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Are Structural Parameters Stable in Malaysia? Pre- and Post-Crisis Analysis

(Adakah Struktur Parameter Stabil di Malaysia? Analisis Sebelum dan Selepas Krisis)

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ABSTRACT

This research examines whether structural parameters of new keynesian models are stable in Malaysia. We imposed the structural restrictions as in DSGE models suggested by Smets and Wouters (2003) and Wickens (2011). We then estimated whether the 2007 financial crisis changes structural parameters by using structural VAR estimation. Our parameters estimates are significant and correctly signed. This empirical finding has found that the structural parameters are not stable after the 2007 financial crisis, for employment, rate of return on loans and policy rate. However, the effects are little on the real variables such as output, investment, consumption and price level. In addition, unexpected change of demand in the non-bank private sector has puzzled the rate of return on loans after the economic crisis compared with before the economic crisis. The monetary policy shocks have given a fluctuation effect on the rate of return on loans and employment after the economic crisis.

Keywords: Global financial crisis, structural parameters

ABSTRAK

Kajian ini menganalisis sama ada struktur parameter model keynesian adalah stabil di Malaysia. Kajian ini menggunakan kekangan berstruktur seperti model DSGE oleh Smets dan Wouters (2003) dan Wickens (2011). Seterusnya, kajian ini menganggarkan sama ada krisis kewangan 2007 mengubah struktur parameter dengan menggunakan penganggaran VAR berstruktur (SVAR). Penganggaran parameter adalah signifikan dan menunjukkan hubungan yang benar. Penemuan kajian mendapati bahawa struktur parameter iaitu gunatenaga, kadar pulangan terhadap pinjaman dan kadar bunga dasar adalah tidak stabil selepas krisis kewangan 2007. Namun. kesannya adalah rendah terhadap pemboleh ubah benar seperti output, pelaburan, penggunaan, dan tingkat harga. Tambahan lagi, perubahan permintaan yang tidak dijangkakan dalam sektor swasta bukan bank memberi kesan yang tidak pasti terhadap kadar pulangan pinjaman selepas krisis berbanding sebelum krisis ekonomi. Kejutan dasar monetari memberi kesan turun naik terhadap kadar pulangan pinjaman dan guna tenaga selepas krisis ekonomi.

Kata kunci : Krisis kewangan global ; struktur parameter

INTRODUCTION

A new Keynesian dynamic stochastic general equilibrium model (DSGE) has been widely used by many developed countries in applied macroeconomics. The model includes sticky prices, habit formation, capital adjustment costs, variable capacity utilization and other frictions that are introduced to capture the underlying dynamic in macroeconomics data. All of these have been developed or analyzed by Christiano et al. (2005) for the US and the Smets and Wouters (2003) for the European countries. This class of models is often called the New Neoclassical Synthesis (see Goodfriend & King 1997 ; Clarida et al. 1998). However, the 2007-2009 US recession differs considerably from other postwar US recessions and from the parallel recessions in other high-income countries like Canada, France, Germany and the United Kingdom. Many scholars have blamed the failure of the DSGE model to predict the crisis. In fact, the crisis lasted up to 2009 due to the significant productivity declines and much smaller declines in labor input according to Ohanian (2010). In addition, his analysis indicated that the 2007-2009 recession is not well understood within current classes of economic models, including both standard real business cycle models, and perhaps surprisingly including models in which financial distress reduces economic activity.

Most small economies including Malaysia have not depended on the DSGE model in predicting their economic performance. The global financial crisis in 2007 was characterized by an episode of acute financial stress and a sharp global economic contraction. However, they are many debates that show that the use of DSGE models remains on the boundary of the policy decision-making process in emerging market economies (Tovar 2008). One possible explanation is that emerging market economies often experienced rapid structural changes. As a result, the estimated structural parameters in DSGE models are often not stable across the different policy regimes. The complex nature of DSGE models may have also important concerns related to the degree of misspecification of current DSGE models. In such cases, we cannot rely on DSGE models because the stability of structural parameters is the fundamental assumption for the validity of DSGE models, as clearly noted by Lucas (1976). Nevertheless, Jiho's (2012) study on Korean economy found a stability of structural parameters during the examined period, although, important policy changes took place during the financial crisis. Thus, this analysis will use an existing DSGE model as a benchmark model in predicting the economy in Malaysia. With application of models developed by Smets and Wouters (2003) and an extension model by Wickens (2011), this study will analyze putting a DSGE to a structural VAR analysis by setting restrictions suggested by Peersman and Straub (2005) and Wickens (2011). In order to prove whether restrictions in DSGE models are suitable to be used by policymakers in Malaysia, thus, by using lengthy quarterly economic data from 1998 to 2014 in Malaysia, we want to estimate for the restrictions suggested by Peersman and Straub (2005). There will be two sub-sample data sets (pre-crisis and post-crisis). The central bank of Malaysia has adopted an interest rate targeting regime as its monetary operational framework taking the overnight rate as the operating target after the financial crisis in 1997. Currently, a manage floating exchange rate is being implemented.

Our main contribution is in the literature of the macroeconomics by using SVAR based on the DSGE restrictions. This paper concentrates on estimating structural parameters of the output, consumption, investment, employment, price, the policy rate and rate of return on loans before and after 2007 financial crisis. The objective of the paper is to empirically analyze whether the 2007 financial crisis changes structural parameters by using structural VAR estimation. This analysis focuses on the time series of Malaysia macroeconomics variables from 1998Q1 to 2014Q3, by using structural VAR analysis. This paper extends in two important directions: i) it estimates the coefficient of contemporaneous effects and ii) it predicts the impulse response effects of innovation lags.

The plan of the paper is as follows: Section 2 contains the literature review, Section 3 the methodology and Section 4 reports the empirical results. Finally, Section 5 concludes the overall findings of the paper. The appendix contains all figures.

LITERATURE REVIEW

There are many approaches that have been formulated for analysing and explaining the 2007 financial crisis. Some have blamed the baseline DSGE model that had been used to predict economic activity in the US. However, they have missed the blaming point where the model does not include banking and financial sectors in the model as another important factor influencing economic performance. Due to the financial crisis, they are a few models that have been formulated to find ways to determine the causes of the financial crisis. Wickens (2011) contributed to the literature by developing a DSGE model of banks and financial intermediation with default risk. He mentioned that the financial crisis of 2007 failed to correctly assess and priced the risk of default. In order to analyze default risk in the macroeconomy, a simple general equilibrium model with banks and financial intermediation was constructed in which default risk could be priced. In the model it was shown how the credit spread could be attributed largely to the risk of default and how excess loan creation may emerge due to different attitudes to risk by borrowers and lenders. His model can also be used to analyse systemic risk due to macroeconomic shocks which may be reduced by holding collateral.

Said (2015) has developed a macroeconomy model by including default shocks in the model that led to bank runs which had not been included in Wickens (2011) model. We will extend a model for the banking sector developed by Said (2013) in banking sector and show how the credit spread created from the difference between the loan rate and deposit rate can be found in the model.

An earlier study that focused on bank runs using the portfolio theory of banking was developed by Diamond and Dybvig (1983). As a response to dramatic signs of banking crisis is bank runs as depositors withdrew their funds rather than risk losing them if the bank's collapse. Therefore, Diamond and Dybvig (1983) had proposed deposit insurance provided by the government and funded through an optimal tax on all consumers that created no distortions. In reference to bank runs, Allens, Carletti and Gale (2008) had also shown how open-market operations conducted by the central bank through the interbank market, and funded by a tax imposed by the government, could remove the risk of bank runs and enabled the economy to achieve its optimal solution. Curdia and Woodford (2010) had included exogenous bad loans in their model and they assumed that the risks of bad loans were not priced. Our model will assume that endogenous bad loans and the risk effect will be priced.

Bank lending is also exposed to output shocks. This is because demand for loans is pro-cyclical. In an earlier study, King (1986) found that although there was no clear relationship between loans and output, there was a rather closer one with output and demand deposits in U.S. banks. However, banks' lending supplies could behave differently according to the business cycle. Boot (2000) and Thakor (2004) discussed how banks deeply involved in relationship lending are likely to undergo smooth lending 'through the cycle'. Nevertheless, Gambacorta and Mistrulli (2004) found that there was a positive correlation between credit and output. An increased in output caused loans to increase. In addition, the interaction between output and excess capital was negative; implying the credit supply of well-capitalized banks was less dependent on the business cycle. Thus, we conclude that the output shocks as in Said's model (2015) can have a pro-cyclical effect on banks' optimal decision.

An alternative explanation of liquidity shortage can be seen in the study of Kiyotaki and Moore (1997). This is due to the existence of credit constraint. The problem of adverse selection implies that, faced with imperfect information about which borrowers are likely to default, even in equilibrium, lenders may not only ration credit, they may also charge them different loan rates. Charging different loan rates may itself affect the behavior of particular borrowers, which can lead to a moral hazard. Those who are will to borrow at a high interest rate may, on average, be more willing to default and hence take the greatest risks.

METHODOLOGY

In the following sections we present a New Keynesian DSGE model as described by Smets and Wouters (2003), Wicken (2011) and Said (2015). Those papers have demonstrated that the medium scale DSGE models are able to fit data as well as conventional theoretical VARs. Several structural shocks can be introduced and estimated within the model framework. These features make them sufficiently rich to capture the stochastics and dynamics in the data and act as valuable tools for policy analysis in an empirically plausible set-up.

SUMMARY OF THE MODEL

Smets and Wouters (2003) developed and estimated a dynamic stochastic general equilibrium (DSGE) model with sticky prices and wages for the euro area. Their model incorporated various other features such as habit formation, costs of adjustment in capital accumulation and variable capacity utilization. They used seven key macroeconomics variables such as GDP, consumption, investment, prices, real wages, employment, and the nominal interest rate. They also introduced ten orthogonal structural shocks including productivity, labor supply, investment, preference, cost-push, and monetary policy shocks that allow for an empirical investigation of the effects of such shocks and of their contribution to business cycle fluctuations in the euro area.

A key feature of the recent financial crisis was default within both the non-bank private sector and the banking sector that was generated endogenously into the DSGE macroeconomics framework. Wickens (2011) has suggested a banking sector as another important sector in a DSGE model, instead of a non-bank private sector and a consolidated government-central bank. He starts with a simple model by assuming that banks receive interest from loans to households and do not pay interest on deposits. Banks also hold reserves at the central bank and can borrow either from non-bank sector or, if this is constrained by a liquidity shortage, from the central bank.

Said (2013) proved that the banking sector in Malaysia is operating in a monopolistic competition, therefore, the price of loans will depend on the demand of loans. The banking sector will set their loan rates based on the difference of demand and supply of loans.

ESTIMATION METHODOLOGY AND DATA

In this section we first discuss how we estimate the structural parameters and the process governing the structural shocks. Our estimation will only include seven endogenous variables Y_t, C_t, I_t, E_t, n_t, R_t,, $R_{Lt} - R_t$ and structural shocks as suggested by Smets and Wouters (2003) and Wickens (2011) and restrictions suggested by Peersman and Straub (2005).

ESTIMATION METHODOLOGY

This paper analyzes macroeconomics effects of aggregate demand, aggregate supply (output and employment), price, and monetary and financial shocks in Malaysia using a structural VAR (SVAR) approach. This paper contributes to the literature on financial, monetary and technology shocks as suggested by Smets and Wouters (2003), Wickens (2012) and Said (2015). SVAR models originate from monetary policy analysis where it has been used extensively to study the transmission of real and monetary shocks. Structural VAR models impose identifying restrictions on an odinary VAR model to infer structural shocks from it. Assume that an unrestricted VAR model,

$$x_t = A(L)e_t \tag{1}$$

is estimated. Where x is a vector of covariance stationary macroeconomics variables, $A(L)$ a polynomial matrix of lag length l, L the lag operator and e a vector of reduced-form innovations in the elements of x with variance-covariance matrix $E(e_t e_t^T) = \Sigma$. These reduced-form innovations are likely to be correlated and can, therefore, not necessarily be interpreted as purely structural innovations. To remedy this, the SVAR approach relates the vector x to a vector of structural innovations, μ_t.

$$x_t = B(L)u_t \tag{2}$$

where $B(L)$ is a polynomial matrix in L. In this SVAR u_t is a vector of serially and contemporaneously uncorrelated, normalized structural residuals with $E(u_t u_t^T) = I$. From equation (1) and (2) it follows that the vector of reduced-form innovations can be represented as a linear combination of the structural residuals, i.e., $e_t = Cu_t$ with $CC^T = \Sigma$. As a result, $x_t = A(L)Cu_t = C(L)u_t$ and $A(L)C = B(L)$, enabling the identification of the structural innovations from the reduced-form innovation of the reduced-form VAR. $C(L)$ is a lag polynomial where Cs are coefficient matrices at the respective lags of the errors. The structure for equation (2) can be obtained from the estimates of the reduced-form representation in equation (1), provided that the transformation matrix C is of full rank.

The structural VAR model in equation (2) imposes identifying restrictions upon VAR estimate in equation (1) to recover structural innovations from the estimated VAR. Identification is achieved in practice by imposing identifying short or long-run restrictions. In our analysis we will include the short and long-run restrictions in order to identify the contemporaneous the structural parameters. In order to exactly identify a VAR model of seven endogenous variables, restrictions need to be imposed in the structural model in equation (2). Following Sims (1980), the Cholesky decomposition is one method of identifying impulse-response functions in a VAR, this method corresponds to an SVAR. There are several sets of constraints A and B that are easily manipulated by the Cholesky decomposition. In order to impose the Cholesky restrictions it is assumed that an SVAR model takes the form of

$$\tilde{A}(I_K - A_1 - A_2L_2 - A_pL^P)y_t = \tilde{B}e_t \quad (3)$$

where $\tilde{A}$ is a lower triangular matrix with ones on the diagonal and $\tilde{B}$ is a diagonal matrix. The P matrix for this model is $P_{sr} = \bar{A}^{-1}\bar{B}$, its estimate, $\widehat{P_{sr}}$ is obtained by plugging in estimates of $\bar{A}$ and $\bar{B}$, and should be equal to the Cholesky decomposition of $\hat{\Sigma}$.

To illustrate with our analysis, we use Malaysian macroeconomics data and analyze a log-linearized model suggested by Smets and Wouters (2003), Wickens (2011) and Said (2015). However, we limit our endogenous variables to seven variables and only include six shocks which are aggregate demand, investment, aggregate supply, output, and monetary and financial shocks. We have reduced the amount of restrictions that are suggested by Smets and Wouters (2003) since some of the restrictions that come out of the DSGE model are at odds with alternative theoretical models or with the existing empirical evidence. In addition, we also include some restrictions suggested by Wickens (2011). All restrictions in the work of Peersman and Straub (2005) that have been used for our empirical estimations are presented in the matrices equation below. All our macroeconomics variables are in log-difference, except for policy rate, R and rate of return on loans, $R_{Lt} - R_t$ in rates variables. We will impose an overidentified model, which is consistent with the theory or model suggested by Smets and Wouters (2003), Wickens (2011) and Said (2015). Our A and B matrices for seven endogenous variables of output, Y_t, consumption, C_t, investment, I_t, employment, E_t, price level, π_t, policy rate, R_t, and rate of return on loans, $R_{Lt} - R_t$ are as follows:

$$A = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 & 0 \\ 0 & a_{42} & a_{43} & 1 & 0 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & a_{65} & 1 & 0 \\ 0 & a_{72} & a_{73} & 0 & 0 & a_{76} & 1 \end{bmatrix}$$

and

$$B = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{55} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & b_{77} \end{bmatrix} \quad (4)$$

In the short run, with these structural restrictions, we assume that the first row of equations suggests output, Y_t responds to other variables in the system with a lag. In row two, the consumption is assumed to respond with a lag to innovations in real, monetary and financial variables. The third row can be viewed as a response of investment, I_t. It shows that investment is contemporaneously affected by output, and consumption, C_t, whereas the rest is assumed to affect investment with a lag. The fourth row of equations suggests that consumptions, and investment contemporaneously affected employment level, E_t. The price level, π_t is shown in the fifth row which is contemporaneously affected by output, consumption, and investment.[1] The monetary variable such as policy rate was set to stabilize the price level with a lag innovation. The sixth row is the response of policy rate to the change in price level. Central bank of Malaysia has to contemporaneously change the policy rate to the change in the price level to stabilize the price level. The final row is a response of rate of return on loans with a lag to innovations in output, employment and price variables. But, it is contemporaneously affected by the policy rate. Since the banking sector in Malaysia is characterized as monopolistic competitions as is suggested by Said 2013, thus, the rate of return on loans depends directly on demand of loans by the non-bank private sector, and therefore, the shocks in aggregate demand (consumption, and investment) contemporaneously affected the rate of return on loans.

For estimating a stability of the models tested, eigenvalues of the companion matrix of the VAR model are calculated. The stability of the models estimated can be seen in the work of Lutkepohl (1993) that shows that if all the eigenvalues are inside the unit circle, the model is stable.

DATA

The model presented in the previous section is estimated with structural VAR estimation techniques using seven key macroeconomics of quarterly Malaysian time series as observable variables: the log difference of real GDP, real consumption, real investment, real employment, price level, the policy rate and rate of return on loans. All data have been adjusted using the consumer price index (CPI) of Malaysia in 2005. The range of data is between 1998Q1 and 2014Q3 which is from the International Financial Statistics. The data will be estimated into three samples of data; first, pre 2007 financial crisis; second, post 2007 financial crisis; and third, full sample of data. The idea of dividing the estimation into sub-samples is for determining the stability of structural parameters before and after the 2007 financial crisis.

EMPIRICAL RESULTS

In this section, we focus on the responses of macroeconomics variables to the aggregate supply, aggregate demand, price, and monetary and financial shocks (as suggested by Smets & Wouters 2003; Wickens 2011; Said 2015) using the SVAR model. Prior to estimation, we also estimated the diagnostic test for determining the optimum lag length of the models. The optimum lag for log-difference of pre-crisis, post-crisis and all data sample models is six and is found by using AIC, SBIC and HQIC.[2]

SVAR RESULTS

We imposed restrictions as specified in matrices equation (4) to identify the structural shocks. The structural parameter estimates of A and B are given in Table 1.

Table 1 shows the results for SVAR estimations for log-difference data. The likelihood ratio tests statistics with p-value of 0.17 for over-identification with X^2 = 5.02 for the pre-crisis data sample. For the post-crisis data sample the likelihood ratio tests statistics with p-value of 0.161) for over-identification with X^2 = 5.52. Finally

TABLE 1. Structural VAR estimates

Matrix A							
Pre-Crisis	1	0	0	0	0	0	0
	–0.9171204*	1	0	0	0	0	0
	–0.3047535	–0.4284036**	1	0	0	0	0
	0	–0.2767598*	–0.3696781*	1	0	0	0
	–0.091871*	–0.0362677*	0.0529879*	0	1	0	0
	0	0	0	0	17.11586**	1	0
	0	12.31627	–2.299352	0	0	0.0595719	1
Post--Crisis	1	0	0	0	0	0	0
	–0.2591462*	1	0	0	0	0	0
	–1.006251*	–0.6583194	1	0	0	0	0
	0	–16.17219*	0.2891319	1	0	0	0
	–0.2985523*	1.178297*	0.171478*	0	1	0	0
	0	0	0	0	26.79407*	1	0
	0	1.491521	–0.9236306***	0	0	0.1290253**	1
All Sample Data	1	0	0	0	0	0	0
	–0.3965794*	1	0	0	0	0	0
	–1.216018*	0.0733939	1	0	0	0	0
	0	1.753462*	–1.382852*	1	0	0	0
	0.09735	0.2469793*	0.0619494	0	1	0	0
	0	0	0	0	5.490371**	1	0
	0	0.1916124	–2.273417*	0	0	0.2551831*	1

TABLE 1. *continued*

Matrix B

Pre-Crisis	2.19e-15*	0	0	0	0	0	0
	0	6.10e-16*	0	0	0	0	0
	0	0	8.37e-16*	0	0	0	0
	0	0	0	3.04e-16*	0	0	0
	0	0	0	0	2.18e-17*	0	0
	0	0	0	0	0	9.36e-15*	0
	0	0	0	0	0	0	1.08e-14*
Post-Crisis	1.23e-16*	0	0	0	0	0	0
	0	1.50e-17*	0	0	0	0	0
	0	0	7.80e-17*	0	0	0	0
	0	0	0	2.37e-16*	0	0	0
	0	0	0	0	1.77e-17*	0	0
	0	0	0	0	0	6.24e-16*	0
	0	0	0	0	0	0	2.35e-16*
All Sample Data	0.0066025*	0	0	0	0	0	0
	0	0.0053897*	0	0	0	0	0
	0	0	0.0089707*	0	0	0	0
	0	0	0	0.0232717*	0	0	0
	0	0	0	0	0.0030273*	0	0
	0	0	0	0	0	0.086403*	0
	0	0	0	0	0	0	0.0539242*

for all sample data the likelihood ratio tests statistics with p-value of 0.153 for over-identification with X^2 = 5.63. All of the samples are shown to be not significant. The test for overidentifying restrictions cannot reject the H-null or the validity of the constraints imposed on the long-run responses, because the value of statistics will be too small. Take note that, because the estimated coefficients of matrix A are expressed on the same side of matrix B in equation (3), the negative (positive) sign should be read as being positive (negative).

In the second row it shows the results for contemporaneous effects on consumption. It shows that output has contemporaneous positive effects on consumption in pre-crisis and full sample data. For pre-crisis, post-crisis, and full sample data it is shown that the increase in output will increase consumption immediately with 0.9171204, 0.2591462 and 0.3965794 coefficient values, respectively. It shows that, the effect of increasing in output on consumption has decreased to 0.1291462 after the crisis from 0.9171204 before the crisis. This has shown that after the crisis it has limited the ability of consumers' demand, as consumers reduced their structure of consumption to saving.

In the third row it shows the contemporaneous effects on investment. It shows that output has positive contemporaneous effects on investment for post-crisis and full sample cases with 1.006251 and 1.216018 coefficient values, respectively. But, it is not significant for the pre-crisis case except the effect of consumption on investment is significant with a positive 0.4284036 coefficient value. The fourth row shows the contemporaneous effects on employment. It is shown that consumption and investment have negative and positive effects on employment, with coefficients –1.753462 and 1.382852, respectively for full sample data. However, for the pre-crisis sub-sample, consumption and investment positively contemporaneously affected employment at 0.2767598 and 0.3696781 coefficient values, respectively. This has shown that the increase in aggregate demand has also increased the employment as it created a lot more excess of demand and pushed firms to offer more employment to produce more goods and services in the economy.

In addition, the fifth row shows the contemporaneous effects on price level by output, consumption and investment in the pre-crisis and post-crisis sub-samples. However, the sign for consumption changed from positive to negative after the crisis. This shows that the structural parameters are not stable after an economic crisis. The contemporaneous effects on policy rate can be shown in the sixth row. It is shown that price level has negative contemporaneous effects on policy rate with coefficient values[3] –17.11586, –26.79407 and –5.490371 for pre-crisis, post-crisis and full sample cases, respectively. In other words, as price grows by one unit, policy rate goes down by 0.171158, 0.26794 and 0.054903 for pre-crisis, post-crisis and full sample cases, respectively. This has shown that the shocks in price level will immediately change the policy rate to ensure the stability of the price level for all cases. The coefficient value after the crisis has increased tremendously to –26.79407. This has shown that the policy has to be adjusted to stable the price level. The final row shows the contemporaneous effects on rate of return on loans. The results show that investment and policy rates have contemporaneous effects on the rate of return on loans for post-crisis and full sample cases. The change in policy rate has a significant negative effect on rate of return on loans with –0.1290253 and –0.2551831 coefficient values for post-crisis and full sample cases, respectively, but is not significant for pre-crisis sub-sample data. The results show that the investment has a positive effect of rate of return on loans with 0.9236306 and 2.273417 coefficient values for both post-crisis and full sample cases, respectively.

IMPULSE RESPONSE

Impulse response functions with a 95% confidence interval for the six structural shocks, output, aggregate demand, aggregate supply, price, and monetary and financial shocks, are reported in figures 1-3.[4] Each structural shock is of one standard deviation of their size.

OUPUT SHOCK

Figures 1a), 2a) and 3a) are the effects of an output shock. The effect of an output leads to an increase in the change rate of return on loans in the pre-crisis sample of the data. However, the change rate of return on loans fluctuates for the post-crisis and full sample data and it's shown that after a quarter four there was a sudden jump in the change rate of return on loans after a decrease in the change of policy rate. The effect of output on the policy rate shows a decrease changes in pre-crisis and full sample data. The levels of employment are shown to fluctuate in the post-crisis case. It can be shown that the 2007 economic crisis has given an unstable effect on the employment level. After a quarter one the changes of employment level has increased and fluctuated after the next quarters. This has shown that economic crisis has given a puzzle changes on the employment level. Nevertheless, there are no clear changes in the level of price and consumption in the three sub-samples. But, the result of output on the change of investment shows a little effect in post-crisis sample.

AGGREGATE DEMAND SHOCK

Figures 1b), 2b) and 3b) are the effects of an aggregate demand shock. The effects of an aggregate demand shock have a positive effect on the rate of return on loans in the pre-crisis case; however, it shows a sharp drop after a crisis and fluctuates thereafter. The effect of aggregate demand on the policy rate fluctuates after the crisis and for the full sample data. However, it shows a little decrease in the pre-crisis case. An unexpected change in aggregate demand has not shown a puzzle effect on employment for the pre-crisis sample. However, the effects are unstable for the post-crisis and full sample data. The price, output and investment responses to the aggregate demand shock are not puzzled since there is no visible effect on all of the components.

INVESTMENT SHOCK

Figures 1c), 2c), and 3c) are the effects of an investment shock. The effect of an investment leads to an increase in the rate of return on loans in the pre-crisis sample of data. However, the rate of return on loans fluctuates for the post-crisis and full sample data. The effect of investment on the policy rate shows an increasing trend from quarter two to quarter seven; however it has decreased thereafter in the pre-crisis and full sample data. The level of employment is shown to have fluctuated in the post-crisis sample. This shows that the 2007 economic crisis has given an unstable effect on the employment level. The mixed results in both pre and post-crisis sub-samples have shown that the structural parameters are not stable after the 2007 financial crisis.

AGGREGATE SUPPLY SHOCK

Figures 1d), 2d) and 3d) are the effects of an aggregate supply shock. The rate of return on loans response has a positive effect on the aggregate supply for the pre-crisis case. However, the rate of return on loans has shown a sharp drop after the crisis and fluctuated thereafter. This has shown that after the financial crisis the rate of return on loans fluctuated in order to adjust to the shock in the aggregate supply. The effect of an aggregate supply shock has a positive effect on the policy rate for the pre-crisis sample. However, after 2007 economic crisis the effect is more unstable. The responses of consumption, price output, and investment have not shown puzzling effects of an aggregate supply.

PRICE SHOCK

Figures 1e), 2e), and 3e) are the effects of a price shock. Unexpected change in the price level has a negative effect on the rate of return on loans in the pre-crisis sample. Nevertheless, the effect is shown to be unstable after the crisis as the response fluctuates. In addition, unexpected change in the price level has a negative effect on the policy rate in the pre-crisis, but, has a puzzle effect after the post-crisis sample. The responses of employment, consumption, output and investment have not shown puzzles effects on the price shock in the pre-crisis sample. However, it does have a puzzle effect on employment after the crisis.

MONETARY POLICY SHOCK

Figures (1f), (2f) and (3f) are the effects of a monetary shock. An unexpected change in the monetary policy rate has a negative effect on the rate of return on loans for the pre-crisis sub-sample. Nevertheless, the effects fluctuated after the sub-sample crisis. The change in the policy rate has no clear effect on employment level before the crisis. Nevertheless, the effect on employment is more puzzles after the 2007 financial crisis.

CONCLUSION

We estimate a New Keynesian SVAR model of the Malaysian economy covering the period 1998 to 2014. The aggregate relationships imposed on the contemporaneous structure of the SVAR model are derived from a close economy New Keynesian model as suggested by Smets and Wouters (2003), and Wickens (2011). The New Keynesian SVAR model is estimated by the maximum likelihood that accounts for the full interactions between consumers, firms, the central bank, and the banking sector. We then estimated dynamic responses of the macroeconomic variables to monetary policy, price, aggregate demand, aggregate supply, and financial, and investment shocks.

Our parameters estimates are significant and correctly signed. The results have concluded that the structural parameters are not stable after the 2007 financial crisis, for employment, rate of return on loans and policy rate. However, the effects are not affected by the real variables such as output, investment, consumption and price level. In addition, unexpected change of demand in the non-bank private sector has puzzled the rate of return on loans after the economic crisis compared prior to the crisis. The monetary policy shocks have given fluctuation effects on the rate of return on loans and employment after the economic crisis. However, the effects on real macroeconomics variables are more stable. The unstable effect on the employment level has shown that policy makers should have taken a necessary action to solve this fluctuation in the employment level.

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ENDNOTES

1 Since the range of data is quarterly, therefore the assumption of sticky price is affected in medium to long run is relevant to be affected contemporaneously by these variables.
2 The results for diagnostic tests can be provided upon request to the author.
3 Data for price level is logged difference and policy rate is not logged, so coefficient needs to be interpreted by dividing coefficients values with 100.
4 The computation of the confidence intervals is based on the bootstrapping procedure.

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APPENDIX

Impulse Response functions of basic structural VAR model

Pre-crisis

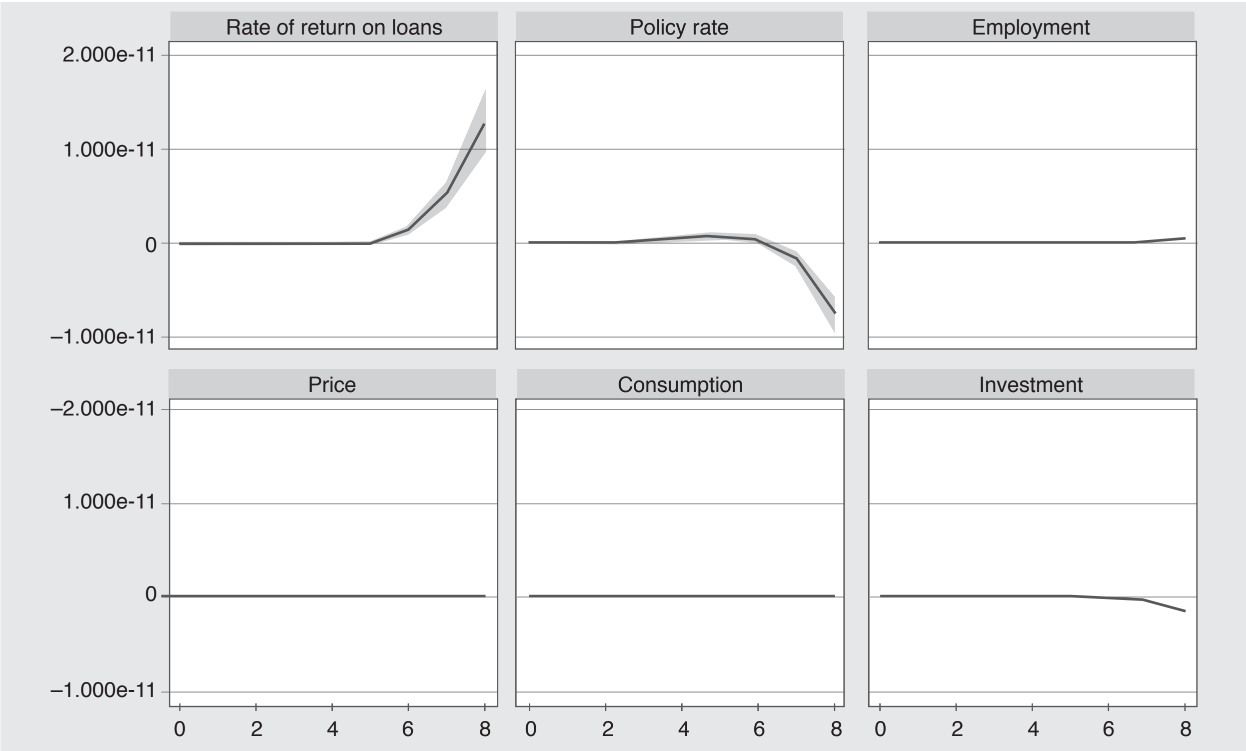

FIGURE 1a. The effect of an output shock

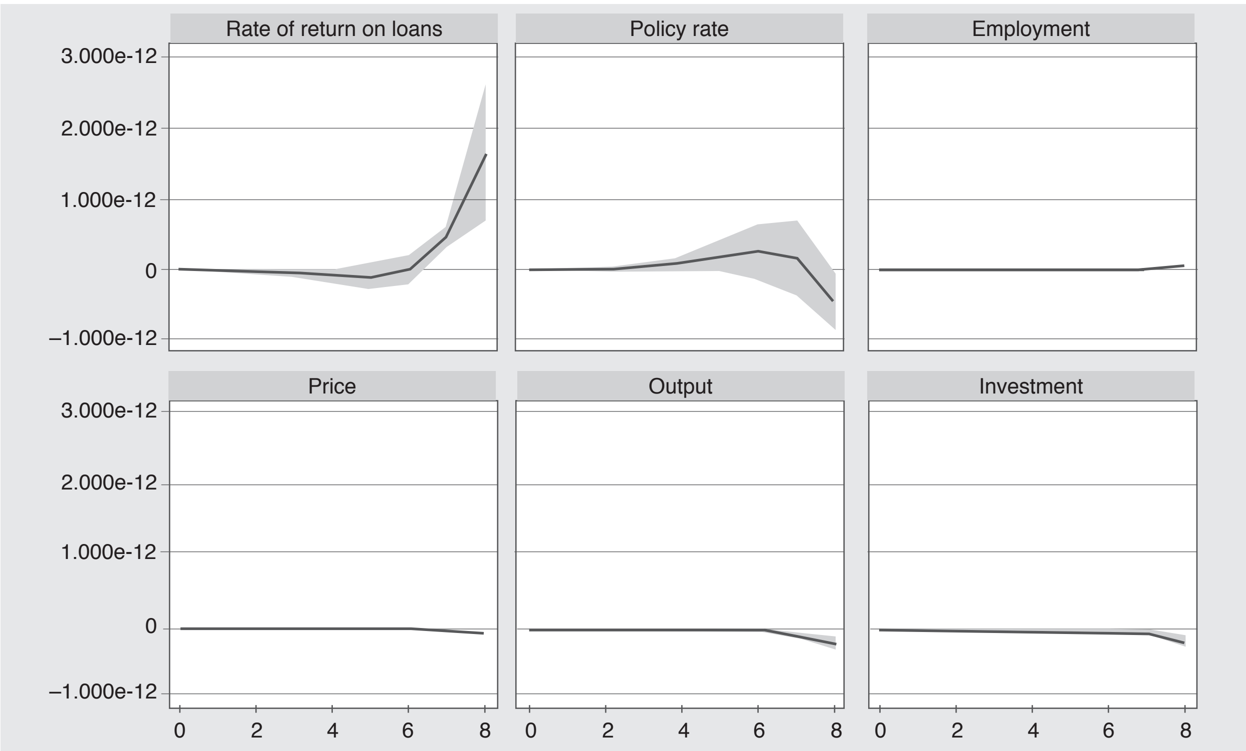

FIGURE 1b. The effect of demand shock

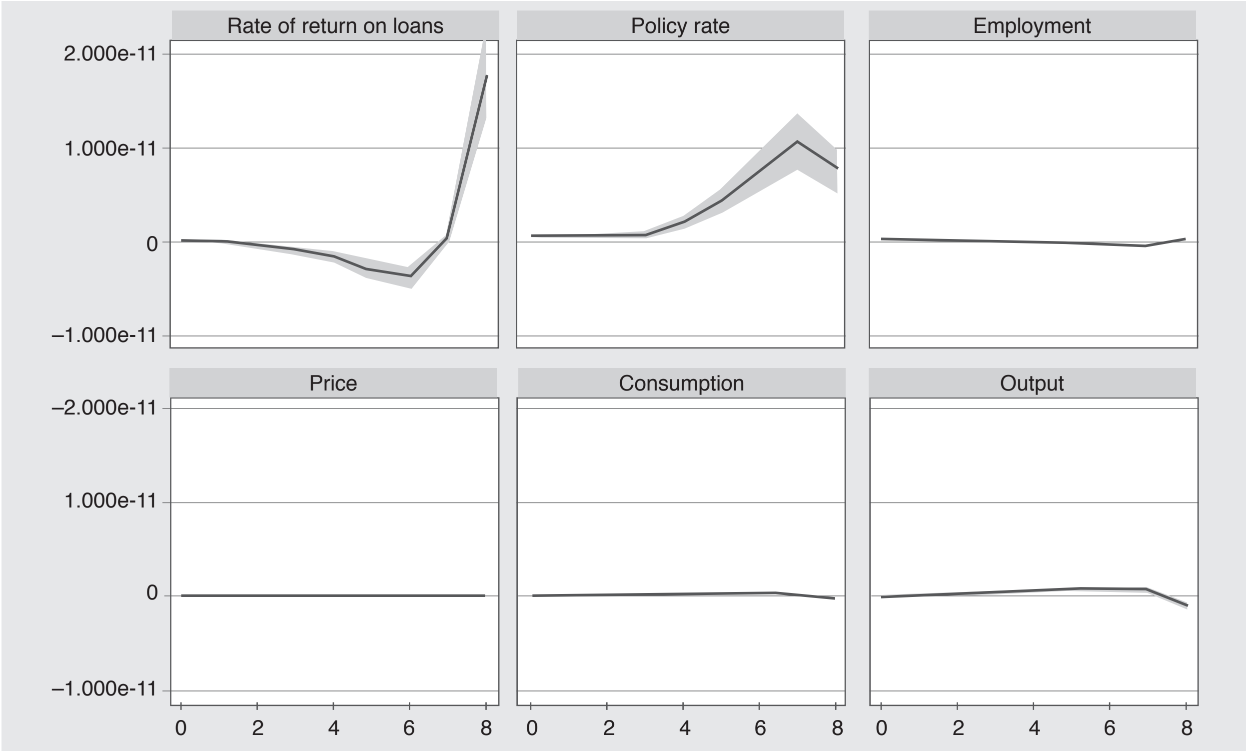

FIGURE 1c. The effect of an investment shock

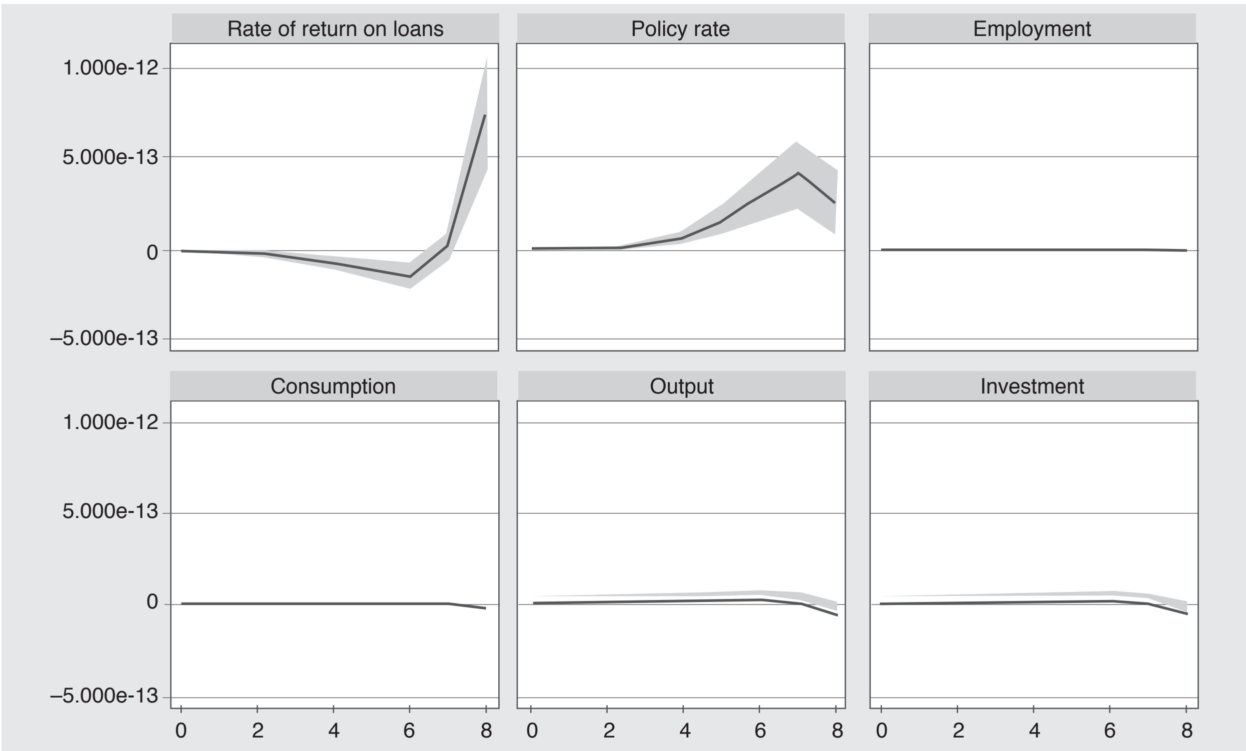

FIGURE 1d. The effect of supply shock

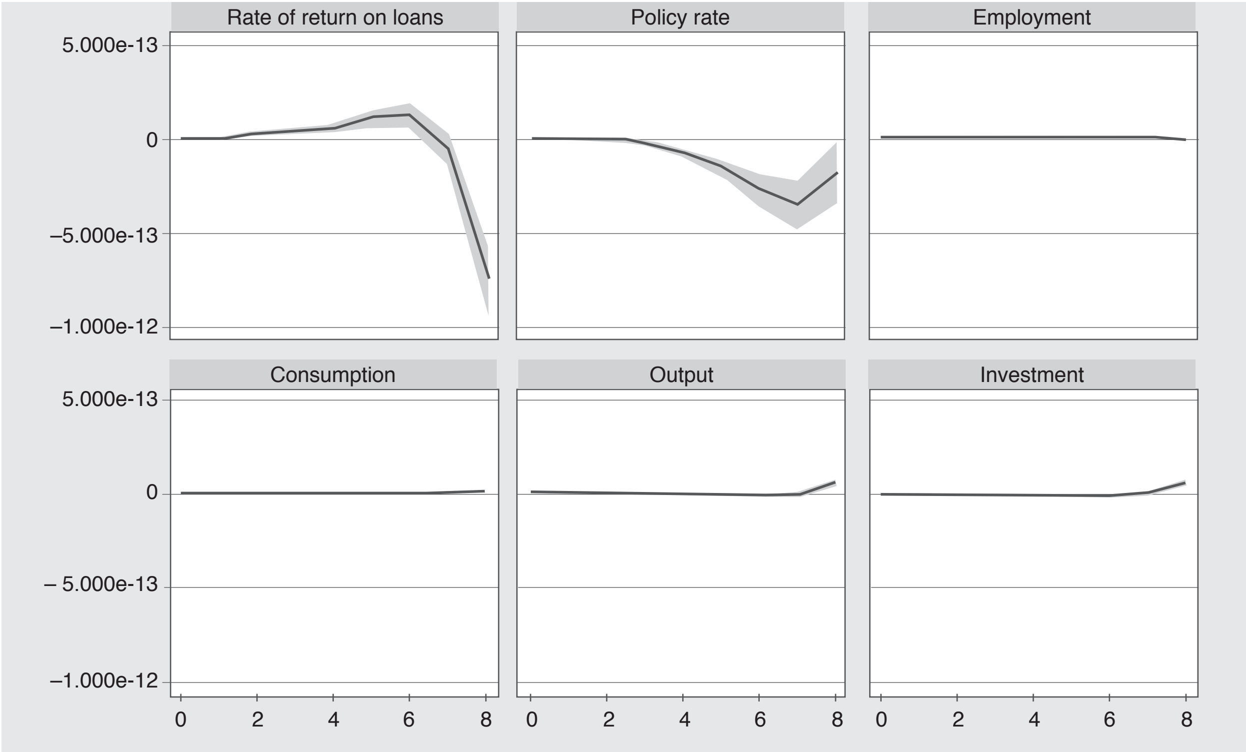

FIGURE 1e. The effect of a price shock

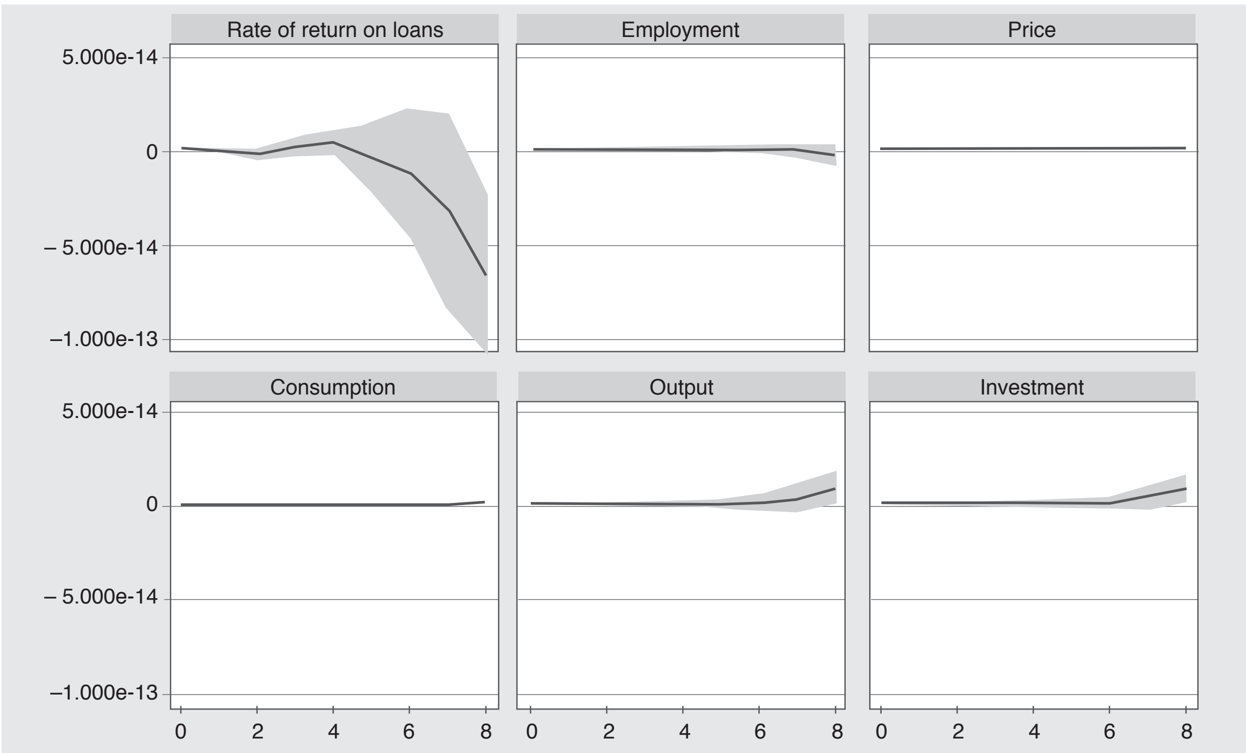

FIGURE 1f. The effect of a monetary shock

Post-crisis

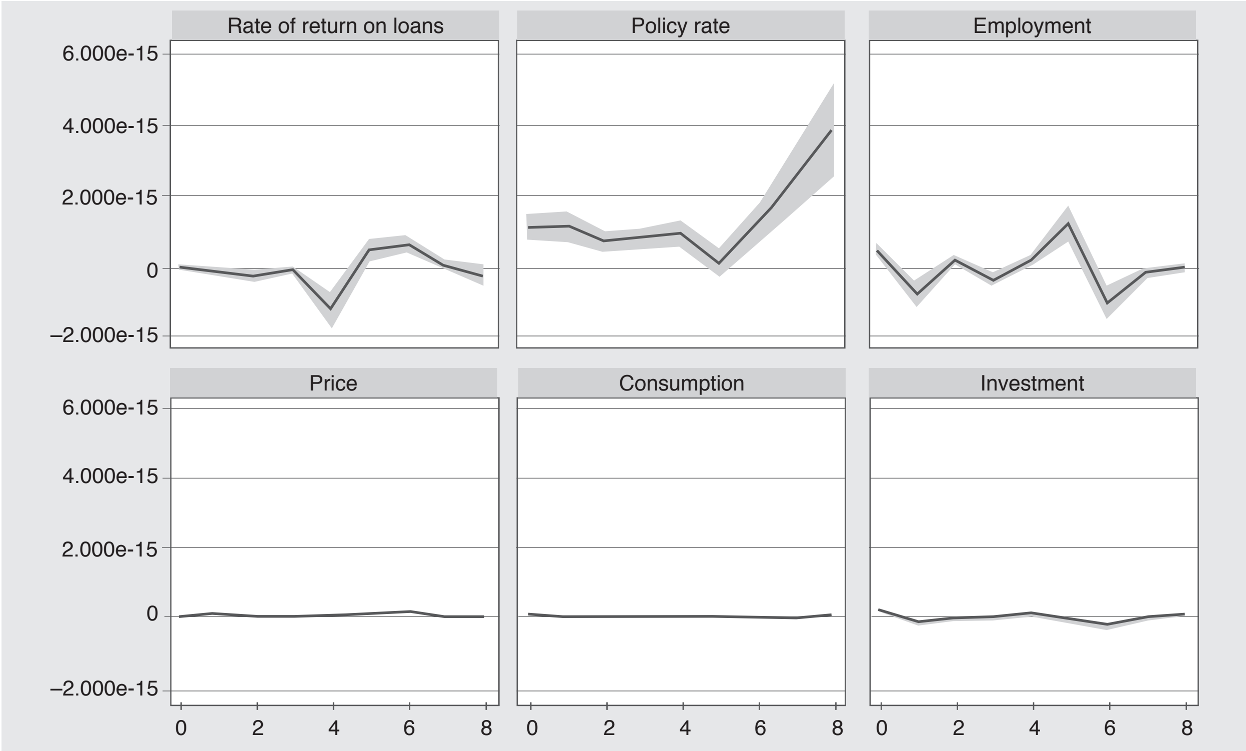

FIGURE 2a. The effect of an output shock

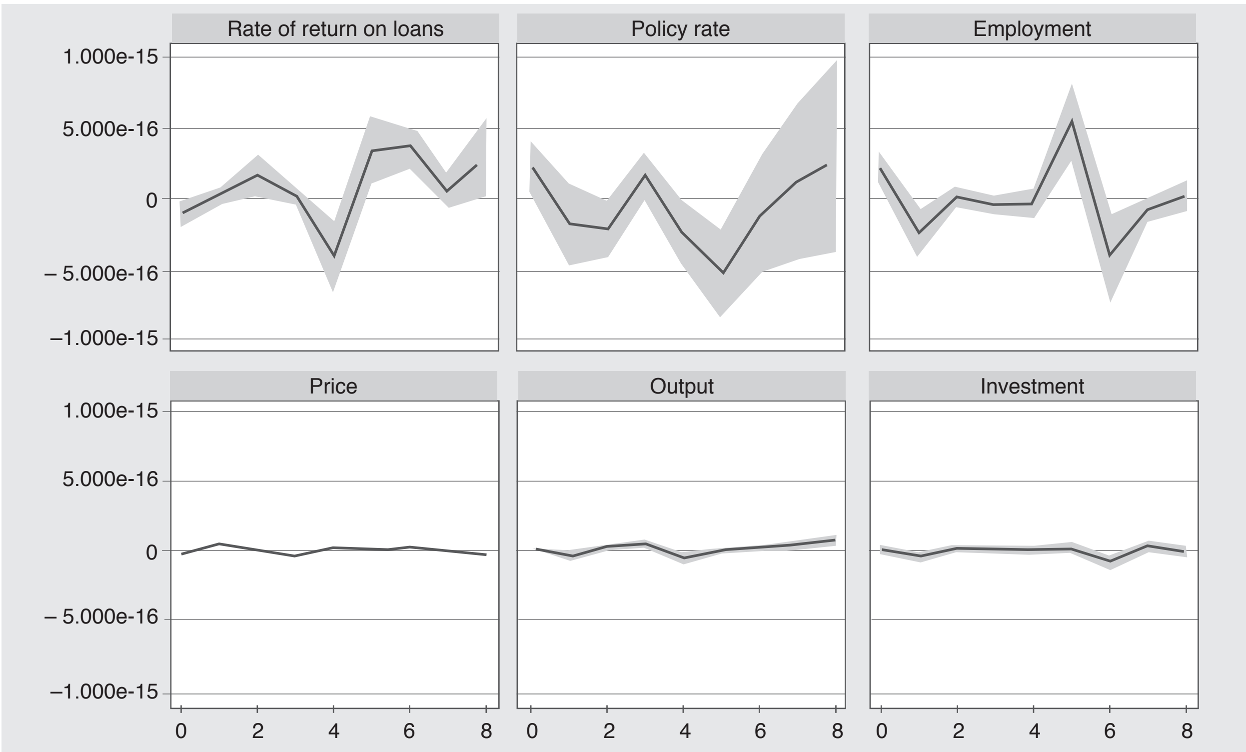

FIGURE 2b. The effect of a demand shock

FIGURE 2c. The effect of an investment shock

FIGURE 2d. The effect of a supply shock

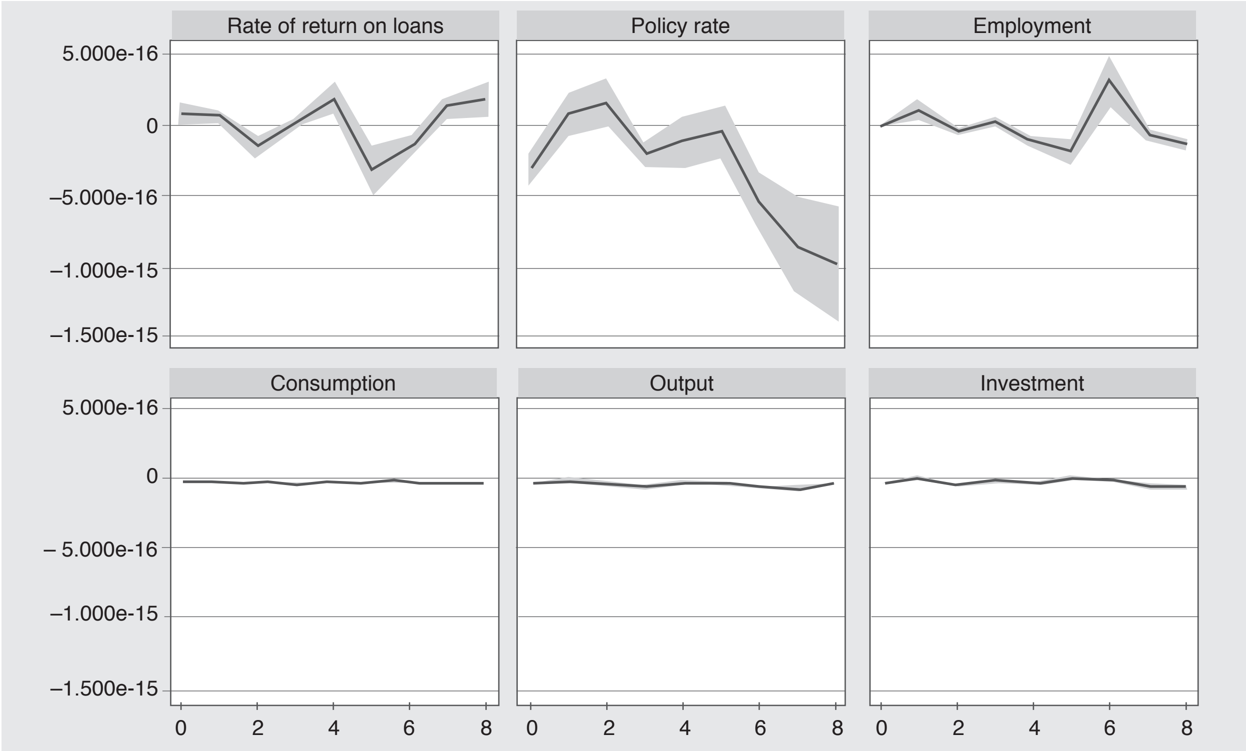

FIGURE 2e. The effect of a price shock

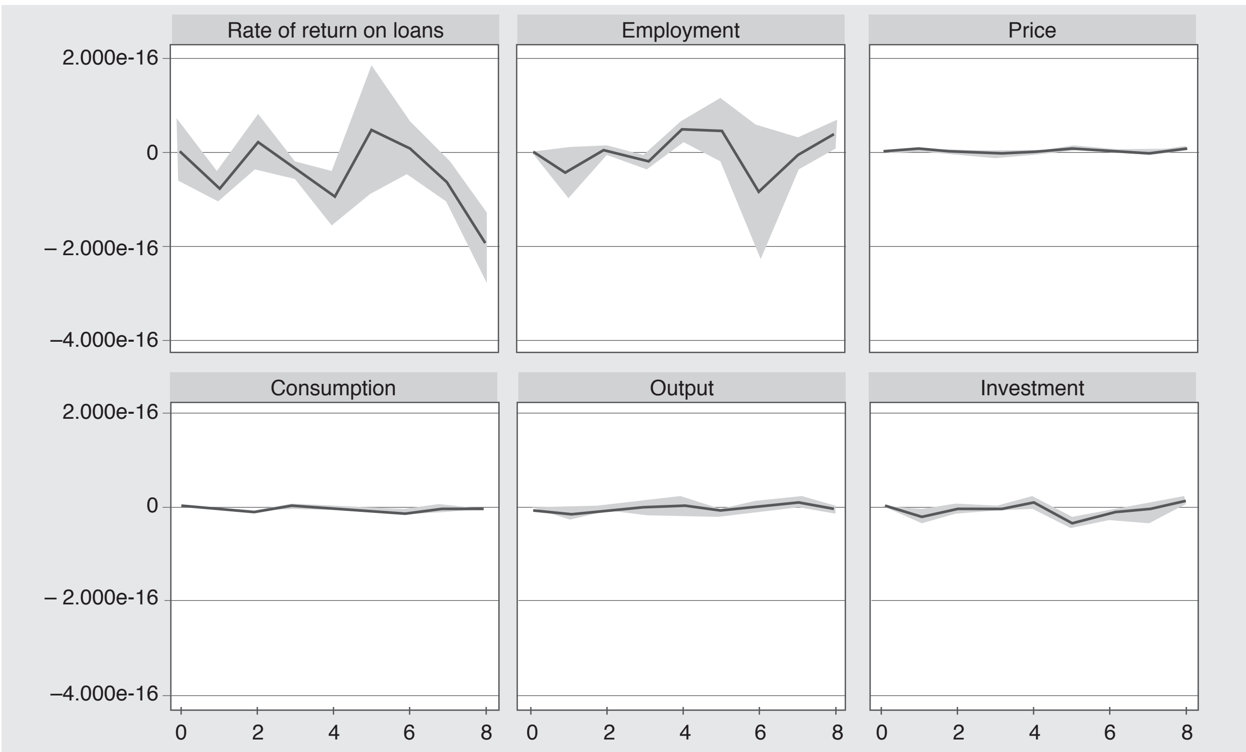

FIGURE 2f. The effect of a monetary shock

All sample

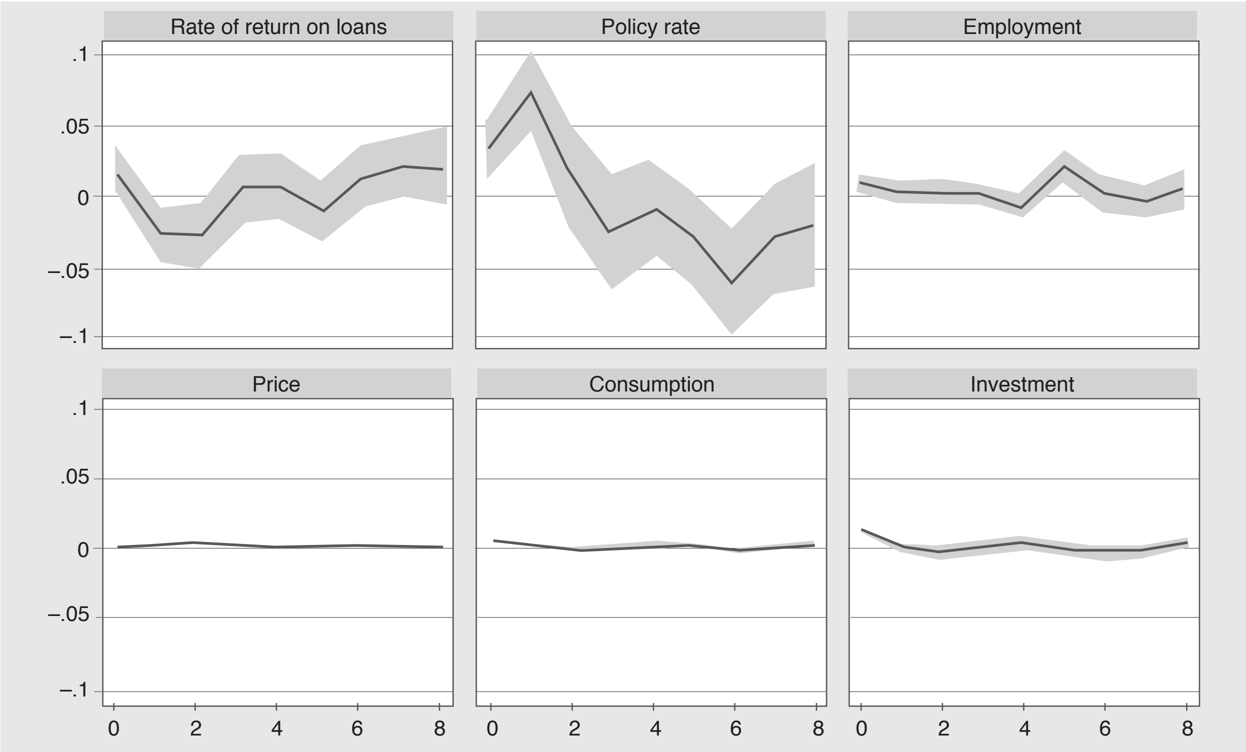

FIGURE 3a.The effect of an output shock

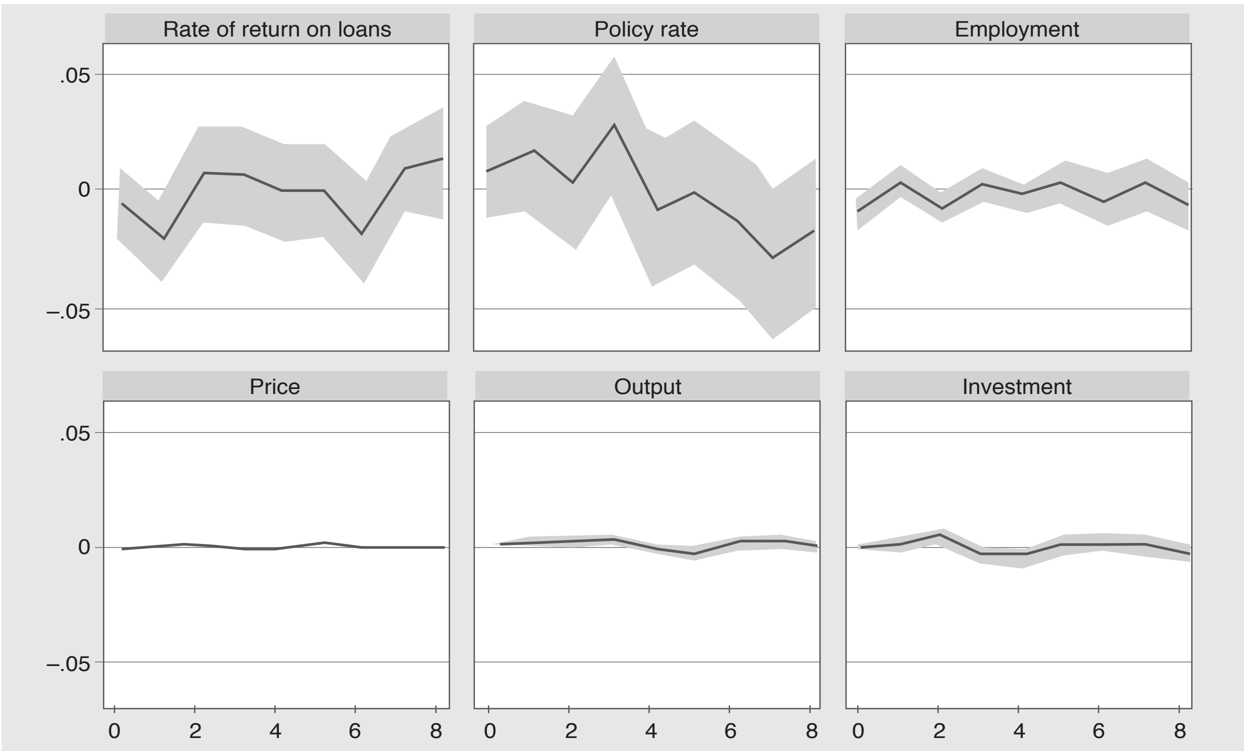

FIGURE 3b. The effect of a demand shock

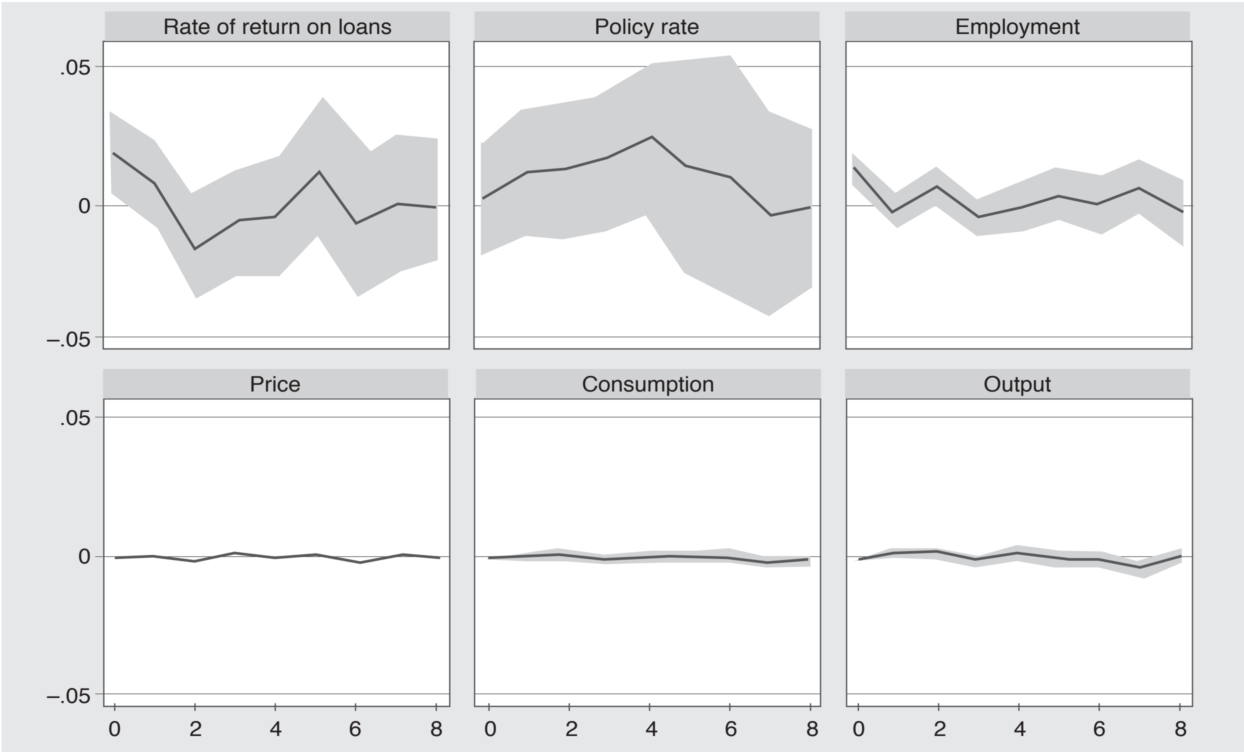

FIGURE 3c. The effect of an investment shock

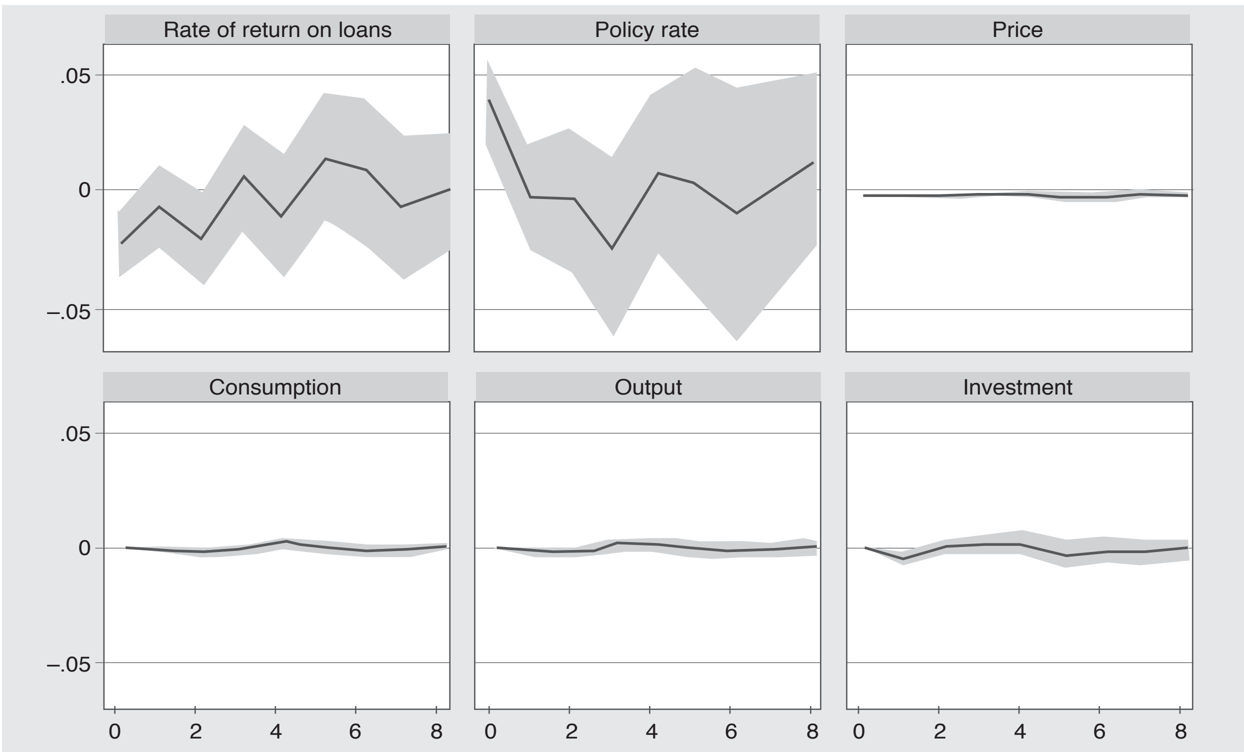

FIGURE 3d. The effect of a supply shock

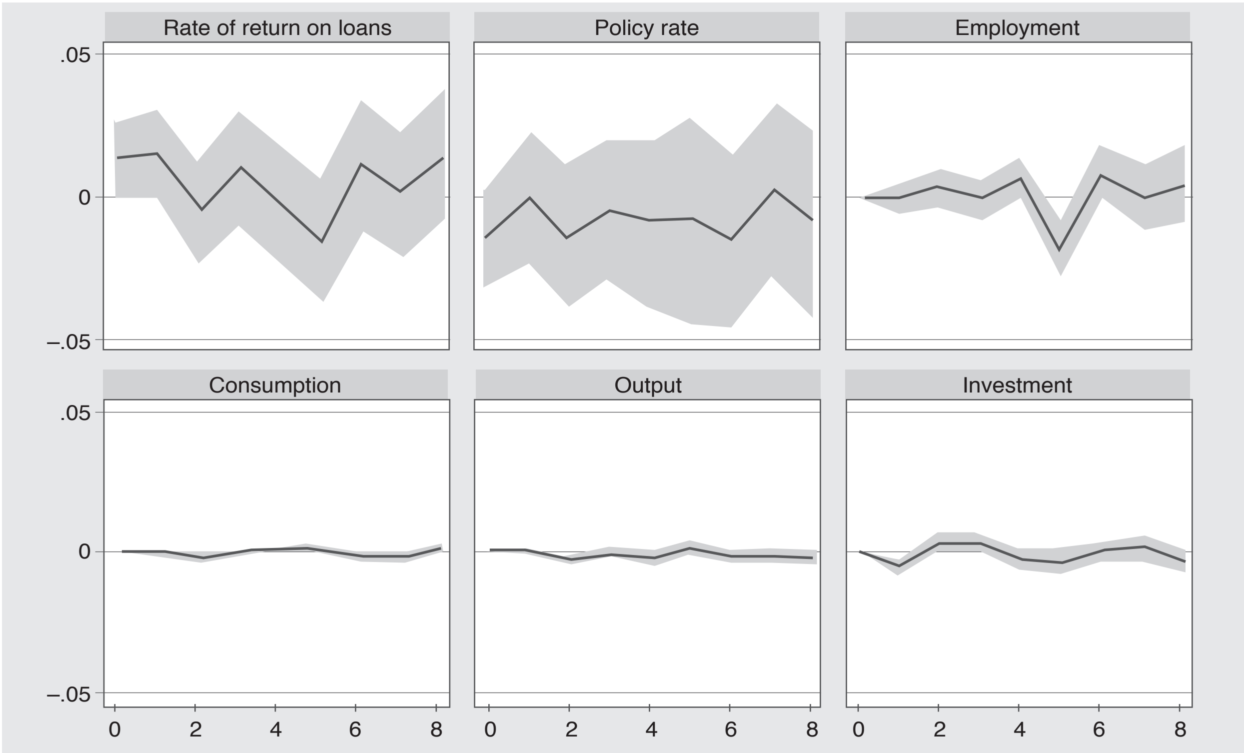

FIGURE 3e. The effect of a price shock

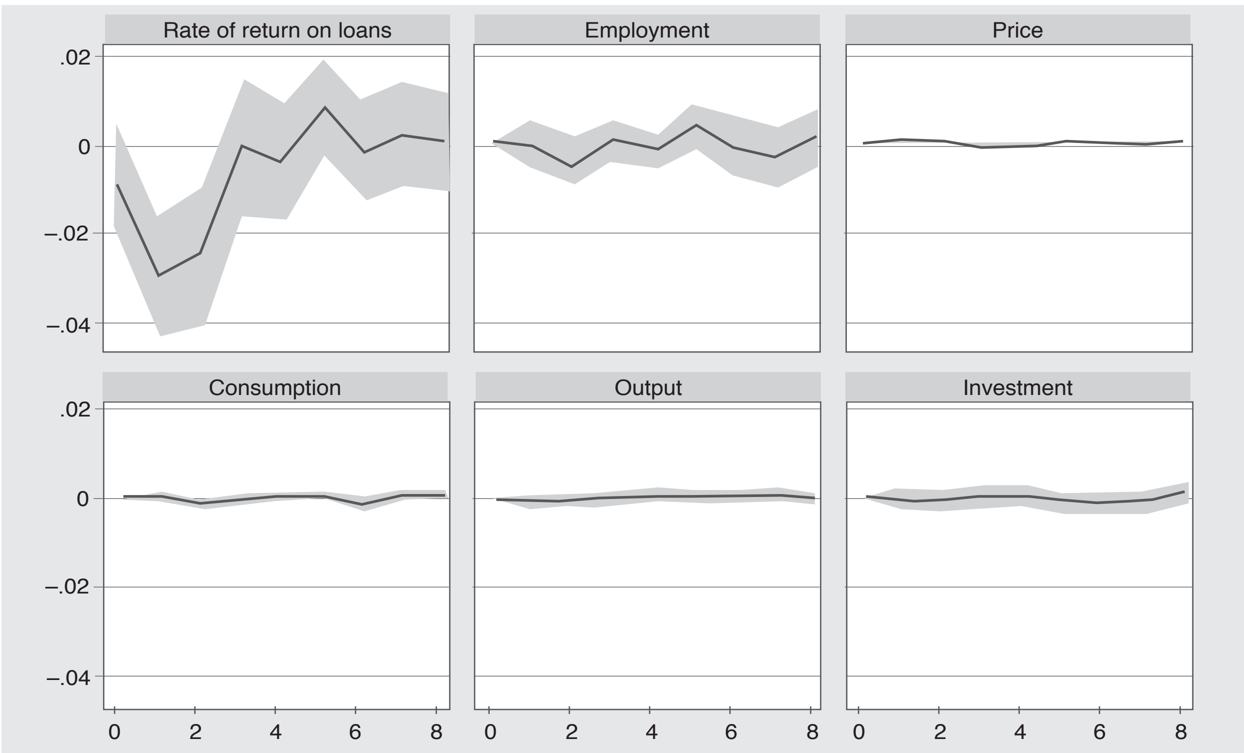

FIGURE 3f. The effect of a monetary shock