

The sources of house price changes in Malaysia

House price
changes in
Malaysia

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Abstract

Purpose – The purpose of this paper is to examine the house market in Malaysia from 2002 to 2015. Specifically, the macroeconomic determinants on the house price and house demand are investigated.

Design/methodology/approach – Structural Vector Autoregressive Regression was adopted to estimate the unexpected changes in both house demand (residential transaction volume) and prices based on economic theoretical reasoning that consider shock from macroeconomic determinants.

Findings – The transaction volume and real house prices respond to most of the macroeconomic shocks. While the impact of real gross domestic product (GDP) on house prices appears to be stronger and longer in comparison to other macroeconomic shocks, a 60 per cent change in house prices can be explained by real GDP regardless of whether it is in the short run or the long run. The studies also reveal that a positive effective exchange rate plays an important role when demonstrating the transaction volume. Moreover, monetary liquidity plays a major role in justifying the transaction volume. This implies that mortgage lending may have an impact on housing demand. Meanwhile, movements of house prices cannot be explained by the demand in quantity. This signifies that supply has a strong influence in determining the price.

Research limitations/implications – This study has implications on policymakers of which the interest rate as a cooling measure might not be effective in the short run. The interest rate has very little impact on housing prices. Furthermore, policymakers should address the concerns on speculations, as the results reveal that monetary liquidity and the exchange rate have a strong impact on the housing demand.

Originality/value – This study seeks to provide answers regarding the recent upsurge of Malaysian housing prices. Besides focusing on the house price changes, this study addresses the role of transaction volume while evaluating the house market, as housing prices are usually downwards rigid. Since the price and transaction volume are both related to the transaction activity, this study is significant and could be a good reflection on the actual demand behaviour in the residential market.

Keywords Malaysia, House prices, Exchange rate, Structural VAR, Real GDP, Transaction volume

Paper type Research paper

1. Introduction

According to the International Monetary Fund, the annual global real housing price spiked to its peak in the year 2007 followed by a downturn after the global financial crisis during the years 2008-2009. Despite the weak momentum in the global housing market, house prices in most of the South East Asian countries retained a positive growth throughout 2015. In Malaysia alone, the outstanding mortgage as percentage of gross domestic product (GDP) has exceeded 30 per cent. This implies that the development of Malaysian house markets is tantamount to some of the developed economies in Asia (IMF, 2014). Prior to the year 2010, Malaysian house prices have recorded an average growth of 3.2 per cent annually. House prices have achieved the peak of its growth of approximately 12 per cent in the year 2012 (BNM, 2012). On top of that, a study carried out by Demographia indicates that Malaysian house prices have exceeded approximately 5.5 times the median annual household income in the year 2014 (The Malay Mail, 2014). The house price in many of the major cities have also been found to fall under the category of severe unaffordability. For the sales volume, we

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observe a more fluctuating trend. Similarly, the sales volume is particularly high after the year 2010 and has achieved the strongest growth of 36 per cent in 2011Q2. Although the sales volume softened following the cooling measure being introduced by the government, housing prices remained at a high level.

The substantial increase of house prices has undoubtedly been a topic of concern, as the housing market shows a feedback effect on the economy. [Kiyotaki and Moore \(1997\)](#) pointed out that houses act as collaterals for loans. Hence, the sharp drop in house prices will deteriorate the collateral value and the financial system. This explains why the house prices change often, and portrays the leading indicator for the economy. Generally, house prices are determined by both the demand and supply force. The existing literature on housing markets reveals that income, population growth, interest rate, inflation and credit availability were the few main factors that contributed to housing demand ([Adams and Füss, 2010](#); [Hort, 1998](#); [Chen et al., 2011](#); [Liang and Cao, 2007](#)), whereby the supply of land, cost of construction, investment of the existing housing stock and the changes in housing stock were the drivers of housing supply ([Ahuja et al., 2011](#); [Liu et al., 2002](#)).

In this paper, we aim to identify the impact of various macroeconomic shocks on sales volume and the house price. In fact, the choice of which variable to determine the house prices is depending on the theoretical model. Our estimation is according to the static equilibrium model of [DiPasquale and Wheaton \(1992\)](#)[1]. Meanwhile, we modify the model a little corresponding to the Malaysian housing market. When explaining the rise of the Malaysian house price, we believed that it is closely related to macroeconomic changes. For example, the effect of the economic downturn is expected to transmit to the housing market by dampening both housing demand and supply. By taking a deeper look at our historical trend of house prices, we can observe the downtick of house prices when the economic crisis hits Malaysia, particularly in the year 1997. On the impact of economic activity on house price, the theoretical explanation is economic boom increases the demand for space and push up the price when the supply of space remains the same. Apart from that, the government's monetary policy has been claimed to be relevant to asset price changes. Since the monetary policy is adopted in stabilizing the macroeconomics, some economists argue that rapid money growth has led to the inflation of asset prices, causing the liquidity to increase the demand of assets, thereby fostering the economic growth. As a result, dynamic general equilibrium economists foresee the increase of asset prices as a consequence of monetary policy failure in stabilizing the price levels. On the other hand, a positive relationship between monetary liquidity and the asset price could be explained by their correlation with the economic boom. Practically, the monetary demand increases during the economic boom; this gives rise to the asset price. The economists of "Bank International Settlement" supported this view by adding that a soar in asset price is more likely to occur in an economy with low or stable inflation.

Additionally, we analyse the effect of real effective exchange on house prices and housing demand. Exchange rate could affect the house price through the construction cost. The depreciation of domestic currency will result in a higher import cost and uplift the overall construction cost and house prices. On the other hand, the exchange rate can reflect the purchasing power of ringgit Malaysia. The movement of exchange rate could have induced the international capital mobility and therefore affect the asset price in Malaysia. To illustrate this, there is an increase in the foreign acquisition of property in Malaysia following the introduction of the "Malaysia My Second Home" (MM2H) programme[2]. Approximately 83 per cent of MM2H applicants have purchased a house in Malaysia ([Lee et al., 2010](#)). As such, the exchange rate potentially affects Malaysian house prices.

Considering the most recent financial turmoil, it is important to understand the key variables that determine the variation of house prices. Malaysia, as a small emerging economy, has experienced exponential growth in the housing market recently. This motivates us to find out the drivers that will exert considerable effects on house price changes in Malaysia. Even though the interaction between macroeconomic changes and asset prices have been a popular subject of existing literature, there are only a few studies which highlight the potential reasons behind the false leap in Malaysian house prices. For instance, [Hii *et al.* \(1999\)](#), [Ong and Chong \(2013\)](#), [Glindro *et al.* \(2011\)](#), [Ibrahim and Law \(2014\)](#) and [Pillaiyan\(2015\)](#) concentrated on the Malaysian market. These studies have underpinned the existing literature in three directions. First, [Hii *et al.* \(1999\)](#) and [Ong and Chong \(2013\)](#) have particularly focused on the relationship between GDP and Malaysian house prices. Both studies have revealed that GDP is the major driver of Malaysian house prices. Meanwhile, [Glindro *et al.* \(2011\)](#) have assessed the data panel of nine Asian Pacific countries, which aims to explain the overvaluation of house prices. Weak evidence of house price overvaluation in Malaysia has been found in the study. Lastly, [Ibrahim and Law \(2014\)](#) and [Pillaiyan\(2015\)](#) have emphasized on the relationship between macroeconomic changes and house price changes in the long run.

A number of macroeconomic variables have been found to contain long run relationships with house prices. Nevertheless, the channels of such linkage appear to be unclear. Besides, most historical empirical studies uncover the link between the macroeconomic and housing market by focusing on the house prices. Certainly, the housing demand which was captured by the sales volume has a more prominent response to the macroeconomics. Comparably, there is a notable level of inertia in house prices ([Oikarinen, 2012](#)). For instance, the transaction volume was expected to slow down for four consecutive quarters during the year 2015, but the weaker demand has not dragged down the Malaysian house prices. Hence, the house price inertia is not uncommon in Malaysia. We have expected the sales volume to provide additional information when explaining the housing market. Given the limited attention given on the house demand, this study will take a preliminary step to extend the current research on the house price determination and to evaluate the influence of key macroeconomic variables on the behaviour of sales volume. From the best of our knowledge, the macroeconomic influence on the house price and sales volume for the case of Malaysia has not yet been examined. On the other hand, this study seeks to contribute to the existing literature by using the structural vector autoregressive regression (SVAR) framework. In the past literature, most of the studies adopted VAR in explaining the relationship. However, the VAR model lacks theoretical support. Thus, the SVAR approach was chosen in the present study given that the interpretation of relationship is embedded with economic theories. According to [Lütkepohl \(2006\)](#), this approach has the significant advantage in identifying the system by imposing a restriction on the contemporaneous feedback effect between the variables. This allows us to obtain an economic interpretation on the structural shock. Additionally, our analysis includes a multiple endogenous variable. Thus, SVAR model is the most appropriate for our analysis. To sum it up, our analysis has shed light on the movement of the Malaysian housing market by providing evidence based on a more theoretically framework.

The rest of the paper is organized as follows. The next section provides a review of some empirical research on the macroeconomic effects and the transmission mechanism on the housing market. Then, Section 3 outlines the empirical approach that has been applied throughout the study. The construction of data is described in Section 4. Discussion of findings is presented in Section 5. Finally, Section 6 provides a brief summary and draws some concluding remarks.

2. Literature review

The relationship between house prices and macroeconomic changes has been extensively discussed in the previous studies. From the microeconomic standpoint, house prices are derived from the disequilibrium of housing demand and supply (DiPasquale and Wheaton, 1992). House prices, in particular, indicate price stickiness. The rationale was that property would not respond to the economic news immediately. Moreover, housing demand drops when the economy busts, but price drops in a smaller magnitude when sellers become reluctant to sell at a lower price. This may fuel the housing bubble when asymmetric responsiveness is present during the economic boom and recession (Adams and Füss, 2010). In other words, the housing market only achieves equilibrium in the long run. Notwithstanding, evidence shows a co-movement of housing market and economy cycles in multiple studies. Baffoe-Bonnie (1998), Blomstrom *et al.* (1996) and Jud and Winkler (2002) revealed that real income is important when explaining the house price changes. By contrast, the international macroeconomic impact has been highlighted by Sutton (2002) and Terrones and Otrok (2004). They have concluded that house prices strongly correspond to changes of the global economy. On the other hand, the feedback effect from the housing market to the economic activity is equally important, as housing can also be treated as an asset. The bi-directional relationship has been addressed by Iacoviello (2005), Leamer (2007) and Li and Chiang (2012). These studies have confirmed that GDP acts as an important indicator to the housing market. Simultaneously, the housing market can affect economic growth via a few channels such as housing investments, consumptions, construction industries and employment opportunities. This is because a higher housing price implies that greater wealth has been accumulated and affects the economy in the context of a higher consumption level. During the housing boom, the construction sector will be stimulated and thereby contributes to economic growth. However, the question of whether the large scale of housing development has enhanced the economic performance remains inconclusive. Lee (2009) focused on the determinants of the house price volatility concerning eight capital cities in Australia. Income growth, inflation as well as unemployment rates are the factors which explain the volatility of house prices. This implies that the house price volatility varies over time.

Meanwhile, various empirical evidence shows relations between monetary growth and house prices. The concept of liquidity effect which was introduced by Friedman (1968) reassured that the asset price was affected via the interest rate channel. The increase in monetary liquidity reduces the interest rate in the short run, and the asset price is affected when the cost of capital changes. On the contrary, monetary expansions could affect the house price through the credit channel. The credit availability could increase mortgage lending and stimulate housing demand (Iacoviello and Minetti, 2007). This was supported by Goodhart and Hofmann (2008) and Collyn and Senhadji (2002). They confirmed clear links between money, bank credits and property prices. Moreover, Marshall (1992) asserts that monetary growth affects the expectation for inflation, causing monetary shocks to induce inflation, making the event of substitution from money to other assets become more likely, fostering the asset price.

The homeownership is very much dependant on the financial infrastructure, especially the finance rate. When the interest rate is low, this enables households to keep the costs at a low rate, within their budget limit and promotes the growth in a housing market. At such a low cost, the investor could expect a higher return. There are a number of studies which have evaluated the role of interest rate in the housing market. Weeken (2004) and Ayuso and Restoy (2006) estimated the equilibrium asset pricing model and explained how the real interest rate and rental stimulate the housing price in England and Wales. They reported

that the surges of housing prices throughout the sample period were largely explained by the low interest rate. Furthermore, [Agnello and Schuknecht \(2011\)](#) focused on the determinants of boom and bust of housing market. They show evidence that low interest rates induce the credit expansion and boost the housing price.

In principle, the capital market and the foreign exchange market are interrelated. The return of asset investment is expected to amplify when the exchange rate of a home country appreciates. Nevertheless, there are only a few studies carried out which explains the effects of the exchange rate on housing market. [Miller *et al.* \(1988\)](#) conducted an analysis on the relationship between the exchange rate and the housing market. They observed a co-movement between the appreciation of Yen against US dollar and housing price. They found that there 30 per cent of home sales were from the Japanese investors. This explains that the speculative behaviour of foreign investors also plays a vital role in determining the housing price. Similar findings have been concluded by [Benson *et al.* \(1999\)](#) who have emphasized on the direct effect of exchange rate on the US housing price. Given that Point Robert and Vancouver are geographically adjacent to each other, the changes of the exchange rate have affected the housing price. Besides that, exchange rates can affect the housing market via the wealth effect, liquidity effect, expected effect and spillover effect due to the rapid credit expansion. This has been outlined in the study done by [Liu and Zhang \(2013\)](#). The appreciation of RMB was found to have positively affected the housing price. Coupled with the excess of global liquidity, this has attracted a tremendous influx of speculators to China and further pushes the housing price upwards.

3. Data and methodology

3.1 Data

To achieve our objective, national all house prices index with (2000: Q1 = 100) will be used as the measure of house prices. The house price index was calculated based on the Lapspeyres weighted formula. The house prices are deflated by consumer price index to construct the real term. Additionally, sales information such as transaction volume will be employed. Meanwhile, GDP is the general indicator that is being used to represent the economic activity and income. Our study computes the real GDP by deflating the GDP deflator. Whereby, the lending rate represents the interest rate. We compute the monetary liquidity by broad monetary (M2) relative to the base of GDP. This proxy is widely used in past studies and is often relevant to the short-term credit market. In short, all of our time series are extracted from a data stream, except transaction volume. It is obtained from the Valuation and Property Services Department of the Malaysian Ministry of Finance through its publications. The quarterly time series is only made available from the year 2002 onwards. Therefore, the research covers the period from 2002Q1 to 2015Q4, according to the data availability. All the growth rates of series are generated and the estimated values of each series in period t will be divided by the value in period $t-4$.

3.2 Methodology

Studies in the past only focused on the behaviour of house price changes. This, however, may not be sufficient when explaining the housing market. Nevertheless, studies done in Malaysia proposed that the economic growth has been the important factor when determining the house prices ([Hii *et al.*, 1999](#); [Ong and Chong, 2013](#)). Whereby, [Ibrahim and Law \(2014\)](#) addressed the impacts of bank credits, interest rates and outputs on house prices. Following to previous studies, this study presents the SVAR model to estimate the unexpected changes in both house demand and prices based on economic theoretical reasonings that consider shock from macroeconomics.

We employ a SVAR model with six variables and particularly focus on the impacts of monetary liquidity on sales volume as well as on house prices. Sources of each shock from both the demand and supply side, to housing demand and prices will be recognized in our model. The SVAR model is formulated as:

$$A_0 Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} \dots + A_p Y_{t-p} + B \varepsilon_t$$

$Y_t = (N \times 1)$ vector of endogenous variable at time t ;

$$A_i = (N \times N) \text{ matrix of parameters for } i = 0, 1, 2, \dots, p; \tag{1}$$

$\varepsilon_t = (N \times 1)$ vector of white noise process; and

$p = \text{lag length order.}$

The matrix A in equation (1) is a system SVAR equation, which describes the instantaneous correlation between the variables. Moreover, matrix B represents the structural parameters. The error term captures the structural shock in the model. The structural shock is assumed to be orthogonal, with the properties of mean value to be zero and serially uncorrelated. However, the identification analysis is necessary when considering that the structural shock could not be identified directly. While the reduced form of VAR can be written as:

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} \dots + A_p Y_{t-p} + u_t \tag{2}$$

Then, we can show the relationship between the reduced form and the structural form by multiplying equation (1) with A^{-1} . Given that we will use AB-model throughout the study, we could rewrite the relations for the innovation as:

$$u_t = A^{-1} B \varepsilon_t \tag{3}$$

$$A u_t = B \varepsilon_t \tag{4}$$

The linear restriction on A and B which is in the explicit form are as per below:

$$\text{vec}(A) = R_A \gamma_A + r_A \tag{5}$$

$$\text{vec}(B) = R_B \gamma_B + r_B \tag{6}$$

R_A and R_B are the suitable matrixes which contains zero to one, where γ_A and γ_B accommodate the unrestricted elements of A and B . r_A and r_B are vectors of fixed parameters. Simultaneously, a set of restrictions are subject to the maximum numbers of identification allowed. In total, the matrices A and B have $2K^2$ elements of parameters of which the maximum restriction of elements in these two structural forms of matrices is $2K^2 - K(K + 1)/2$.

The above-mentioned six variables are described in a vector $Y_t = (\Delta REER_t, \Delta IR_t, \Delta RGDP_t, \Delta M2G_t, \Delta TV_t, \Delta RHPI_t)'$ where REER is a real effective exchange rate; IR is the lending rate; RGDP represents the real gross domestic product; M2G is the M2 as a percentage of the GDP as the proxy of monetary liquidity; TV is the transaction volume which reflects the housing demand; RHPI is the real house price index; Δ denotes the percentage change; t is the time subscript.

Where error term in the reduced form can be written as $u_t = (u_t^{\Delta LR GDP}, u_t^{\Delta IR}, u_t^{\Delta LM2G}, u_t^{\Delta LRHPI}, u_t^{\Delta REER}, u_t^{\Delta LTV})$. Similarly, the error terms for the structure are denoted as $\varepsilon_t^{\Delta REER}, \varepsilon_t^{\Delta IR}, \varepsilon_t^{\Delta LR GDP}, \varepsilon_t^{\Delta LM2G}, \varepsilon_t^{\Delta LTV}, \varepsilon_t^{\Delta RHPI}$. In short, our AB-model then can be expressed as:

$$= \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & a_{65} \\ a_{61} & a_{62} & a_{63} & 0 & a_{65} & 1 \end{bmatrix} \begin{bmatrix} u_t^{\Delta LR GDP} \\ u_t^{\Delta IR} \\ u_t^{\Delta LM2G} \\ u_t^{\Delta LRHPI} \\ u_t^{\Delta REER} \\ u_t^{\Delta LTV} \end{bmatrix} \\ = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} \end{bmatrix} \begin{bmatrix} \varepsilon_t^{\Delta LR GDP} \\ \varepsilon_t^{\Delta IR} \\ \varepsilon_t^{\Delta LM2G} \\ \varepsilon_t^{\Delta LRHPI} \\ \varepsilon_t^{\Delta REER} \\ \varepsilon_t^{\Delta LTV} \end{bmatrix} \quad (7)$$

In this study, we impose contemporaneous identification restrictions to vector A^{-1} . In equation (7), the estimation is based on the contemporaneous restrictions. Regarding the order of the variables, real GDP is placed on the top in the system. Our first row suggests that the real GDP will only respond to other variables in the system dynamically. Given the features of inertia is actively real, we restricted the real GDP to not respond immediately to the shock. This is in line with the model of Sims and Zha (2006) and the intertemporal investment and saving (IS) equation in Rotemberg and Woodford (1997).

Following the past studies, the nominal interest rate is a proxy to capture monetary policy shocks bearing in mind the fact that central banks use it as a monetary tool. Meanwhile, the nominal interest rate assumes that it does not contemporaneously interact with other variables as presented in the second row. The intuition is a delay in information, as most of the data are released on a quarterly basis. Additionally, the goal of achieving a low price level has been long addressed by the Malaysian central bank, especially after the 1997 Asian Financial crisis (Ibrahim and Sufian, 2014). Hence, central bank of Malaysia is predicted to only respond to the commodity price level change. This restriction is consistent with the previous study (Elbourne, 2008). Even though the interest rate is a major tool for the implementation of monetary policy tools, we still include the monetary liquidity in our analysis. This is because the interest rate policy has to be associated with a desirable money supply (Handa, 2009). As monetary supply is often used to adjust the interest rate target, our model allows the monetary liquidity to contemporaneously respond to the interest rate. This is the reason why we place the order of monetary liquidity after the interest rate. We also expect that real GDP has an immediate impact on the monetary liquidity, as GDP is one of the components to calculate the ratio.

As in Woodford (2003), prices respond immediately to output shock; our model presumes that house prices react immediately to real activity; we display this restriction in our fourth row. Additionally, the monetary policy and the monetary liquidity also assume to have taken immediate impact on house prices. Theoretically, housing assets are forward looking and will react towards the macroeconomic and monetary policy news instantly. Nevertheless, we assume that house prices do not respond simultaneously to the real effective exchange rate shock and transaction volume. This is because the exchange rate is expected to pass through to the house prices via construction costs or the foreign demand of houses. Whereby, there is empirical evidence that exchange rates pass through price with a delay (Goldberg and Knetter, 1997). For the transaction volume, house prices assume to react through the lagged value. To illustrate this point, it is noteworthy that Malaysian house prices have not changed much even though demand has slowed down during its recent years (The Edge, 2016).

Given that house prices are assumed to not instantly respond to the exchange rate, we place the order of real exchange rate in the fifth row. Exchange rates are assumed to respond to all of our variables except transaction volumes. This assumption is based on the flexible-price monetary model, expecting the exchange rate to respond immediately to real activity, monetary and prices. This is reasonable, as the exchange rate is a fast-moving variable. According to the theory, exchange rate responds to the consumer price, as central banks may adjust the interest rate to maintain the stability of price levels. This could affect the capital inflow and therefore cause movement in exchange rates. The model is altered slightly by assuming the exchange rate responds to house prices instead[3]. We made a conjecture that exchange rates potentially responds to house prices as housing rents is weighted as approximate 23 per cent in our consumer price index, of which this restriction is in line with the study. On the other hand, we include a dummy variable to capture the effect of the removal of RM pegging to USD after July 2005, and estimated the impact exogenously. Finally, we assumed that the transaction volume responds contemporaneously to all of the variables except the house price. This is because house price information is usually made available with a delay.

As this study comprises six endogenous variables, $2K^2 - K(K + 1)/2$ shall amount to 51 restrictions, to identify the full model. Obviously, equation (7) shows that our model is over-identified and the formal test for over-identifying is conducted. The over-identifying restriction can be traced out by the likelihood-ratio (LR) test, which can be described as:

$$LR = T \left(\ln \left| \widetilde{\Sigma} u \right| - \ln \left| \widetilde{\Sigma} u \right| \right)$$

Where $\widetilde{\Sigma} u$ represents the variance-covariance matrix of the SVAR and $\hat{\Sigma} u$ denotes the reduced form. The statistic is distributed as chi-square and the number of degree freedom refers to the number of over-identifying restrictions.

4. Results and discussion

4.1 Descriptive analysis

Table I provides descriptive statistics for the annualized growth rate of the six series. Over the sample period (2002Q1-2015Q4), standard deviation for the six series indicates that transaction volume and monetary liquidity are more volatile compared to all other

series. By contrast, the variability of real house price and real GDP are relatively much lower. Furthermore, Figure 1 shows the historical structural shock of each variable. Our series shows a more volatile manner after the year 2008. This may reflect the impact of global financial crisis in the year 2008 towards Malaysian macroeconomics.

Variable	Observations	Mean	Std. dev.	Maximum	Minimum
ΔTV	52	0.0295	0.1251	0.3377	-0.2106
$\Delta RHPI$	52	0.0351	0.0359	0.1023	-0.0331
$\Delta RGDP$	52	0.0201	0.0351	0.0941	-0.0778
$\Delta REER$	52	-0.0019	0.0730	0.1093	-0.2428
$\Delta M2G$	52	0.1379	0.3143	0.9518	-0.3838
ΔIR	52	0.0308	0.4341	0.7600	-1.2000

Notes: TV is transaction volume; RHPI is real house price index; RGDP is real gross domestic product; REER is real effective exchange rate; M2G is the M2 as % of GDP; IR is the interest rate and Δ is the first difference operator

Table I.
Descriptive analysis of the variables



Figure 1.
Estimated historical structural shock

4.2 Stationary test

Before estimating the formal relationship between house prices and the macroeconomic variables, we proceed to the unit root test as a preliminary analysis of the data. We present the results of the unit root test in Table II. Both the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests suggest that each data series has a unit root in the level form except the transaction volume[4], while the time series turns stationary after the first differencing. Following Kim and Moreno (1994), our study opts for the first difference VAR, as our variables in the system are stationary after first difference.

After confirming the stochastic properties of the variables, we determined the lag length of the model based on the Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC) and Hannan and Quinn (HQ) prior to the estimation of SVAR model. We estimated the reduced form of VAR with the lag order of two, and we found that the residuals in the system are free from serial correlation[5]. Our estimation of structural parameters for matrices A and B have been reported in Table III. We present matrix A in negative form for an easier interpretation to the contemporaneous coefficients. For an exact identification, 51 restrictions are required. Note that our model is over-identified. However, our χ^2 test statistic for log likelihood ratio test is 4.479 with a corresponding *p*-value of 0.107. Hence, we have insufficient evidence to reject the null hypothesis of over-identifying restrictions. This implies that the restrictions being imposed in the model is valid. In most cases, the sign of the contemporaneous coefficient in Table III coherent with our expectation.

From Table III, it can be concluded that a 1-unit increase in real GDP is accompanied by approximately 3 units' increases in the monetary liquidity. This is in line with our expectation; a growing economy often comes along with an expansion of money supply. Furthermore, a 1-unit increase in interest rate causes the money supply to decrease by 0.29 units. This implies that investors prefer the long-term asset and therefore decreases the money supply given to a higher interest rate.

On the other hand, house prices have been found to only statistically respond to the real GDP. A 1-unit real GDP increase results in a 0.3-unit increase in house prices. Generally, the increase in real GDP entails the growth in household income. Higher income results in a higher demand of housing and therefore pushes up the house price. For the exchange rate, our findings suggest that GDP adversely affects it. These results are interesting, and the possible explanation is the growth in real GDP increases the money demand. Currency depreciates when there are larger transaction values to be financed (Officer, 1981). Our results also show evidence that exchange rates positively respond to both interest rates and house prices. Exchange rates appreciate by 0.1 units when interest rate rises by 1 unit. This

Variable	Level		First difference	
	ADF	PP	ADF	PP
TV	-1.9640	-4.1368***	-8.2198***	-15.3259***
RHPI	-0.6259	-0.7636	-5.7993***	-5.7774***
RGDP	0.0990	-2.9738	-5.4232***	-12.3863***
REER	2.0750	1.5092	-5.1738***	-5.1868***
M2G	-2.5185	-3.3061	-3.7804**	-8.3364***
IR	-3.4425	-2.3369	-3.5743**	-3.9736**

Table II.
ADF and PP unit
root tests

Notes: The constant and trend terms are included in the test equations and the AIC is used to select the optimal lag order in the ADF test equation. ** and *** are denoted as significant at 5% and 1%, respectively

Equation model test

LR test for over-identification

Chi-square (2)

4.4788

p-value

0.1065

Notes: Matrices A and B are the contemporaneous and residual matrices in the SVAR, respectively. *, ** and *** denote significance at 10%, 5% and 1%, respectively. The significant levels of coefficients are determined by the Z test. Standard errors are in parentheses

$$\begin{aligned}
 -A = & \begin{bmatrix} -1 & 0 & 0 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 & 0 & 0 \\ 2.9999 & -0.2927 & -1 & 0 & 0 & 0 \\ (0.7822)*** & (0.1335)*** & & & & \\ 0.3048 & -0.0057 & 0.011 & -1 & 0 & 0 \\ (0.0816)*** & (0.0128) & (0.0130) & & & \\ -0.4988 & 0.1034 & 0.0277 & 1.1067 & -1 & 0 \\ (0.2362)** & (0.0328)*** & (0.0334) & (0.3619)*** & & \\ -0.2873 & -0.2413 & 0.0024 & 0 & 0.6697 & -1 \\ (0.6246) & (0.1044)** & (0.090) & & (0.3863)* & \end{bmatrix} \\
 B = & \begin{bmatrix} 0.0232 & 0 & 0 & 0 & 0 & 0 \\ (0.0023)*** & & & & & \\ 0 & 0.1359 & 0 & 0 & 0 & 0 \\ & (0.0136)*** & & & & \\ 0 & 0 & 0.1282 & 0 & 0 & 0 \\ & & (0.01282)*** & & & \\ 0 & 0 & 0 & 0.0118 & 0 & 0 \\ & & & (0.0018)*** & & \\ 0 & 0 & 0 & 0 & 0.03 & 0 \\ & & & & (0.003)*** & \\ 0 & 0 & 0 & 0 & 0 & 0.0895 \\ & & & & & (0.009)*** \end{bmatrix}
 \end{aligned}$$

Table III.
Structural parameter estimates of -A and B matrices

is consistent with the expectation. Higher interest rates attract the capital inflow, and therefore stimulate the exchange rate. When house prices increase by 1 unit, this triggers the exchange rate to appreciate by 1.1 units. Higher house prices influence everyone to expect the inflation increase, therefore expecting a higher interest rate. This could attract foreign investments and lead to exchange rate appreciation. Similarly, the transaction volume is reported to negatively respond to interest rates and the depreciation of the exchange rate. When the interest rate increases by 1 unit, the transaction volume slows down by 0.24 units, given to a higher borrowing cost. If the Malaysian ringgit depreciates by 1 unit, transaction volume decreases by 0.67 units.

Since the contemporaneous coefficients give little insight into the relationship between our variable, we expect more information to be retrieved by the structural impulse response. [Figure A1](#) depicts the impulse response of transaction volume and house prices to the various shocks. Panels A and B show that house prices and transaction volumes respond to economic shock in the larger magnitude. House prices have positively responded to the economic shock for the first four years. Then, the response is statistically significant and suggests that the real GDP has a persistent impact on real house prices. Interestingly, transaction volume responds to the shock negatively in the first two quarters, and positively responds to it in the subsequent four quarters. The maximum point of the estimates of the pass through to quantity demand during the fifth quarter is 0.03. The impact has turned negative after the second year. The possible explanation would be the intrinsic nonlinearities of house prices towards the changes of shock. Theoretically, the economic boom increases the quantity demand of houses as household income is higher. As house prices could respond asymmetrically to the positive changes of economic growth ([Katrakilidis and Trachanas, 2012](#)), house prices might increase in a larger magnitude when the quantity demand increases during the economic boom. Whereas, with high house prices, the quantity demand may be dampened and this explains why the transaction volume negatively responds to the economic growth after the second year.

Panels C and D show the response of house prices and transaction volumes towards the monetary policy shock. Our results indicate that the transaction volume negatively responds to the interest rate shock as the shock becomes insignificant and approaches zero after one year[6]. By contrast, the effect of the interest rate on house prices persists slightly longer. Our results show that the negative impact on house prices has persisted for two years, but the shock on house price is not too strong compared to other macroeconomic shocks. This is consistent with our expectation that a higher borrowing cost has a negative impact on the quantity demand and house prices even though the magnitude is rather small. The reason why the interest rate has a smaller effect is because the strong economic growth has diluted the effect of a higher borrowing cost. Similar findings were proposed by [Costello *et al.* \(2015\)](#) and [Ong \(2013\)](#). [Costello *et al.* \(2015\)](#) suggest that interest rate shock has a neutral effect on Australian house price. Meanwhile, [Ong \(2013\)](#) argue that interest rate has no impact on the Malaysian house price due to the behaviour of the speculative purchase.

Additionally, Panels E and F show the impact of monetary liquidity on house prices and transaction volumes. House prices have positively responded to the monetary liquidity shock and the effect has been found to last for approximately two years. Conversely, the positive shock of monetary liquidity on the transaction volume lingers on for slightly longer, approximately two and a half years. The maximum point estimated to pass through to the transaction volume during the six quarters is 0.014. As land supply is inelastic, the increase of liquidity pushes up the house prices given the increase of quantity demand, signaling that mortgage lending has an impact on house prices changes. Meanwhile, the rapid growth of monetary liquidity could also encourage an influx of foreign capital if foreign investors perceive that the upsurge of house prices is fundamentally macroeconomic and will continue to rise ([Baks and Kramer, 1999](#)).

Panel G illustrated that the appreciation shock in the effective exchange rate causes house prices to increase but the impact is not strong. The impact seems to persist for approximately six quarters and the impact dies out to zero. However, the Panel H shows that the transaction volumes positively and statistically respond to the positive shock of the exchange rate significantly. The impact has lasted for approximately ten quarters. Regarding this positive relationship, we have provided an explanation on how a stronger

currency may signify the general economic conditions well in Malaysia. When the overall economic environment is conducive to growth, households are keen to own a house and therefore boost the transaction volume. In fact, the stability of the exchange rate is important to guarantee the confidence of investors over the Malaysian economy. In particular, this is the key to make our public policy a success, for example, the MM2H programme. To restate, this programme intends to attract foreigners who wish to reside in Malaysia for up to 10 years. There were 12,000 applicants who have been approved to participate in this programme. On top of that, there are large influxes of investment from China, approximately RM8.55bn in Malaysia real estate market during the peak boom in 2013 ([Financial Times, 2017](#)). By far, Malaysia has the most liberal policy on the foreign ownership of property among all other Asian nations. There is no restriction on the numbers of foreign acquisition of property in Malaysia. Foreigners are able to own both types of property titles (leasehold and freehold) in Malaysia. Nevertheless, there is a restriction on the minimum property purchase price; foreigner can only buy a property in the price range from RM1m to RM2m (depends on the state). Our study conjectures that foreigners are confident and may be interested in buying a property and spending extended periods here when the Malaysian ringgit is strong and the economy is stable.

Through the variance decomposition analysis, we were able to identify the importance of each shock to the house prices and transaction volumes. According to [Table IV](#), the impact of real GDP is highly consistent, which explains the 60 per cent change in GDP. Another 23 per cent is explained by its own shock. Approximately 7 per cent is explained by the monetary liquidity in the first year. The interest rate and exchange rate have very little impact on the house price in the short run. However, the impact of the effective exchange rate tends to be stronger in the long run, as it is only 3 per cent in the first year but increases to 12 per cent in the seventh year. Amusingly, the transaction volume only explains a small portion of house prices, approximately 4 per cent. This may give hints that the supply side has a stronger power in determining the house price. This is consistent with the current situation of the housing market in Malaysia. The slowing down of the Malaysian economy causes a weaker demand in the housing market since the year 2015. But, this has not put down the housing price. Meanwhile, the real effective exchange rate has a more persistent impact on the changes of transaction volume. In the short run (first year), the changes in transaction volume could be explained by the effective exchange rate, monetary liquidity and real house prices, which are reported to be 18, 10 and 8 per cent, respectively. The real GDP only explains a 5 per cent change of the transaction volume during the first year. Yet, the GDP persistently explains the 15 per cent change in the transaction volume from the fourth year onwards. The impact of the exchange rate on the transaction volume is recorded to be stronger and has increased up to 50 per cent in year 7. Similar to the house price, the interest rate has an insufficient impact on the transaction volume, which only accounts for about 6 per cent in the first year and plummets down to 3 per cent in year 4. On a final note, house price has a stronger impact on the transaction volume in the short run, as it explains a 10 per cent change in the transaction volume in the second quarter. However, the effect diminishes and reduces to 6 per cent of the transaction volume from year 3 onwards. The reason behind this could be that most Asians perceive that the house is merely just shelter. The homeownership in Malaysia is considered high. Malaysia has achieved more than 80 per cent homeownership since the 1980s ([Kim, 2012](#)). Moreover, the Malaysian house price has been stable throughout the past two decades, all up until the year 2010. This may easily explain why our results show that price shock has only short run impact on the transaction volume.

Table IV.

Structural variance decomposition of RHPI (per cent contribution of each shock to the changes of house prices)

Period	RGDP shock	IR shock	M2G shock	RHPI shock	REER shock	TV shock
1	30.23	0.73	1.00	68.03	0.00	0.00
2	54.35	3.28	3.43	37.14	1.42	0.38
3	59.14	3.90	5.75	26.72	2.87	1.62
4	61.42	4.20	6.55	22.77	2.87	2.18
5	62.08	4.39	6.77	21.22	2.79	2.76
6	62.16	4.47	6.61	20.83	2.65	3.28
7	62.16	4.47	6.37	20.81	2.55	3.64
8	62.20	4.42	6.19	20.84	2.48	3.86
9	62.40	4.34	6.05	20.80	2.43	3.97
10	62.79	4.25	5.91	20.63	2.40	4.02
11	63.31	4.17	5.78	20.36	2.37	4.02
12	63.82	4.10	5.68	20.06	2.32	4.02
13	64.21	4.06	5.61	19.80	2.30	4.03
14	64.41	4.03	5.56	19.61	2.36	4.03
15	64.42	4.02	5.52	19.47	2.53	4.04
16	64.26	4.01	5.49	19.35	2.85	4.04
17	63.99	3.99	5.47	19.24	3.28	4.03
18	63.64	3.97	5.46	19.13	3.78	4.02
19	63.26	3.95	5.46	19.01	4.33	3.99
20	62.86	3.92	5.46	18.88	4.92	3.97
21	62.43	3.89	5.45	18.74	5.55	3.94
22	61.97	3.86	5.44	18.59	6.24	3.90
23	61.45	3.83	5.41	18.44	7.00	3.87
24	60.87	3.79	5.39	18.27	7.85	3.83
25	60.22	3.75	5.36	18.09	8.80	3.78
26	59.49	3.70	5.34	17.89	9.85	3.73
27	58.69	3.66	5.31	17.68	10.98	3.68
28	57.83	3.60	5.29	17.45	12.21	3.62

5. Conclusion

The rapid growth in house prices has received much attention from the researcher. Ample studies emphasize in identifying whether the house price movement is related to the economic fundamentals. Despite the fact that Bank Negara Malaysia has concluded that the recent house price inflation is closely related to macroeconomic changes, the responsiveness of housing prices to different shocks seem to remain unclear. Recognizing roles of macroeconomic sources in shaping the behaviour of the house prices, we have adopted the structural vector autoregressive (SVAR) model. Our analysis includes the transaction volume given to the inertia features of the house price. In particular, the focus of this study is to identify the key variables that affect the movement of house prices and the quantity of demand while highlighting the transmission mechanism. We impose contemporaneous restrictions according to economic theories and assume that not all variables respond to all shocks contemporaneously.

According to the impulse response analysis, the effect of real GDP on house prices and transaction volumes persist comparably longer and stronger. The impact on housing prices is statistically significant and persists for four years. Moreover, the economic shock on transaction volume is somehow compelling. Our results show that the transaction volume initially responds decisively to the positive shock of economic growth. However, it turns to a negative response in the second year. We have made conjectures that the presence of nonlinearities may have affected the behaviour of quantity demand. Meanwhile, the interest

Period	RGDP shock	IR shock	M2G shock	RHPI shock	REER shock	TV shock
1	1.10	6.01	0.03	0.83	4.44	87.59
2	1.42	6.05	10.53	9.37	3.99	68.63
3	1.47	6.39	11.87	8.44	9.88	61.95
4	4.69	5.54	10.20	8.80	17.60	53.17
5	8.50	4.85	9.14	8.04	22.99	46.48
6	9.70	4.47	9.16	7.43	26.88	42.36
7	9.56	4.36	9.47	7.17	28.68	40.76
8	9.58	4.31	9.59	7.04	29.46	40.02
9	10.55	4.26	9.48	6.91	29.57	39.24
10	12.12	4.18	9.25	6.74	29.39	38.32
11	13.61	4.11	9.02	6.57	29.32	37.38
12	14.65	4.04	8.79	6.42	29.60	36.50
13	15.19	3.98	8.58	6.31	30.29	35.64
14	15.40	3.92	8.40	6.22	31.30	34.75
15	15.42	3.85	8.26	6.15	32.50	33.81
16	15.39	3.77	8.14	6.08	33.79	32.83
17	15.36	3.68	8.04	6.02	35.09	31.81
18	15.39	3.59	7.92	5.96	36.39	30.76
19	15.46	3.49	7.78	5.90	37.70	29.67
20	15.54	3.39	7.63	5.85	39.04	28.56
21	15.59	3.28	7.46	5.81	40.45	27.40
22	15.61	3.18	7.29	5.78	41.93	26.22
23	15.57	3.07	7.12	5.75	43.48	25.01
24	15.48	2.96	6.95	5.73	45.09	23.79
25	15.37	2.85	6.79	5.71	46.71	22.56
26	15.24	2.74	6.63	5.70	48.34	21.35
27	15.12	2.63	6.48	5.68	49.95	20.14
28	15.00	2.53	6.34	5.66	51.52	18.96

Table V.
Structural variance decompositions of TV (per cent contribution of each shock to the changes of transaction volume)

Lag	AIC	SIC	HQ
0	-10.96	-10.50	-10.79
1	-17.34	-15.489*	-16.64
2	-17.99	-14.75	-16.76*
3	-18.49*	-13.86	-16.73

Table VI.
Lag order selection criteria

Note: *Indicates lag order selected by the criterion

rate has very little impact on the housing price and the transaction volume. The shock only lasts for about one year. Besides that, the house price and transaction volume were found to respond positively to the monetary liquidity shock. However, the shock has a longer impact on the transaction volume. Considering that the positive shock of effective exchange rates on transaction volumes appears to be longer, this is significant and persists for two and a half years. We can explain that a stronger currency signifies that the economic environment is conducive to growth and thereby increases the real income and boosts the housing demand. Moreover, the stronger Malaysian ringgit may also induce foreigners to consider acquiring property and extending their stay in Malaysia.

In the short run, the variance decomposition analysis shows evidence that housing price is majorly and consistently illustrated by real GDP, whereas its own shock only explains 23 per cent. The exchange rate affects house prices at a larger magnitude in the long run. We

found that the interest rate can explain only 4 per cent change in housing price. Another compelling discovery is that the transaction volume only explains a small portion of house prices change, implying that the supply side has a stronger power in explaining the house prices. On the other hand, real effective exchange has a persistent impact on the changes of transaction volume. Real GDP explains meagre changes of transaction volumes in the short run, but the effect gradually increases to 15 per cent from year 4 onwards. Similar to house prices, the monetary policy has very little impact on the transaction volume. The interest rate has a larger impact in the short run but diminishes when there is a 6 per cent change in transaction volume in the medium run. Finally, the house price explains a more significant change in transaction volume in the short run, but the impact declines afterwards. This could be illustrated by the general perception of owning a house as a shelter in Asia.

In sum, our results deserve further attention. First, the evidence that the interest rate shock has very little effect on house price changes and transaction volume suggests that a cooling measure using the interest rate might not be helpful when controlling the price in the short run. Second, the monetary policy could have stimulated the house demand, as our results show that more liquidity persistently explains the transaction volume. The rapid monetary growth might come with a strong economic prospect. When the strong economic growth is sustainable, this increases the demand. Besides that, we have found a notably strong impact of exchange rate on quantity demand, indicating that the strong currency of the Malaysian ringgit strengthens the confidence of families who are eager to purchase a house. Whereas, we also provide explanation that the appreciation of the Malaysian ringgit increases the interest of foreigners who would like to buy a property and stay in Malaysia. Even though foreigners may have restrictions when purchasing a property in Malaysia, the restrictions might not be sufficient. For instance, non-Malaysians are not eligible to purchase a property below RM1m in Kuala Lumpur and Penang. However, the average price of a condominium in Kuala Lumpur is estimated to be around RM700k, whereas double storey houses come with an average price of RM900k. Obviously, the difference of RM100k between Malaysian and non-Malaysian purchases might not be very effective in curbing the foreigner's interest. Finally, transaction volume has played a minor role in explaining the house prices changes. This implies that the role of market power in shaping the house price may be weaker than the supply side. Hence, to be more effective, policy attention on the supply side may be required.

Notes

1. DiPasquale and Wheaton (1992) proposed that the demand function of housing is depending on the economic activity, interest rate and construction cost. In view of the inelasticity of land, our study focuses on the demand-side factors.
2. MM2H programme was introduced by the Malaysian government in year 2002. This allows foreigners to stay in Malaysia for as long as possible with a social visit pass. The social visit pass is renewable for a 10-year period. Foreigners are allowed to purchase a property above RM1m.
3. The structural identification scheme has been analysed as a check. Alternatives have been tried out by altering the order of exchange rate; removing the restriction on the exchange rate, assuming the exchange rate not respond to house price change, and restricting the monetary policy to respond to real GDP and exchange rate, the result is robust to changes.
4. The KPSS test for the variable TV has been done as ADF and PP test yield inconclusive result, the KPSS test included the constant and trend in the test equation. Our result shows that transaction volume is stationary after first difference, I(1).

5. Our model consists of six variables with 52 observations. To conserve the degree of freedom, we restrict our maximum lag trial to lag 3. Our lag length criteria result does not come with a conformity conclusion, where AIC select lag 3, SC suggest lag 1 and HQ suggest lag 2. Since the lag length recommended by HQ is in between both SC and AIC, we choose lags order of 2 in our model. Additionally, we have try out alternative lags (1, 3 and 4) as a check, the null hypothesis of serial correlation is rejected.
6. As a check, we have used the overnight policy rate as an alternative measure of interest rate; our result remains unchanged.

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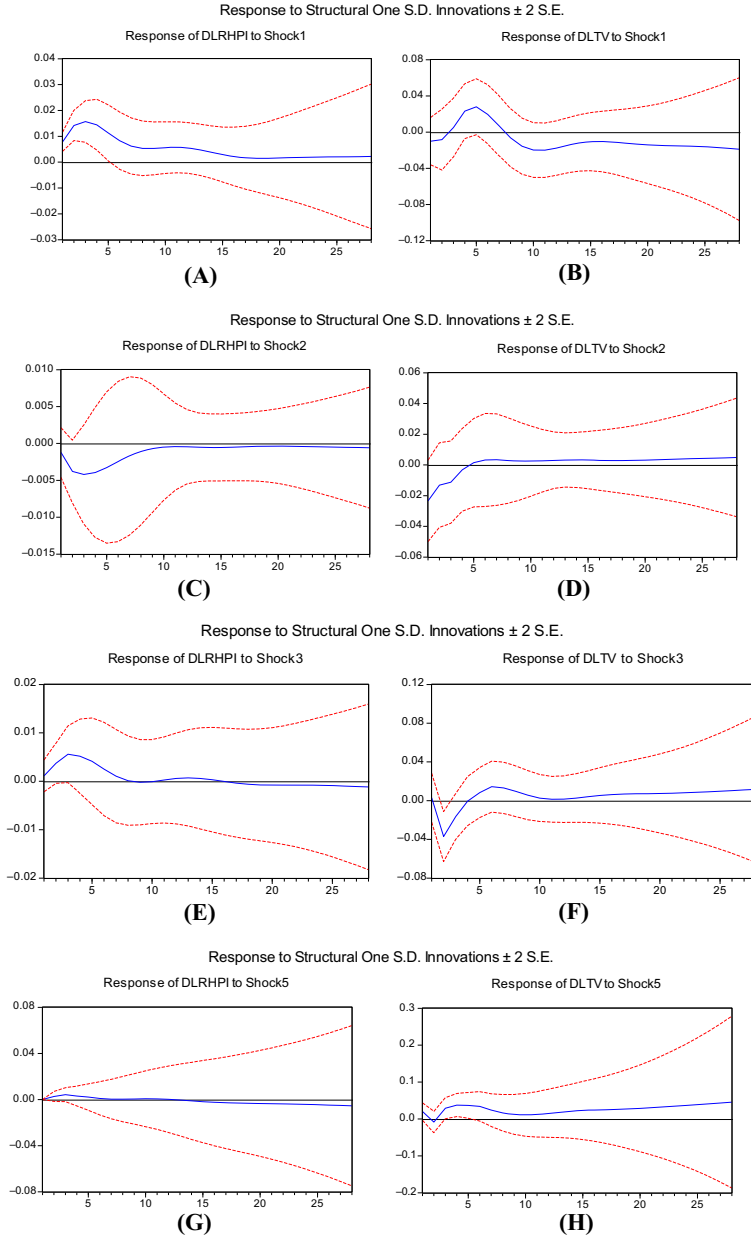


Figure A1.
Responses to structural macroeconomic shock of transaction volume and house prices

Note: Shocks 1, 2, 3 and 5 refer to DLRGDP, DIR, DLM2G and DLREER, respectively

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