Modeling the Effect of Fiscal and Monetary Policy on Housing Price

in Germany between Years 2000 and 2020

Study Program

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Executive Summary

Since Keynes published his book 'The General Theory of Employment, Interest and Money', the monetary and fiscal policies are used to stabilize the economies all over the world. Numerous research is conducted to clarify how these policies can affect different sectors of economy. In this work, we focus on the German housing market and how it is related to monetary and fiscal policies. Firstly, we examine the monetary transition channels[1] with the data from German economy from year 2000 to 2020. Secondly, we use computational macroeconomics to identify a Structured Vector Autoregressive (SVAR) model of the system. Therefore, we first choose a set of important variables which can affect the model. Then, under some reasonable assumptions a model is identified which represents the housing market related section of macroeconomics system of Germany. Finally, this model is used to identify how every variable in model can affect the rest of the variables. At last, the shortcomings of this model are identified and we suggest some improvements for future works.

[1] See. *Mishkin, F. S.*, 1996.

List of abbreviations

ISLM	Investment Saving Liquidity Money
SVAR	Structured Vector Autoregressive
r	Interest Rate
rg	Government Spending
ry	Real output
hp	House Price
h	Housing Supply

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1 Introduction

The need for a shelter is one of the most fundamental human needs. The psychological and economical impact of housing on people economy is undeniable. Therefore, housing sector is a major area of interest for both governments and people. Developments in housing market can affect both consumers and credit institutes. Considering its importance, the housing market plays a central role in monetary and fiscal policies of many countries. In order to better understand this sector of economy, one needs to be able to model it. Models are used to simulate the behavior of the real system for prediction and planning purposes. In this work, we firstly examine an existing well known model in this area with the real data from German economy. Secondly, identify a model from data to get a better understanding of the system.

1.1 Problem Definition

Understanding a system is a prerequisite to simulation or control of a system. Housing sector of economy is no exception to this rule. How can governments or central banks respond to a rising house prices? Or what would happen to housing prices if the central bank decides to increase the interest rate. This questions can only be answered, if there exists a sound model of housing market economy that researchers can rely on. Models are a represent the real system. Hence, the questions where to get a model which is close enough to the real system?

1.2 Objectives

In this paper we try to explain the relationship between housing price and monetary and fiscal policies in Germany . The major objectives of the study are: Firstly, to explain the behavior of the housing market in relationship to monetary policies in Germany using the previously mentioned housing related monetary transmission channels. Secondly, to analyze the data and derive a model using computational macro economics method SVAR and examine how shocks to different macroeconomics variables affect housing price and housing output.

1.3 Methodology

Firstly the transmission channels proposed by Mishkin[2] illustrated in Figure 1 are used to explain the macro economics and housing related data in Germany. Secondly, an SVAR model is proposed and identified using the data evidence. Details about each of these two methods are explained in corresponding chapters.

[2] See. *Mishkin*, *F.*, 2007.

2 Monetary Transition Channels

In his paper[3], Mishkin gives an overview of the transmission mechanisms of monetary policy in economy. Most important channels are namely interest rate channel, asset prices and credit channel. In the following sections we review this paper and explain every channel in detail.

2.1 Interest Rate

Interest rate channel is explained with the traditional Keynesian Investment Saving Liquidity Money (ISLM) and shows the effects of a monetary expansion as follows:

$$M \uparrow \Longrightarrow r \downarrow \Longrightarrow I \uparrow \Longrightarrow Y \uparrow$$

where $M \uparrow$ indicates expansionary monetary policy which leads to fall in real interest rate r, which lowers the cost of capital, causing rise in investment spending I, therefore resulting in an increase in output y.

2.2 Asset Price Channels

According to Mishkin[4] the exchange rate channel can be illustrated as follows:

$$M \uparrow \Longrightarrow r \downarrow \Longrightarrow E \downarrow \Longrightarrow NX \uparrow Y \uparrow$$

An expansionary monetary policy leads to fall in domestic real interest rate. As a consequence domestic currency$E$ becomes less attractive in comparison to other currencies. Depreciated currency makes domestic good more attractive for export. As a result net export NX raises followed by aggregate output. Furthermore, two sub-channels are introduced for equity price namely Tobin's q and Wealth Effects[5]. Tobin's q can be summarized as following[6]:

$$M \uparrow \Longrightarrow P_e \uparrow \Longrightarrow q \uparrow \Longrightarrow I \uparrow \Longrightarrow Y \uparrow$$

[3] See. *Mishkin, F. S.*, 1996.
[4] See. *Mishkin, F. S.*, 1996.
[5] See. *Mishkin, F. S.*, 1996.
[6] See. *Mishkin, F. S.*, 1996.

Higher equity prices P_e leads to a higher q factor (market value of the firm divided by replacement cost of capital). When q is high companies issue equities and buy new investment goods which are relatively cheaper so investment increases. The wealth channel is described as follows[7]:

$$M \uparrow \Longrightarrow P_e \uparrow \Longrightarrow wealth \uparrow \Longrightarrow consumption \uparrow \Longrightarrow Y \uparrow$$

Housing and land price which is our topic of interest in this work can be categorized in this channel as equity.

2.3 Credit Channels

Two basic channels of monetary transmission emerged because of asymmetric information are Bank Lending and Balance Sheet channels. Bank Lending Channel[8]: This transmission channel is very straightforward:

$$M \uparrow \Longrightarrow bankdeposits \uparrow \Longrightarrow bankloans \uparrow \Longrightarrow I \uparrow Y \uparrow$$

Increased bank reserves and available loans causes investment to rise. Balance Sheet Channel[9]:

$$M \uparrow \Longrightarrow P_e \uparrow \Longrightarrow adverseselectionandmoralhazard \downarrow \Longrightarrow lending \uparrow \Longrightarrow I \uparrow \Longrightarrow Y \uparrow$$

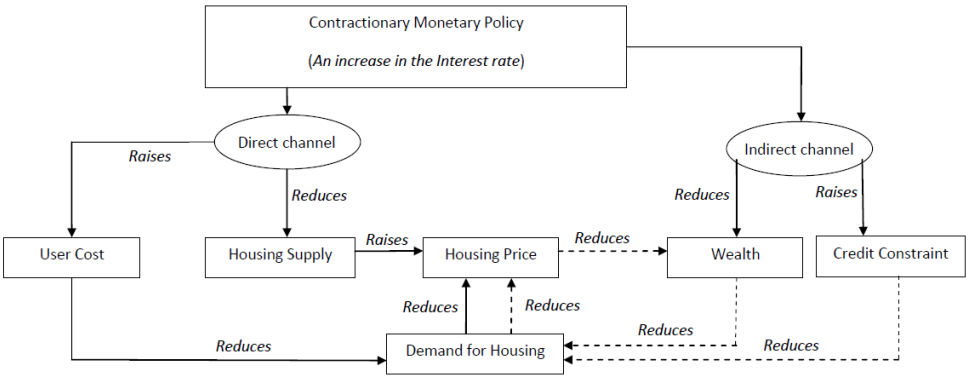
Expansionary monetary policy raises the cashflow and consequently reduces adverse selection and moral hazard (risk) and therefore more lending.

2.4 Housing Related Transmission Channels

Among all the channels explained in previous sections, a very concise representation of the housing market related channels are shown in Figure 1

[7] See. *Mishkin, F. S.*, 1996.
[8] See. *Mishkin, F. S.*, 1996.
[9] See. *Mishkin, F. S.*, 1996.

Figure 1: Monetary Transmission Channels Affecting the Housing Market



Source: See *Wadud*, *I.*, *Bashar*, *O.*, *ali ahmed huson joher*, *h. j.*, 2009

Following his older paper on monetary transmission channels, Mishkin concentrates merely on housing market in his more recent paper[10] and explains these channels as follows:

2.4.1 Direct Channels

Direct Interest Rate Effects through the User Cost of Capital

The user cost of housing capital can be described as[11]

$$uc = hp((1-t)i - \pi_e) - (\pi_h - \pi_e) + \delta$$

whre uc is user cost of capital, hp is the relative purchase price of new housing capital, i is the mortgage rate and π_h and π_e are the appreciation of housing prices and real inflation. δ is depreciation rate for housing. The formula also deductible mortgage interest by adjusting the nominal mortgage rate by the marginal tax rate t. after tax real interest rate. One can see that when the interest rate raises the user cost of capital raises and consequently the demand for housing decreases. The fall in demand result in a fall in supply and consequently aggregate demand. Looking more precisely in $(\pi_h - \pi_e)$ part of user cost equation one can see the effect of interest rate. When interest rate raises the expected appreciation of housing price falls and therefore the current user cost of capital increases which in turn result in decline in demand.

[10] See. *Mishkin*, *F. S.*, 1996.
[11] See. *Mishkin*, *F.*, 2007.

Interest Rate Effect on Supply[12] Higher short-term rates, which increase cost of supply and decreases housing activity.

2.4.2 Indirect Channels

Wealth Effects[13] There evidences proving an increase in wealth should have positive effect on consumption[14]. As we know from previous section an expansionary monetary policy can increase the demand for housing which normally leads to in increase in house price. Therefore, this results to an increase in total wealth and consequently aggregate demand. Balance Sheet, Credit-Channel Effects on Consumer Spending[15] An increase in house price improves the house hold balance sheet and reduces the risk for the credit giver as explained in previous sections.

2.5 Data Analysis

In this section we introduce the variables we think play a role in housing sector of economy. The data evidence from German market and the sources of data are introduced here too. following are the list of the variables.

2.5.1 Interest Rate

Interest Rate (r) is the money market interest rate[16] (EONIA) rate at which banks provide loans to each other with a duration of 1 day, In my opinion this is a good indicator of the monetary policy since it combines central banks ECB's deposit facility rate and ECB interest rates for main refinancing operations. This affect is more clear when we look in the recent data after 2018 where central banks interest rate for refinancing is zero but the deposit facility goes negative and this stimulates banks to lend more money. Original data is monthly and we need to average to get the yearly rate.

[12] See. *Mishkin*, *F.*, 2007.
[13] See. *Mishkin*, *F.*, 2007.
[14] See. *Mishkin*, *F.*, 2007.
[15] See. *Mishkin*, *F.*, 2007.
[16] See. *BundesBank*, Unknown, n. d.

2.5.2 Government Spending

General government deficit(-) or surplus(+) as defined in the Maastricht Treaty[17] is used to describe Government Spending (rg). In my opinion, it is a good indicator of the Government fiscal policy since it includes both expenditure and earning of the government. Change in percentage for each year is calculated and sign is reversed such that when the government has a deficit it is an indicator if positive government spending.

2.5.3 Output

Real output (ry) is represented by the data from German overall econonmy[18].

2.5.4 Housing Price

House Price (hp) is represented by the data from OECD[19].

2.5.5 Housing Supply

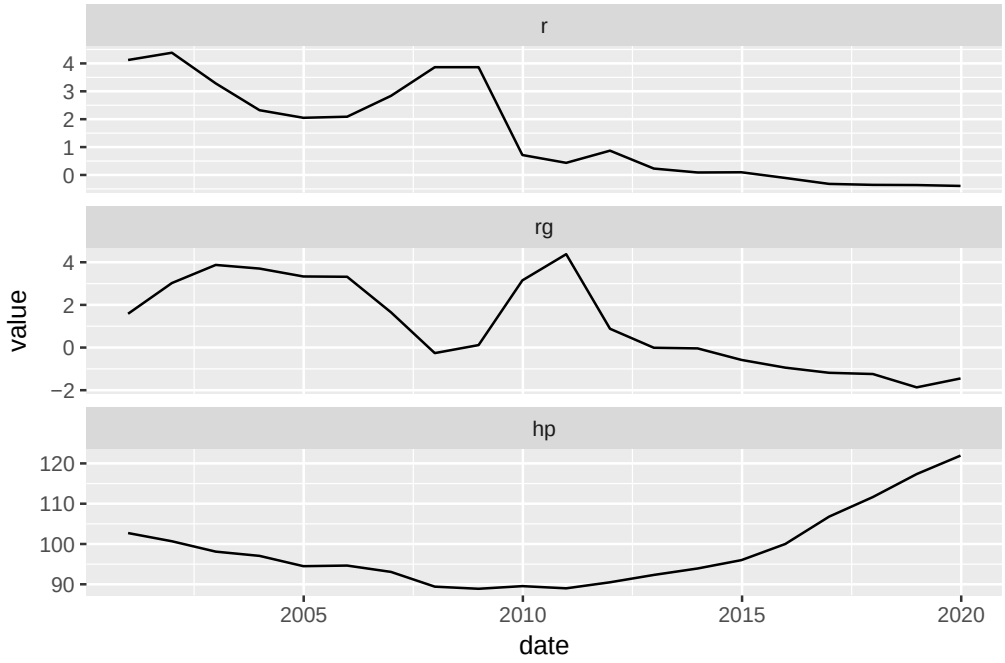
For Housing Supply (h) west Germany's data from Statista[20] is used. Data is unfortunately only for west Germany but we used it as we thought that it is enough representative.

2.5.6 Data Analysis

If we look into Figure 2 and take the period 2008 till 2011 as an example into account, we can see that r and rg are reduced and hp is increased as a result with a little bit of delay. This change in the house price is expected as we described in chapter 2.

[17] See. *BundesBank*, Unknown, n. d.
[18] See. *BundesBank*, Unknown, n. d.
[19] See. *OECD*, Unknown, n. d.
[20] See. *Statista*, Unknown, n. d.

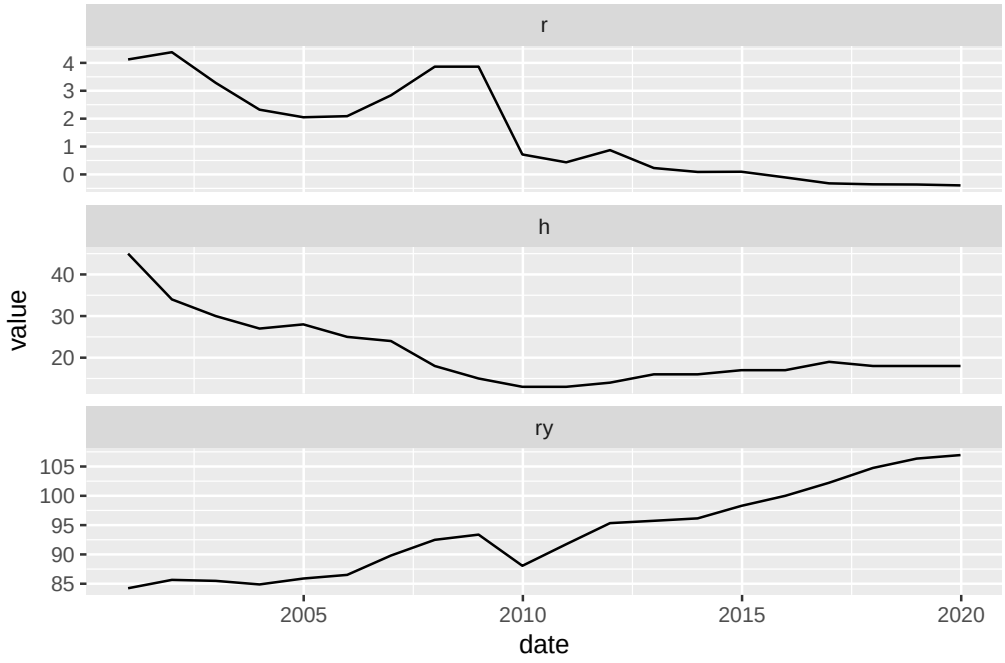
Figure 2: Interest Rate, Government Spending and House Price in Germany in Years 2000-2020



Source: Own Figure

Moreover, if we look into Figure 3 and take the period 2008 till 2011 as an example into account, we can see that r and rg are reduced and hp is increased as a result with a little bit of delay. This change in the house price is expected as we described in **??**.

Figure 3: Interest Rate, Housing Supply and GDP in Germany in Years 2000-2020



Source: Own Figure

3 SVAR Identification

For implementaiton of the methods introduced in previous section the SVAR package in R[21] software is used.

3.0.1 SVAR Model Identification

The structural VAR models are often used to trace the contemporaneous linkage among macroeconomic variables. The SVAR model has the following general form[22]:

$$A_0 Y_t = mu + A_1(L) Y_t + B\varepsilon_t$$

where yt = [y1t , ..., yKt] is a vector of observable variables, Ai , i = 1, . . . , p, are (K × K) coefficient matrices, and intercept parameters are collected in µ. We focus on the case of time invariant deterministic terms for notational clarity. Model augmentation with time-varying deterministic terms (e.g., breaks, linear trends), however, is straightforward. Furthermore, the VAR model is stationary (invertible) by assumption. The vector ut consists of reducedform residuals, which are serially uncorrelated with E(ut) = 0 and Cov(ut) = sigmau. The nonsingular matrix B captures the instantaneous effects of the structural shocks on the variables of the system Where Y_t is n-vector relevant variables, then A_0 and B are $n * n$ matrices and $A_1(L) = \sum_{i=1}^{q} A_{1i} L^i$ is the matrices polynomial in the lag operator in which A matrices have the same size as A_0 matrix. The error termsε_t (structural schocks) is an n-vector of serially uncorrelated zero mean structural schocks with and identitiy contemporanous covariance matrix. The crucial part in SVAR modelling is the choice of the macroeconomics variables. The second challenge is that the nmuber of parameters to be identified in the structural model is larger than that of the reduced VAR form. Therefore, some new relations needs to be introduced. This can be usually done by introducing restrictions on A_0 or B_0 matrix.

In this work, we assume the following set of variables as the variables involed in modeling.

[21] See. *Lange*, *A.* et al., forthcoming.
[22] See. *Lange*, *A.* et al., forthcoming.

The assumed Y is :

$$\begin{bmatrix} ry \\ \pi \\ rg \\ r \\ mc \\ h \\ hp \end{bmatrix}$$

$$h^s = a_1 mc + a_2 rhp + b_1^s \varepsilon^s h^d = a_3 ry + a_4 rhp + a_5 r + a_6 \pi + a_7 rg + b_1^d \varepsilon^d h^s = h^d$$

The notion of time is deleted from the above equation but once can consider that the every variable reperesnt different time instance for example $a-1mc$ depending on the cohsen number of lags represent $a_{1t}mc_t, a_{1(t-1)}mc_{(t-1)}$... this will lead to

$$rhp = c_1 mc + c_2 ry + c_3 rhp + c_4 r + c_5 \pi + c_6 rg + b_1 \varepsilon$$

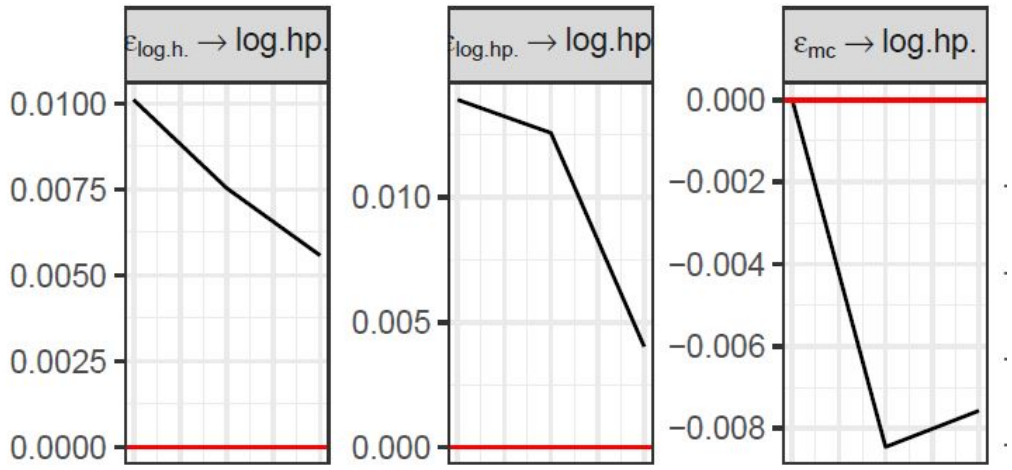
The second assumption chosen by author in this work is that A_0 is a lower triangular matrix therefore as one can see in the order of variables in bla equation every variable can have only correlation with previous variables in the same time stamp and with all variable in previous time stamps. Therefore, the order of variables play a crucial role in our model.

3.1 SVAR Results

The following picture shows the impulse response of the identified model to different shocks. As one can see in Figure **??**, when the housing supply increases housing price starts to decrease. This result fits to what we expected from the monetary transition channels. However, the plot shows a small drop in house price as a result of an increase in material cost. In my opinion, this is due to negligible affect of material cost on housing price in Germany. Furthermore, a close look at Figure **??** show that after an increase in interest rate, housing price start to decrease for a period of 2 years. This result can also be explained with both IS-LM and Transition Channels model. the housing supply increases housing price starts to decrease. This result fits to what we expected from the monetary transition channels. Besides that, the plots implies that an increase in GDP leads to higher prices. This is also expected from an economy with growing GDP to experience and increase in house prices. However, the first plot implies that an increase in government spending can decrease the house price. In my opinion, this is not a result that one may

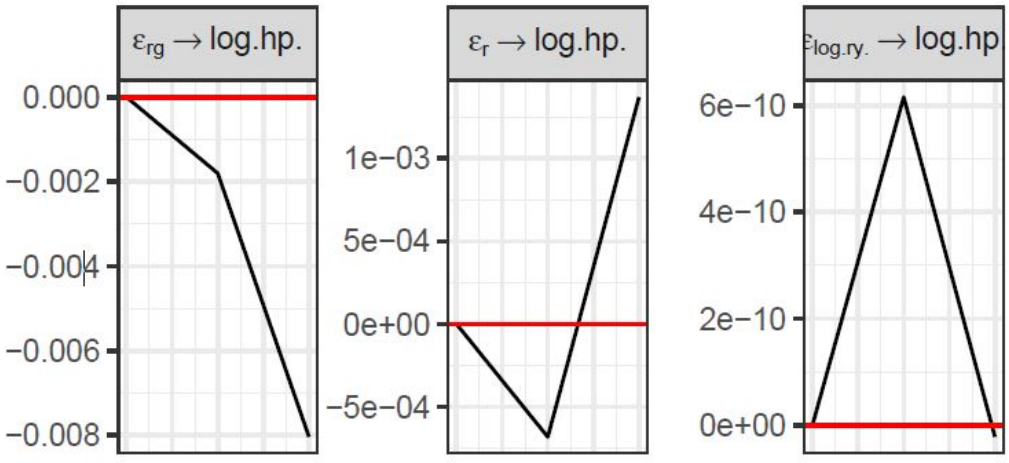
expect. Usually an increase in government spending should lead to an increase in GDP and consequently the housing price. This impulse response can be a result of small number of lags (2 lags) chosen for the identified model and the sticky nature of housing price. Besides that, as the data set used for this identification covers only last 20 years,it can be that the data is not informative enough for this type of identification. However, this can be improved by adding feasibility constraints to the model.

Figure 4: Impulse Response of a Shock in Housing Supply, Housing Price and Material Cost on Housing Price



Source: Own Graph

Figure 5: Impulse Response of a Shock Government Spending, Interest Rate and Output on Housing Price



Source: Own Graph

4 Conclusion

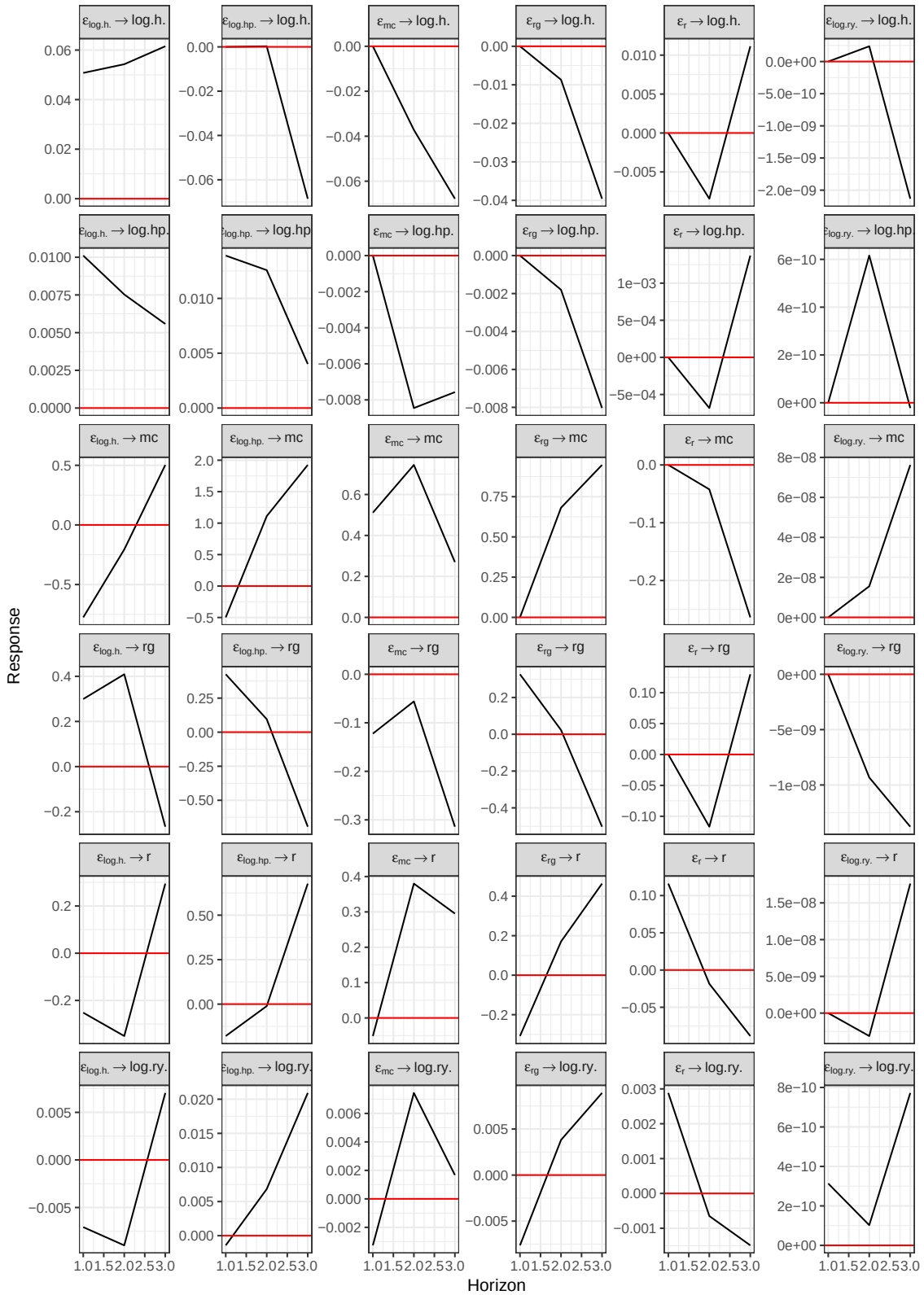
Both introduced models in this work show a correlation between monetay and fiscal ploicies and house price. An expansionary monetary policy will lead to a heigher house price as well as higher GDP. As the analytical can be used to understand the economy, they usually cannot hand quantative or accurate results for every country. Since, every country has its own economic system, in my opinion, that is better to make sure the used model presents the real system accurately or identify a model from data. For model identification one needs to make sure that the data used for the identification process contains enough information about dynamics of the system. In my opinion a combination of both approaches should be used for an accurate and reliable modeling of the system.

Anhang

Appendix 1: Appendix

One can find a full plot of the identified SVAR model to various shocks in Figure 6.

Figure 6: Full Impuse Response of the Identified SVAR Model



Source: Own Graph

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