are unable to provide funds to positive NPV projects in the real economy. The authors produce this result by referring to a chance that banks suffering large liquidity shocks may borrow in order to finance a private benefits project. In the ensuing screening game (in which contracts are defined in terms of an interest rate and loan size), borrowing banks that are undertaking this gamble want to maximize the loan they take out. Indeed it is shown that there exists a loan size above which only such bad banks" would be attracted and lenders would thus have an incentive to decrease the size, resulting in Type I credit rationing.

3 literature review

After the banking crisis at 2007, the importance of relationship banking sector with the real sector was more than ever before. So modeling the transmission of shocks from the banking sector to the real sector was entered into the DSGE models. In the literature on closed economy models, the two main ways in which an active banking system is incorporated into DSGE models with financial friction, is through the external finance premium proposed in Bernanke, Gertler and Gilchrist(BGG, 1999) or through Collateral constraint tied to real estate values for enterpreneurs proposed in Iacoviello(2005). Gerali and et(2010) , Smits and Wouters(2007) designed DSGE models based on the framework of the banking sector, the households and firms. While the banking sector and financial intermediaries receive deposits from households and supply credit to firms. Iacoviello (2011) introduces a banking sector with one bank and focuses on how financial shocks(repayment shocks) affect an economy with patient and impatient households. This group studies have not been addressed the role of the interbank market at the balance sheet shocks transmitted to the real economy. But the effect of shocks as banks ‘default shocks on the real sector has been discussed. The results represent reduced credit supply and thus reduce economic growth.

In another group of studies, have entered interbank at DSGE model. Giri (2014) has considered two types of banks. Banks are faced with shortage liquidity for credit supply and thus borrowing from the interbank market and giving credit to the real sector, the second group of banks that have excess funds, lend to interbank and invest less risky assets such as bonds. results suggest that Credit shocks in the interbank market, has reduced the supply of loans from the banking sector to the real sector of the economy, then has reduced Investment and economic growth.

Another hand the credit shock in the interbank market raise the interest rates of credit at the interbank market.

Dib(2010) While modeling the interbank market, has assumed Banks are related together through the interbank market. Banks financed through borrowing from the interbank market and Capital. Banks have monopoly power to set interest rates on deposits and loans. Combined portfolio and leverage ratios are determined exclusively. They May be related defaulted the borrowings from other banks. In addition shocks starting from the banking system, are also investigated monetary policy shocks. The main findings of the paper show default at the interbank market and reducing the bank's capital has a negative effect on production. Deposits and borrowings from the interbank market affect the supply of credit and production. If increases default of borrowing from other banks in the interbank market, will increase inflation and interest rate policy.

De Walque and et al (2010), are considered Interbank market and regulatory sectors at DSGE. In this model have considered the interaction between the banking system and the real sector of the economy and importance of stabilize the financial sector and regulatory policy. In this model, three assumptions have been considered. First, firms face with default regarding the banks. Second Banks in the interbank market are confront with nonperforming loan. Lack of liquidity at interbank Are compensated with injection liquidity from central bank. Results indicate that non performing at firms Causes nonperforming at interbank, then reduce supply credit and growth but increase inflation.

4 Structure of the model

As pointed out by Giri (2014) , we assume banking sector confront with shortage of liquidity and borrow from interbank. Like De Walque and et al (2010), is assumed banks borrow from interbank, but they don't pay off timely. We suppose nonperforming loan at interbank, because in recent years some banks have not reimburse timely their borrowing from interbank. Continue this process, interbank market can be confront with risk of non-repay fund and due to the significant role of the banking system in financial markets will be Deleterious effects on macroeconomic variables such as output and inflation.

4.1 Households

Households are constrained and decide the amount of consumption, the amount of labor they wish to supply to the production sector and the amount of liquidity according to the following utility function:

$$\sum_{s=0}^{\infty}(\beta^h)^s E_t\left[\frac{(c_t)^{1-\sigma_c}}{1-\sigma_c}-\frac{N_t^{\,1+\sigma_n}{}_t}{1+\sigma_n}+\frac{1}{1-\vartheta}\left(\frac{M^{\,h}{}_t}{P_t}\right)^{1-\vartheta}\right] \quad (1)$$

Where β is the intertemporal discount factor, c_t denotes real consumption, N_t is supply of labor in goods sector, M_t^h is the liquidity at households. σ_c Denotes inverse of the elasticity of intertemporal substitution of consumption, σ_l is inverse of elasticity of intertemporal substitution of labor, ϑ is elasticity of liquidity at household. They are subject to the budget constraint:

$$m_t^h + c_t + d_t + i_t = w_t N_t + (1+r_{t-1}^d)\frac{d_{t-1}}{\pi_t} + r_t^k k_t + \frac{m^{\,h}{}_{t-1}}{\pi_t} + t_t + \frac{\pi_t^f}{p_t} + \frac{\pi_t^b}{p_t} \quad (2)$$

Where w_t is the real wage, t_t is tax, $1+r_t^d$ is the interest rate that household receive from bank, $D_t = \int_0^1 D_{jt} d_t$ is the deposit, π_t^f is profit of production sector and π_t^b is profit of banking. k_t Is Quantity of capital, i_t is investment. Investment is added to capital stock at beginning of period and creates future capital stock. k_{t+1} can obtain:

$$k_{t+1} = (1-\delta)k_t + i_t \qquad (3)$$

Where δ is depreciation rate. Let obtain first order conditions with respect to c_t , N_t , d_t , m_t^h , k_t .

4.2 Final good producer

Final good producer buys intermediate goods that is shown with j, and produce final good by using Dxit- Stieglitz.

$$Y_t = \left(\int_0^1 Y_{jt}^{\left(\frac{\theta-1}{\theta}\right)} d_j \right)^{\frac{\theta}{\theta-1}} \qquad \theta \succ 1 \qquad (4)$$

Where Y_{jt} is intermediate good, θ is constant elasticity of substitution between intermediate goods. Final good producer trying to determine their purchases of intermediate goods according to differ prices so determine the maximum profit. Demand function for differentiated product by any intermediate producer can be obtained:

$$Y_{jt} = \left(\frac{P_{jt}}{P_t} \right)^{-\theta} Y_t \qquad (5)$$

Price for final good is:

$$P_t = (\int_0^1 P_{jt}^{1-\theta} d_j)^{\frac{1}{1-\theta}} \qquad (6)$$

4.3 Intermediate producer

Production sector, characterized by monopolistic competition and Rotenberg pricing, adopts a standard Cobb-Douglas production function with capital k_t , and labor N_t , subject to productivity shocks.

$$Y_{jt} = A_t N_{jt}^{1-\alpha} K_{jt}^{\alpha} \qquad (7)$$

Where $\alpha \in (0,1)$ is elasticity of production with respect to capital.

$$A_t = \rho_A A_{t-1} + (1-\rho_A)\bar{A} + \varepsilon_{A,t} \qquad \rho_A \in (0,1) \text{ و } \varepsilon_{t,A} \approx N\left(0, \sigma_{\varepsilon_{t,A}}\right) \qquad (8)$$

That A_t is technology shock.at the beginning of the every period, Each firm j receives l_{jt} from the bank and is financing γ_t proportion of cost of capital stock and labor. γ_t Is:

$$\gamma_t = (1-\rho_\gamma)\bar{\gamma} + \rho_\gamma \gamma_{t-1} + \varepsilon_{\gamma,t} \qquad \varepsilon_{t,\gamma} \approx N\left(0, \sigma_{\varepsilon_{t,\gamma}}\right) \text{ و } \rho_\gamma \in (0,1) \qquad (9)$$

And l_{jt} is:

$$L_{jt} = \gamma_t \left(P_{jt} r_t^k K_{jt} + P_{jt} W_t N_{jt} \right) \tag{10}$$

They pay r_{jt}^l that it is interest rate of loan. Adjustment costs confront by firms is:

$$PAC_t^j = \frac{\varphi_f}{2} \left(\frac{P_{jt}}{(\bar{\pi}) P_{jt-1}} - 1 \right)^2 Y_t \tag{11}$$

Where $\varphi_f \geq 0$ is adjusted cost parameter, $1+\pi_t$ is inflation rate, Y_t is total production. The marginal cost is:

$$mc_{jt} = \frac{\left[\gamma_t (1+r_t^l) w_t \right]^{1-\alpha} \left(\gamma_t (1+r_t^l) r_t^k \right)^{\alpha}}{\alpha^{\alpha} (1-\alpha)^{1-\alpha} A_t} \tag{12}$$

Firms wish to maximize profit:

$$\pi_{jt}^f = P_{jt} Y_{jt} - P_t mc_t Y_{jt} - PAC_t^j \tag{13}$$

Then obtain first order conditions with respect to, k_{jt}, N_{jt} and P_{jt}.

4.4 Commercial banks

This paper model banks by introducing monopolistic competition, but interest rates of deposit and loan are determined by central bank. They intermediate all the transactions among agents. They collect deposit D_{jt} from household and sets deposit rate r_t^d as a markdown below the loan rate r_t^l .they also claim to firms and receive r_t^l. In each period, firms are faced with nonperforming loan rate α_t^b and banks receive $(1-\alpha_t^b) r_t^l$.

$$\alpha_t^b = \rho_{\alpha b} \alpha_{t-1}^b + (1-\rho_{\alpha b}) \overline{\alpha} + \varepsilon_{t,\alpha b} \qquad \varepsilon_{t,\alpha b} \approx N(0, \sigma_{\alpha b}) \tag{14}$$

That α_t^b is nonperforming loan Shock.

If the bank is faced with a shortage of funds, then borrow the interbank market D_t^i and pay r_t^i . banks set interest rate of interbank by agreement together. r_t^i must be less than of r_t^l and more than of r_t^d .if r_t^i more than of r_t^l they don't want claim to firms, because claim to interbank is riskless and high yield, then decrease claim to firms. Banks need a certain amount of borrowing from interbank and deviation from steady state equilibrium condition makes them quadratic cost:

$$\frac{1}{2} \varphi di \left(\frac{D_t^i}{\bar{D}} - 1 \right)^2$$

Where φdi is quadratic cost parameters. γ_t^i Is non-repayment ratio of due to interbank. If banks cannot repayment timely, they are confronted with cost: $\frac{1}{2} \varphi \gamma di \left[\gamma_t^i d_t^i \right]^2$

$$\gamma_t^i = \rho_\gamma \gamma_{t-1}^i + (1-\rho_\gamma) \overline{\gamma} + \varepsilon_{t,\gamma} \qquad \varepsilon_{t,\alpha b} \approx N(0, \sigma_{\alpha b}) \tag{15}$$

Where equation of above Is non-repayment ratio of due to interbank shock.

Due to interbank is:

$$d_t^i = (d_{t-1}^i)^{\phi_{di}^{di}} (y_t)^{\phi_{di}^{y}} \varepsilon_{t,di} \tag{16}$$

According to the above, profit of banks is:

$$\pi_t^b = (1-\alpha_t^b)(1+r_t^l)L_t - (1+r_t^d)D_t - (1+r_t^i)\gamma_t^i D_t^i \quad (17)$$
$$-\frac{1}{2}\varphi_{di\gamma}\left[(1-\gamma_t^i)D_t^i\right]^2 - \frac{1}{2}\varphi_{di}\left[\frac{D_t^i}{\bar{D}^i}-1\right]^2$$

Balance sheet of banks is:

$$l_t = d_t^i + (1-\eta_t)d_t \quad \textbf{(18)}$$

Where η_t is reserve requirement.

Banks maximize profit subject to d_t^i , l_t^i , d_t .

4.5 Central bank

Central bank is able to set loan interest rate and reserve requirement. Loan Interest rate is:

$$(1+r_t^l) = \left(\frac{1+r_{t-1}^l}{1+\bar{r}^l}\right)^{\rho_r} (\frac{1+\pi_t}{1+\bar{\pi}})^{\rho_\pi} (\frac{y_t}{\bar{y}})^{\rho_y} (\frac{\mu_t}{\bar{\mu}})^{\rho_m} + \varepsilon_{l,t} \quad (19)$$

Where ρ_y , ρ_π , ρ_m , ρ_r are the weights assigned to the output, inflation stabilization, growth of money and interest rate of previous period. Growth rate of money is:

$$\mu_t = \frac{M_t}{M_{t-1}}(\pi_t) \quad (20)$$

Reserve requirement is:

$$\eta_t = \pi_t^{\phi_\eta^\pi} \eta_{t-1}^{\phi_\eta^\eta} \varepsilon_{t,\eta} \quad (21)$$

That ϕ_η^π , ϕ_η^η are weights assigned to inflation rate and reserve requirement at previous period.

4.6 Government and oil sector

Government in financed with tax t_t , oil revenue or_t and money m_t . government expenditure is:

$$g_t = t_t + or_t + m_t - m_{t-1} + \pi_t \quad (22)$$

Tax is:

$$t_t = y_t^{\varphi_t^y} \quad (23)$$

Where is weights of output.oil revenue shock is:

$$or_t = \rho_{or} or_{t-1} + (1-\rho_{or})\bar{or} + \varepsilon_{or,t} \qquad \varepsilon_{t,or} \approx N\left(0, \sigma_{\varepsilon_{t,or}}\right) \quad (24)$$

$\bar{or}$

That is oil revenue at steady state.

4.7 Market Clearing

In equilibrium the output and liquidity market must be clear.

$$y_t = c_t + i_t + g_t + AC_t \quad (25)$$

$$m_t = m_t^h + d_t \quad (26)$$

5 Estimation

5.1 Methodology and Stylized Facts

This paper use Baysian techniques to estimate the structural parameters of this model. First, obtain the first order condition and linear them, which are explained in Appendix A and B. then solve the model. Use the Kalman filter to drive the likelihood function and find the expression of log posterior Kernal. Second, for given papameter values and the given sample of data, maximize the log posterior Kernal using Monte Carlo method such as Metropolis- Hastings algoritm to obtain the posterior distribution. The posterior means of the parameters are then used draw statistical inference on the parameters. The Sample runs 1360-1391.

5.2 Calibrated Parameters

We fix some parameters, because they are either notoriously difficult to estimate or because they are better identified using other information. Adjusted cost of capital, adjusted cost of inflation, Quadratic cost parameter of due to interbank and cost of non repayment are in line with the literature(wooters (2007), Dib(2010), De Walque(2010)). Adjusted cost of capital φ_k is 8.6. adjusted cost of inflation φ_π is 4.26. Quadratic cost parameter of due to interbank φdi and cost of non repayment $\phi di\,\gamma$ are 0.001 and 679.some parameters are Calibrated appropriately of Iranian economy such as ϕ_{di}^{di} and ϕ_{di}^{y} are 0.46 and 0.347.

5.3 Priors and posterior estimates

Priors and posterior estimates are reported in table 1. The methods used to obtain the initial values of the parameters are: Some parameter such as discount rate and depration rate are identified by solving model. the weights assigned to the output, inflation stabilization, growth of money and interest rate of previous period, weights assigned to inflation rate and reserve requirement at previous period and weights of output estimate by Eviews according the their functions.parameters of shocks estimate by Eviews according the following equation:

$$\log(X_t) = c + \rho \log(X_{t-1}) + \varepsilon_{x_t}$$

Where ρ is Autoregressive Cofficient and its standard deviation of ε_{x_t} are used as a standard deviation of variable. productivity shock is selected appropriate structural of model. Distribution of parameters are selected based on the characteristics of parameters and features of the distribution.

Table 1- Prior and Posterior

parameters	Prior distribution		Calibrated from	Posterior distribution	
	Mean	deviation		mean	deviation
σ_c	0.93	0.01	Author calculations	0.9378	0.1
σ_n	0.63	0.01	Author calculations	0.6394	0.05
ϑ	0.67	0.01	Author calculations	0.6697	0.01
δ	0.24	0.01	Solving model	0.06	0.05
θ	4.33	0.01	Mark-up 30%	4.35	0.05
β	0.97	0.01	Solving model	0.9699	0.001
α	0.78	0.01	Author calculations	0.8167	0.05
ρ_A	0.53	0.01	appropriate structural of model	0.5038	0.05
ρ_{or}	0.56	0.01	Author calculations	0.5524	0.05
ρ_{pi}	0.89	0.01	Author calculations	0.6268	0.05
ρ_{mio}	0.82	0.01	Author calculations	0.5606	0.05
ρ_y	0.36	0.01	Author calculations	0.3626	0.03
ρ_{γ^i}	0.65	0.01	Author calculations	0.63	0.05
ϕ_η^π	0.062	0.01	Author calculations	0.059	0.01
ϕ_η^η	0.83	0.01	Author calculations	0.83	0.001

6 Impulse responses

In this section we want to assess whether and how the transmission of Shocks is affected by bank intermediaries in the context of the close economy with interbank. We consider three shocks. The first is financial shock, while the second is monetary policy shock(demand shock). The third is thechnology shock(supply shock).

6.1 Financial shocks

The introduction of the nonperforming loan(npl) shock is to understand the effects of credit losses originating in production sector on business cycles.If subprimers pay back less than expected, bank suffers a loan loss and a reduction in bank capital. As a result, banks either raise new capitl or reduce lending if raising new capital is difficult. Hence, the reduction in bank credit propagates the recessions.

Figure 1:nonperforming loan shock

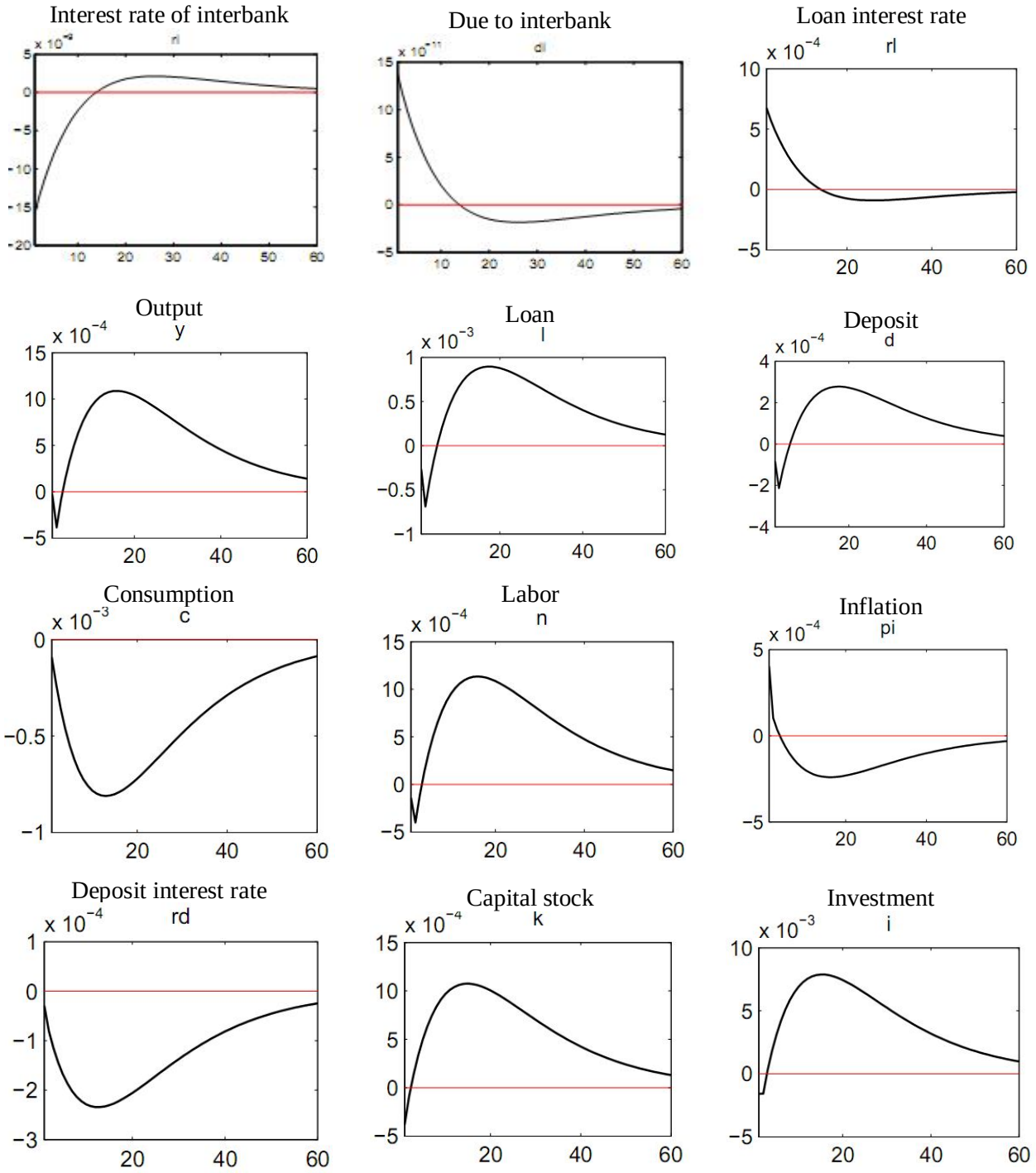


Figure 1 shows the impulse response of Iranian npl shock on the Iranian economy. The consequences of the npl shock on the domestic economy in this model in line with Iacoviello(2011). Npl shock transmits to the economic activity through the following Channels.

First, the npl shock starts with the subprimers who pay banks less than initially agreed on their obligatios, implying that savers transfer wealth toward the borrowers.When facing a positive shock to wealth, households consume More and withdraw deposit from bank. Decline in deposits lead to a large drop in loans to enterpreneurs according to the balance sheet identity. With the reduced loans, enterpreneurs have to Accummulate less capital, so that aggregate output falls, then consumption fall.

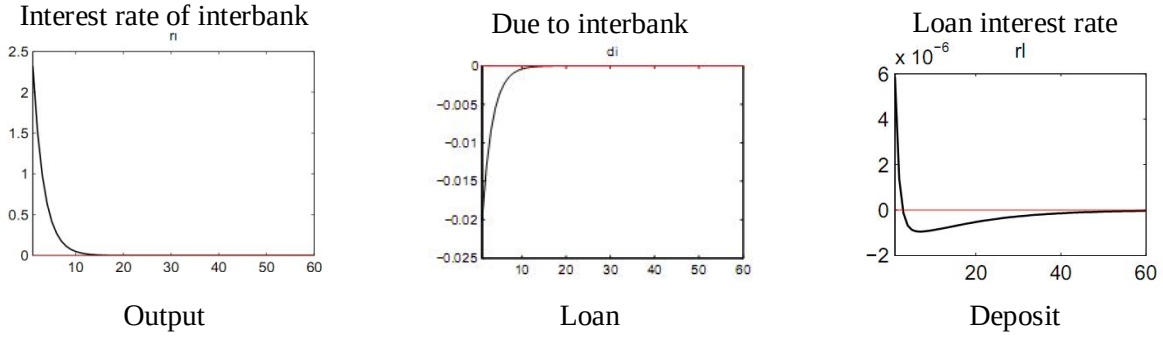
Second, since the labor supply is elastic, the labor demand of households will also respond to fall in output. The households save less.because of the reduced savings, the marginal product of labor falls, then output decline. Inflation raises in response to the drop in output. The central bank reacts to the shock by raising the loan interest rate and banks reduce interbank interest rate.Due to falling at interbank interest rate, rise borrowing from interbank.

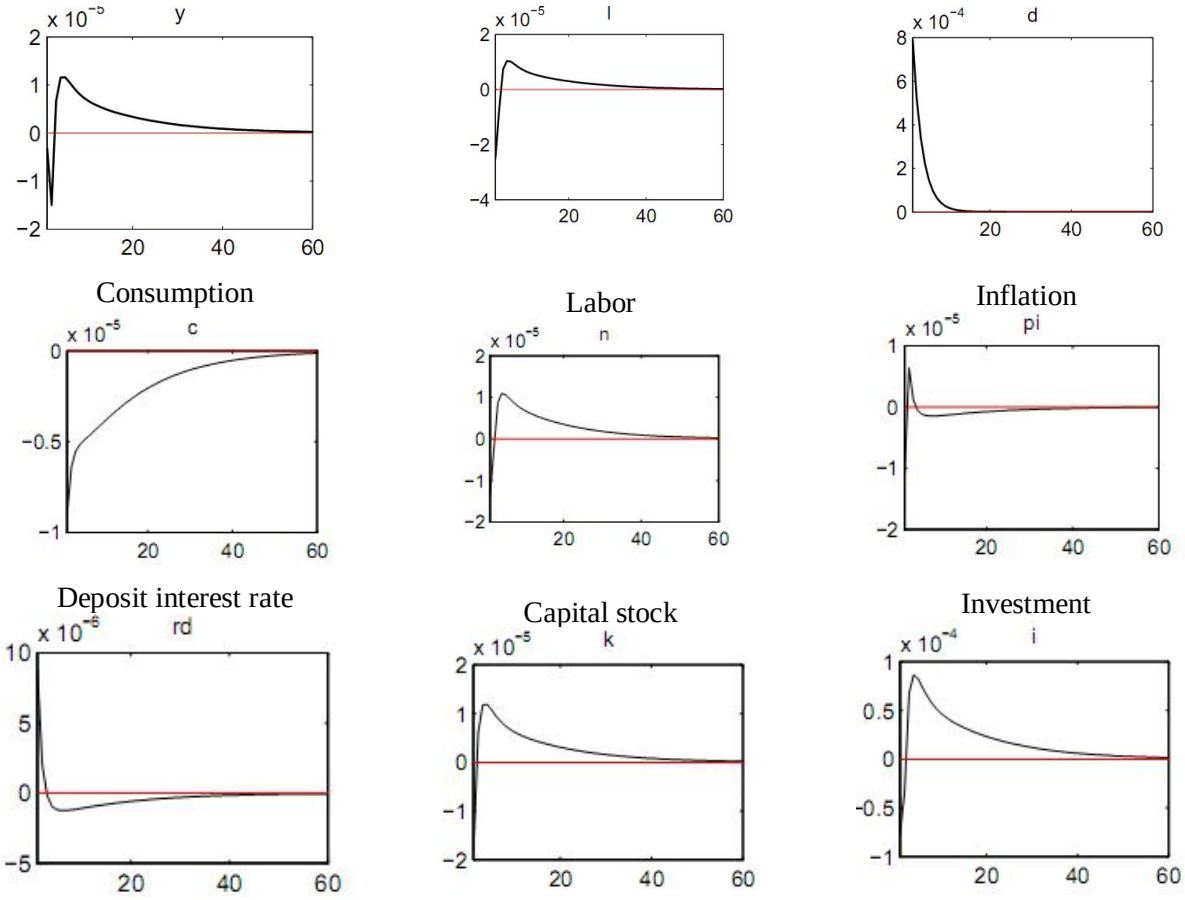
Third, the banking system puts direct pressure on the bank balance sheet by reducing the value of banks assets(loans) relative to liabilities(deposit). Without any further adjustment to either loans or deposits, banks borrow from interbank. Hence,raise borrowing from interbank. Because of raising borrowing from interbank, rise interbank interest rate and to continue fall borrowing from interbank. The reduction of credit supply leads to a further decline in output, thus propagating the credit crunch.(See figure 1).

Figure 2 shows the impulse response of Iranian default shock in interbank on the Iranian economy. The consequences of this shock on the domestic economy in this model in line with de walque(2010). This shock transmits to the economic activity through the following Channels.

First, Default shock at interbank starts with the some banks pay other banks less than initially agreed on their obligatios.This Phenomenon lead to fall at confidency between banks and banks cut deposit allocated to interbank lending.bank with defaulting cannot borrow from other bank and fall borrowing from interbank.due to default in interbank, rise interbank interest rate, then rise interbank lending and borrowing.

Figure 2: default in interbank market shock





Second, Due to Default shock at interbank and fall in interbank borrowing, decreas bank funds and loan. Hence, entrepreneurs borrow less and produce less. Output fall and Inflation declines in response to the drop in output. But raise deposit interest and Household concume less and save more. Then rise deposit and loan rise in response to the rising in deposit. This Phenomenon lead to rising at Capital stock, investment and output, but fall inflation.

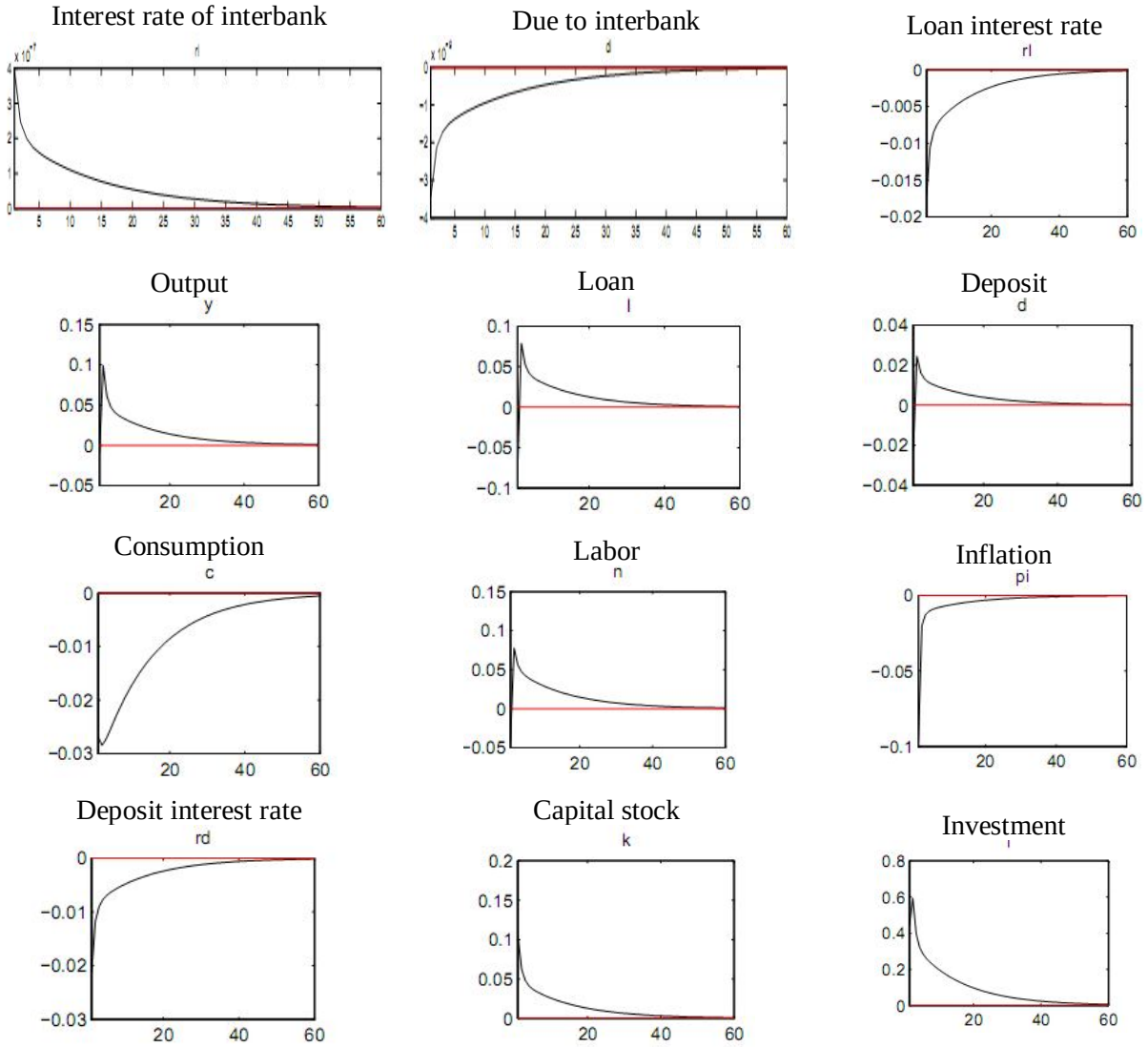
6.2 Monetary policy shock

Next this paper consider an tightening Monetary policy in Iran.Tow monetary policy re considered: interest rate and requirement reserve. The role of the banking sector in the transmission of the monetary policy shock has been investigated by previous work such as Christiano et al.(2007), Goodfriend and Mc Callum (2007) and Gerali et al. (2010). As discussed in Christiano et al.(2007) and Goodfriend an Mc Callum (2007), Financial frictions enhance the amplitude of business cycles through three channels(borrowing constraint, financial accelerator and nominal debt) besides the traditional interest rate channel. With the existence of banks, the banking attenuator effect identified by Goodfriend and McCallum(2007) and Gerali et al.(2010) is another Channel to propagate business cycles. This paper also expect that the banking attenuator effect refers to a sluggish and heterogenous pass-through of the change the interest

rate to monopolistically competitive banks. Here we are not going to highlight how each channel affects the transmission of monetary policy shock, but focus on the role of the banking sector.

Central bank increase interest rate, this policy has two effect on banks. First because of the raising loan interest rate, interest revenue increase and banks increase deposit rate while attract more deposit. Household decrease consumption and more save. The raising of deposit leads to a further increase in credit. As a result, investment and output increase and inflation decrease. Second, raising in lending rates will increase the interbank market interest rate. Because of rising interbank market interest rate, due to banking system decrease.

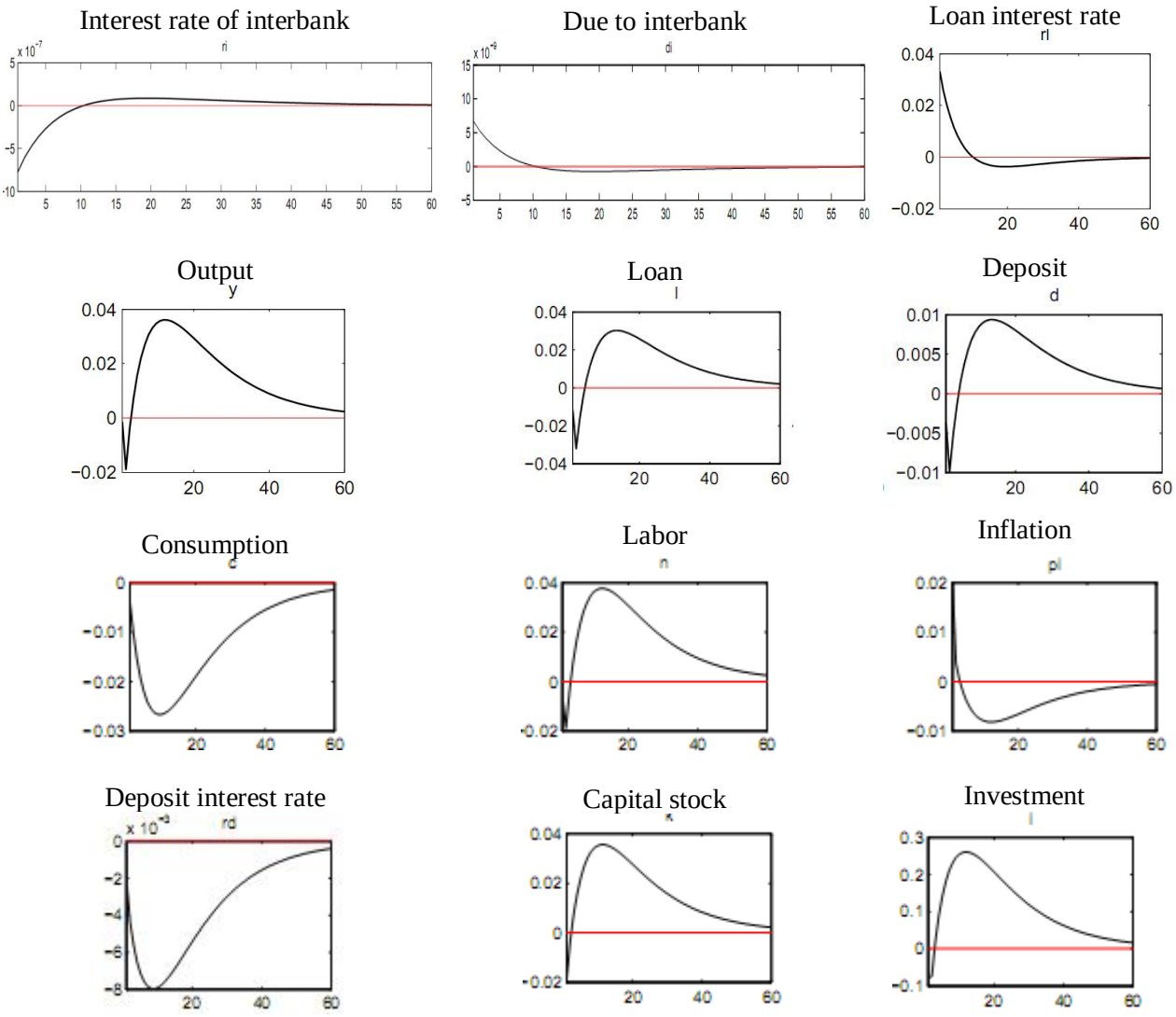
Figure 3: interest rate shock



Central bank raises requirement reserve. Raising in requirement reserve usually aimed at short term cash management, affects on banking and lead to a further increase bank' s reserve with the central bank and interbank interest rate. Increasing in interest rate of interbank lead to decrease

due to interbank. On the other hand raising in requirement reserve, lead to fall deposit in bank and decrease operationl cost. Then loan declines in responses to drop of deposit and also profit of bank declines. As a result, financing , investment and output fall but Inflation raise in response to the drop in output.(See figure 4).

Figure 4: requirement reserve shocks



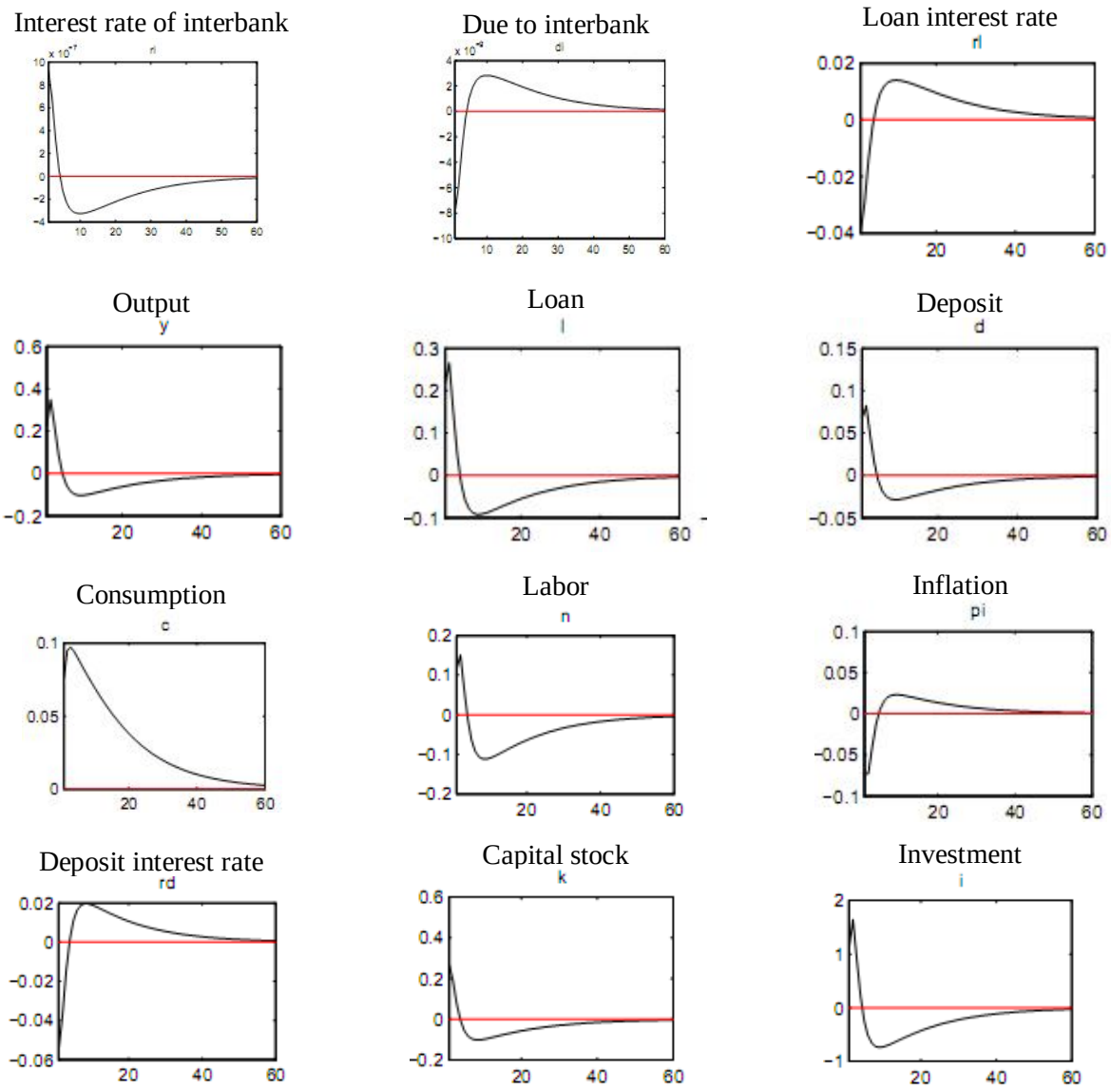
6.3 Thechnology Shock

Figure 4 Shows the impacts of positive technology shock on the Iranian economy. Since the production is more efficient, output rises. The Supply of goods increases, thus reducing the price

of the goods. The technology innovation reduces marginal costs and inflation, which leads to a drop in loan rate. Households raise their saving and entrepreneurs borrow more. Because of the rising savings, the marginal product of labor increases so that the aggregate capital increases. The rising in consumption leads to a rising demand for goods, therefore raising inflation. Central bank raises the loan rate.

In the presence of bank intermediaries, the endogenous propagation mechanism is amplified because credit spreads benefits enterpreneurs from the greater availability of credit. Enterpreneurs borrow more and product more. Because of raising production, inflation decrease.

Figure 5: Technology shock



7. concluding Remarks

This paper proposes a micro founded framework that incorporates a banking sector into a DSGE model to evaluate the role of an active banking sector in business cycles and the contribution of financial shocks to the Iranian economy fluctuations.

Financial frictions are modeled using both the demand and supply sides of credit market. We use the financial accelerator a la BGG (1999) to model the demand-side of credit market. The supply-side of credit market consists of heterogeneous banks that offer different banking services and borrowing from interbank market. This model provides rich and rigorous framework to address monetary and financial stability issues. The model includes demand and supply-sides of credit market and thus allows for policy simulation analysis of factor such as: (1) credit default; (2) endogenous bank defaults on interbank borrowing; (3) monetary policies shocks.

The model reproduces salient features of the Iranian economy, reproducing volatilities of key macroeconomic variables and their correlations with output, and the pro-cyclical banks' balance sheet. Banks can affect credit supply conditions and the transmission of real effects of shocks to the economy. Also, financial shocks explain a large fraction of business cycles. This result is robust to simulations with different shocks. Thus, the main role banks play in this economy is to reduce the effects of uncertainty.

Future work will consist of estimating the model's structural parameters, incorporating credit to households, extending the framework to an open economy model and capital requirement regulations.

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