Asymmetric Impact of Monetary Shocks During Low and High Household Debt Regimes in Malaysia

Chee-Hong Law[1]

March 2026

Abstract

In recent decades, the assumption that a monetary policy has a monotonic impact on economic variables has been challenged by various studies. This paper aims to plot the state-dependent impulse response function of seven endogenous variables in response to a monetary policy shock in Malaysia, focusing on consumption. This analysis involves the quarterly data from 1996 to 2022. Using the identified monetary policy shock from two sources, the findings indicate that the impact of monetary policy is different during the low and high household debt regimes. Specifically, consumption demonstrates a larger reaction when household debt is high. Besides, the dominance of the income effect on the substitution effect has been found in the reactions of a few variables. High household debt has also been linked to more volatile reactions of some examined variables in the longer term. The asymmetric results suggest that the central bank should calibrate monetary policy accordingly based on the level of household debt. Besides, implementing a more transparent monetary policy that aims to lower market uncertainty should be considered to minimise fluctuations in consumption following a change in monetary policy during the high household debt regime.

JEL Classification Numbers: E52, E21, E44

Keywords: Monetary policy shocks, household debt, consumption, state-dependent

1. Introduction

In the last two decades, the world has experienced several drastic economic developments, such as fluctuations in commodity prices, the economic closure due to the COVID-19 pandemic, and rising home prices in many countries, especially in the advanced countries before the outbreak of 2007-2008 global financial crisis and the rising household debt in advanced and emerging countries. These events raise an intriguing issue: is it possible that the

[1] The author is from the School of Social Science, Universiti Sains Malaysia and can be reached via email at cheehong@usm.my. The views expressed in this paper are solely those of the author and should not be taken to represent those of the Central Bank of Malaysia, or the Government of Malaysia. The author gratefully acknowledges the invaluable comments and feedback provided by Samantha Ong, Ikmal Adian, and Amanda Chong Kay Yenn.

monetary policy has asymmetrical impacts on the economy under different economic conditions? Florio (2004) further lists factors that could cause a monetary policy's asymmetric effect. These factors include the confidence level and expectation of the private sector regarding the economy, the response of long-term interest rates to changes in the short-term interest rate, the price adjustment mechanisms, and capital market imperfections. The possibility of nonlinear impact from the monetary policy has raised interest in examining the economic reactions in various economic scenarios in recent decades.

The study of nonlinearity in the response to monetary policy is relevant in Malaysia because Malaysia is one of the countries in the ASEAN with the highest household debt. According to BNM (2021), Malaysia ranked second as the country with the highest household debt-to-GDP ratio in Southeast Asia (89 per cent) in 2021, just slightly lower than Thailand (89.3 per cent). Indeed, Cai et al. (2020) summarised that the high household debt has caused many Malaysians to become financially vulnerable. The vulnerability, in turn, could affect the implications of monetary policy on consumption. This issue is particularly important because of the significance of consumption in Malaysia's gross domestic product (GDP).

In detail, this paper monitors the reactions of seven endogenous economic variables, i.e. consumption, house prices, exports, imports, headline CPI, GDP and stock market return to the monetary policy shocks (MPSs) during the high and low household debt regimes. The focus variable in this paper is consumption. The international oil price is also included as an exogenous variable, given that it is highly unlikely for that variable to be affected by the domestic economy. The local projection method proposed by Jorda (2005) will be implemented to illustrate the state-dependent impulse response functions. The estimation involves the quarterly data from 1996 to 2022. The MPS data is derived from Choi et al. (2023), who compiled the MPS of Malaysia from multiple indicators such as yield rate. However, their monthly data is available until December 2019. Therefore, we processed the 3-month treasury bill rates to complement the dataset. It is crucial to note that the MPS in this paper refer to a shock from a policy hike.

Theoretically, a higher interest rate could affect consumption through several channels. For instance, a higher interest rate should lower consumption because it will discourage borrowing to support current spending. However, this idea has been challenged because a higher interest rate creates an income effect. This effect suggests that a higher interest rate increases the interest rate income, causing more consumption. If the income effect exceeds the

substitution effect, it could result in a positive relationship between interest rate and consumption. Moreover, a lower interest rate could increase savings or lower consumption due to the precautionary saving hypothesis. According to this hypothesis, a low interest rate reduces investment returns, causing more demand for savings. This point could be valid in developed and developing countries (Aizenman et al., 2017). Besides, the wealth effect channel posits that when the interest rate is low, the financial wealth of a household will increase due to higher equity prices, leading to more consumption.

Equally important, the impact could differ under low and high household debt regimes. Kim and Lim (2020) argue that via the cash flow channel, a drop in the interest rate will cause households with high debt levels to increase consumption more than those with low household debt. This is because a lower interest rate reduces the interest payment of the borrowers. Hence, in a country with high household debt, a drop in the interest rate will have a high impact on increasing consumption. The flexibility of interest rates also plays a role in determining the impact size of monetary policy on the output level. Additionally, a higher debt level prompts households to be less sensitive to a reduction in interest rates due to the demand for precautionary savings. Furthermore, the home equity channel reckons that rising home equity after a drop in the interest rate causes more aggregate demand by getting new loans from higher home equity. However, this channel could be muted when the household debt is high (Alpanda & Zubairy, 2019). These arguments lay the foundation for this paper's hypothesis, i.e., the consumption response in Malaysia could be asymmetrical to the interest rate when the household debt is different.

A few main conclusions are presented here. The impact of monetary policy shocks on key macroeconomic variables varies across low and high household debt regimes. The impulse response functions have shown that consumption reactions to MPS are generally larger during the high household debt regime. Besides, a stronger income effect than the substitution effect also caused the consumption to react positively in some quarters after an MPS. The reduction effect of MPS on house prices, although statistically insignificant, is found in the high household debt regime, and the dominance of the income effect is weaker in that household debt regime in the longer horizon. The reduction effect on exports indicates that an MPS leads to higher exports a quarter later, likely due to lower imported input prices, during the low household debt regime.

As for imports, the expected import increment after an MPS does not happen in the high household debt regime. Interestingly, the price puzzle is found in the headline CPI impulse responses, with the effect happening relatively late in the high household debt regime. The GDP drops (rises) in the low (high) household debt regime in the first two quarters after an MPS. Finally, the stock market displays a statistically significant lagged increment after an MPS in the low household debt regime, probably due to the income effect.

The remaining paper is structured as follows. Section 2 summarises the recent related papers. The data and methodology applied in this paper are covered in Sections 3 and 4. The state-dependent impulse response functions and the output of robustness analyses are available in Section 5. Section 6 concludes.

2. Literature Review

A review of previous papers shows that the previous papers have already examined the asymmetrical effect of monetary policy under different household debt conditions. For example, Chen et al. (2013) show in a threshold vector autoregression that in the U.K., the credit regime impacts the monetary policy impact on housing prices. Particularly, during the credit boom, a monetary policy shock will have a stronger initial but less persistent effect on housing prices in the U.K. than in the normal credit regime. Examining the impact of monetary policy in high and low household debt regimes, Kim and Lim (2020) adopted the interacted panel VAR method on 23 countries. Consumption and investment reacted strongly to a monetary policy shock during the high household debt regime in their studies. The effect is even stronger if a tight monetary policy is implemented. In addition to the household debt, higher adjustable-rate loans also caused a greater reaction to the monetary policy. Studying the Swedish data by deploying ordinary least squares and instrumental variables, Folden et al. (2021) displayed that families with debt will reduce consumption significantly compared to those without debt.

Besides those methods, the local projection has been used to examine the outcome of a monetary policy in different household debt or borrowing conditions. For instance, Harding and Klein (2019) used the local projection on the US data and found that household deleveraging caused the monetary policy to have a large and statistically significant reduction effect on output; it was not the case during leverage periods. Cumming and Hubert (2019) emphasise the impact of borrowing constraints faced by the U.K. household in the monetary policy-consumption nexus. They conclude from local projections that an increase in

constrained households will cause monetary policy to be more influential. Besides, rising borrowing relative to income will not affect the effect of monetary policy.

The paper by Alpanda and Zubairy (2019) is one of the previous papers with an objective similar to this paper. They examined the impact of monetary policy via various monetary transmission mechanisms in the U.S. Based on different identified monetary policy shocks and nonlinear local projection estimation, the household debt level affects the impact of a monetary policy shock nonlinearly. In particular, they summarise that if the household debt is above its threshold, the impact of monetary policy is smaller on GDP, consumption, residential investment, house prices, and household debt.

Next, Alpanda et al. (2021) reported a panel local projection estimation that involved 18 advanced countries. Based on their estimation, they found that consumption has a stronger response to monetary policy shocks during high household debt, high interest rates, and high economic growth. Next, Cumming and Hubert (2023) applied the local projection to the mortgagors grouped into high and low-indebted groups in the UK. They concluded that if a country's high-indebtedness households increase, its consumption responses to monetary policy shocks will increase.

For Malaysia, the literature has largely focused on the asymmetric effect of an increase or decrease in the monetary policy rate, the varying effect of different interest rates on the official interest rate and the role of economic growth in the effectiveness of a monetary policy. This paper represents a first attempt at explicitly testing the link between consumption and interest rates during Malaysia's high and low household debt regimes.

In detail, Agenor (2001) estimated the asymmetric effect of monetary policy shocks (money market rate, discount rate, and monetary-based) due to the output gap, initial policy instrument level, and initial inflation level. They applied vector autoregression to achieve the study objectives. They summarise that monetary policy has asymmetric impacts on inflation, output, and exchange rate. However, the results are sensitive to the measurement of the output gap and the source of the asymmetric effect.

Tan and Muzafar (2007) investigated the effect of monetary policy during economic growth and recession periods in four ASEAN countries, including Malaysia. They reported that during the economic recession, an increase in the money supply positively affected the real output in Malaysia when estimated with the Markov-Switching model. Later, Tan et al. (2010) used three-state Markov-Switching estimation to estimate the asymmetric impact of an increase in money supply, which is the indicator of the monetary policy, in the same countries. They summarise that the tight and expansionary monetary policy has different impact sizes, with the

former being larger than the latter. Besides, the effect of an expansionary monetary policy is larger when inflation increases in Malaysia.

Next, Zulkhibri (2012) analysed the bank lending data to see the effect of the bank lending channel under different bank characteristics and monetary policy stances. Their differenced GMM method suggests a statistically significant impact of small bank size in increasing the bank loan supply sensitivity to the interest rate. Moreover, tight (loose) monetary policy could reduce (increase) bank loan supply. Maggie et al. (2015) examined the asymmetric pass-through effect of policy rates on different retail interest rates in Malaysia. The main findings are that the deposit rate is more responsive to policy rate changes than the lending rate. Moreover, an increase in the policy rate causes the deposit and lending rate to respond faster; it is slower when the policy rate drops.

Caporale et al. (2020) used the threshold VAR to estimate the bank lending channel in Malaysia during high and low economic growth regimes. They extended the research to data from Islamic financial institutions in addition to conventional banking. They reported that Islamic bank credit is more responsive to a change in interest rate than conventional bank credit in both high and low economic growth regimes. Moreover, Islamic finance has a more positive influence on output growth when economic growth is low.

3. Data Description

Eight economic variables are included in the estimations: consumption, house price, exports, imports, GDP, CPI, stock market, and oil price. All data are measured in nominal terms. The oil price is a significant exogenous variable that could affect the Malaysian economy. Moreover, it also serves as a tool to mitigate the possibility of the price puzzle effect, which is common in impulse response analysis.

The quarterly data from 1996 to 2022 has been analysed here. Table 1 below lists the data source and measurement of all endogenous and exogenous variables. The data in this paper is mainly sourced from BNM, the Department of Statistics, Malaysia and the Federal Reserve Bank of St. Louis. While most data are available quarterly, the stock price index in this paper is derived from an average of the first trading day of each month in every quarter. Besides, the monthly headline CPI is averaged to get the quarterly headline CPI. All data are transformed into the natural logarithm before estimation.

Table 1: Data source and unit of measurement

Variable	Sources	Unit of measurement
Private final consumption expenditure	BNM	RM Million
House price	BNM	Index (Base year = 2010)
Exports	BNM	RM Million
Imports	BNM	RM Million
GDP	BNM	RM Million
Household debt	BNM	RM Thousand
Headline CPI index	Department of Statistics Malaysia	Index (Base year = 2010)
Stock price index	Bursa Malaysia	FTSE Bursa Malaysia KLSE
Oil price	Federal Reserve Bank of St. Louis	US Dollar per barrel

Choi et al. (2023) have argued that there are six measures to gauge the monetary policy shocks either empirically or by interpreting the movement of interest rates before (T-1) and on the day a monetary policy decision is made (T). This paper used Malaysia's monetary policy shock (MPS) computed by Choi et al. (2023) to identify the monetary policy shock. In their dataset, two measurements of MPS have been used to compile the monthly time series data of MPS. They measured MPS from 1-month yield rates and the residual from the Taylor rule. After that, the author calculates the quarterly shock by averaging the MPS in each quarter.

However, the dataset compiled by Choi et al. (2023) ends in December 2019. Therefore, the 3-month treasury bill has been treated as a proxy of monetary policy due to its long data coverage and reflects the liquidity changes in the money market. The change is the difference between the 3-month treasury bill rate on the day a monetary policy is made (T) and the day before a monetary policy is made (T+1) when computing the missing data. All interest rate data to compute the missing MPS is provided by Bank Negara Malaysia.

4. Methodology

The local projection estimation in this method is based on the state-dependent model proposed by Jorda (2005). Ramey and Zubairy (2018) and Alpanda and Zubairy (2019) have also used the same method to study the responses of variables to a shock when the responses are assumed to be state-dependent. This method is selected because of its simplicity in modelling in a local

projection framework (Alpanda et al., 2021). Besides, this model does not impose strict endogeneity and exogeneity assumptions among the examined variables, unlike single structural equations. Although a vector autoregression model offers flexibility, Alpanda and Zubairy (2019) suggest that local projection outperforms the vector autoregression (VAR) model when there is a model misspecification problem. The local projection method also does not require the assumption of regime periods and the transition of the economy, two assumptions needed for regime-switching VAR.

In the linear format, the Jorda (2005) method estimates the responses of a variable to the monetary shock in each horizon, h, as follows:

$$Z_{t+h} = \alpha_h + \varphi_h(L)y_t + \beta_h shock_t + \varepsilon_{t+h} \text{ for } h = 0,1,2, \ldots, \quad (1)$$

Where z is the variable of interest, y is a vector of other variables considered in the estimation, $\varphi_h(L)$ is a lag operator, and $shock$ is the identified MPS. The interest of the estimation is to estimate β_h which will show the response of z at time $t+h$ to the shock at time t. In other words, the impulse response function of the Jorda (2005) method is constructed as a sequence of the β_h estimated at separate regressions for each horizon.

Then, a state-dependent model can be derived by modifying equation (1). In that model, the impulse response can be obtained by regressing the following equation for each horizon $h$as follows:

$$oneneZ_{t+h} = I_{t-1}[\alpha_{A,h} + \varphi_{A,h}(L)y_t + \beta_{A,h}shock_t + (1 - I_{t-1}[\alpha_{B,h} + \varphi_{B,h}(L)y_t + \beta_{B,h}one + \varepsilon_{t+h} \text{ for } h = 0,1,2, \ldots, \quad (2)$$

where $I_{t-1} \in \{0,1\}$ is the dummy variable representing the household debt level states before a monetary policy shock. The high household debt regime is assigned a value of one, while the low household debt regime is assigned a value of zero. The identification of the household debt regimes will be discussed later in this section.

A few assumptions are imposed to carry out the estimation. First, the oil price is assumed to be exogenously decided, an assumption that is reasonable since Malaysia's oil production cannot influence the global price level. Second, the maximum lag to be considered in the estimation is eight quarters, and the Bayesian Information Criteria decide the appropriate lags for the local projection regression. Third, the impulse response function will show the responses of a variable within eight quarters after an MPS. Fourth, a trend component will be included in the model. Fifth, the 90% confidence intervals will be observed for all generated impulse response functions.

A critical step of this estimation is identifying the household debt regime. The first step of the identification in this paper is to divide the household debts banks offer by GDP to get the household debt-to-GDP ratio. BNM compiles the household debt dataset. Alpanda and Zubairy (2019) explained that examining the household debt to GDP ratio instead of the household debt only enables the estimations to consider the effect of economic conditions and population growth. Next, the household debt gaps, which are the household debt-to-GDP ratio deviation from a smooth trend, are constructed. The smoothed trend is generated using the Hamilton filter, where the fitted value of a regression that regresses the household debt-to-GDP ratio on the four lagged values of the ratio back-shifted in two years (i.e. four observations in this case, as we are dealing with quarterly data[2]). Lastly, household debt in a particular year belongs to the high household debt regime if the value of the household debt gap is more than positive and vice versa if the gap value is less than negative. Robustness analysis of the baseline model is examined by measuring the MPS as the sum of the shocks in a particular quarter as an alternative measurement of MPS. The alternative MPS is then applied to the state-dependent model.

5. Results

A line chart that displays the household debt to GDP gap is presented. Based on Figure 1 below, household debt to GDP has positive values in most observed periods, with two peaks in the third quarter of 1996 and the second quarter of 2020. This means that household debt usually falls under the high regime. The household debt to GDP gap is higher in 2020 due to a sharper contraction in the nominal GDP (the GDP dropped by 18.4%, 3.5% and 4.3% year-on-year in the second to fourth quarter in 2020). Moreover, the implementation of a moratorium on loans has slowed down the debt repayment process, causing a relatively higher amount of household debt. Besides, high household debt regimes are found in only two periods: from 1996Q1 to 1996Q4 and from 2012Q4 to 2022Q4, likely due to excessive credit growth, rising house prices and a low-interest rate environment. The next discussions discuss the implications of monetary shocks on all variables in the local projection estimation. It is worth mentioning that the shock referred to in the following discussion is a rise in the interest rate.

[2] Hamilton (2018) has suggested that the trend component generated by the Hodrick-Prescott (HP) filter could create spurious dynamics, especially at the end point of time series data. This paper has also analysed the same model but using the HP filter to obtain the household debt-to-GDP gaps as the method is commonly used in the literature, including that of Alpanda and Zubairy (2019). The results show that the positive and negative gaps are more was found scattering around the years. The generated impulse response functions are also more volatile in patterns and sensitive to alternative measurements of monetary policy shock deployed in this paper.

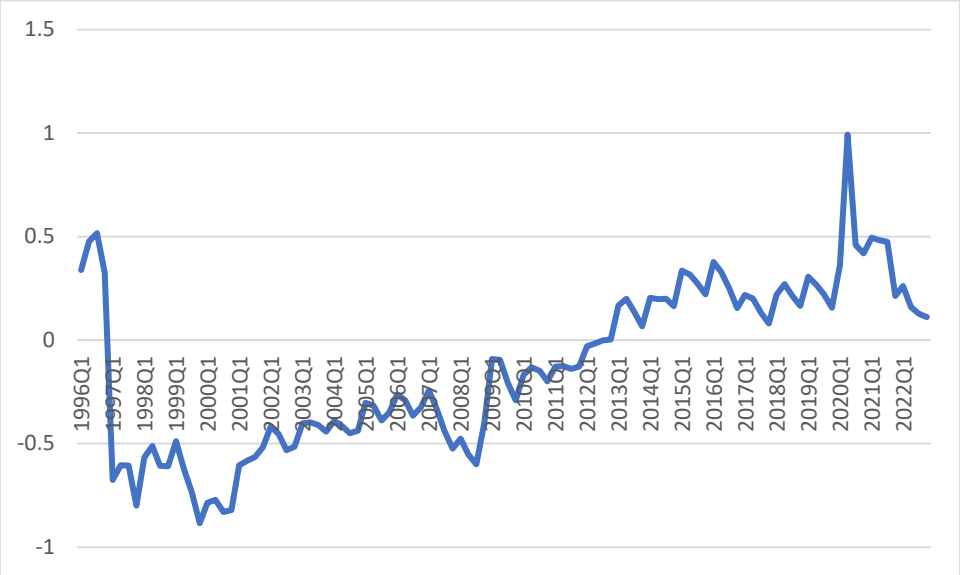


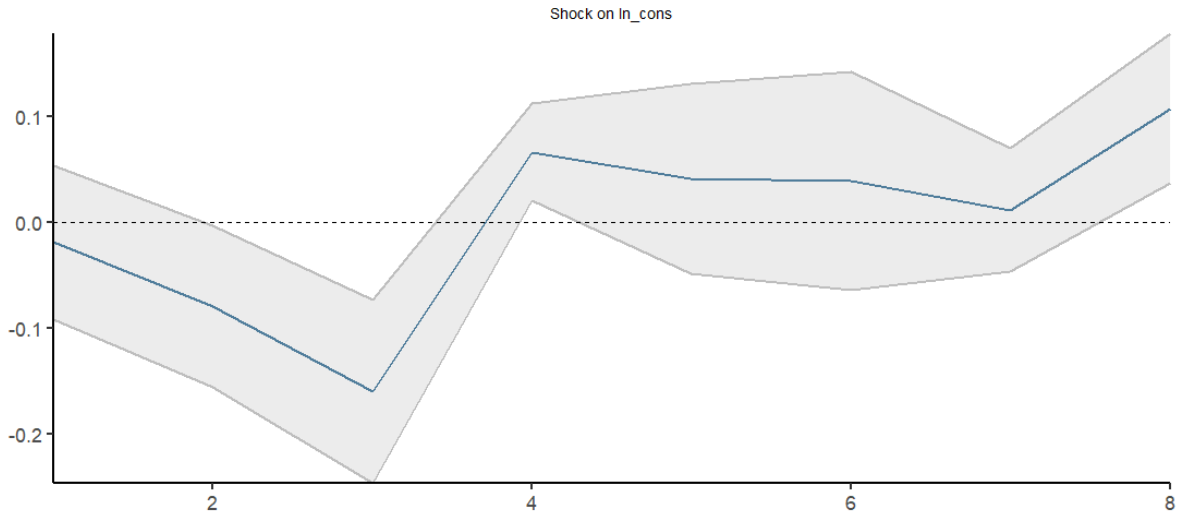
Figure 1: The household debt to GDP gap

5.1 Consumption reactions

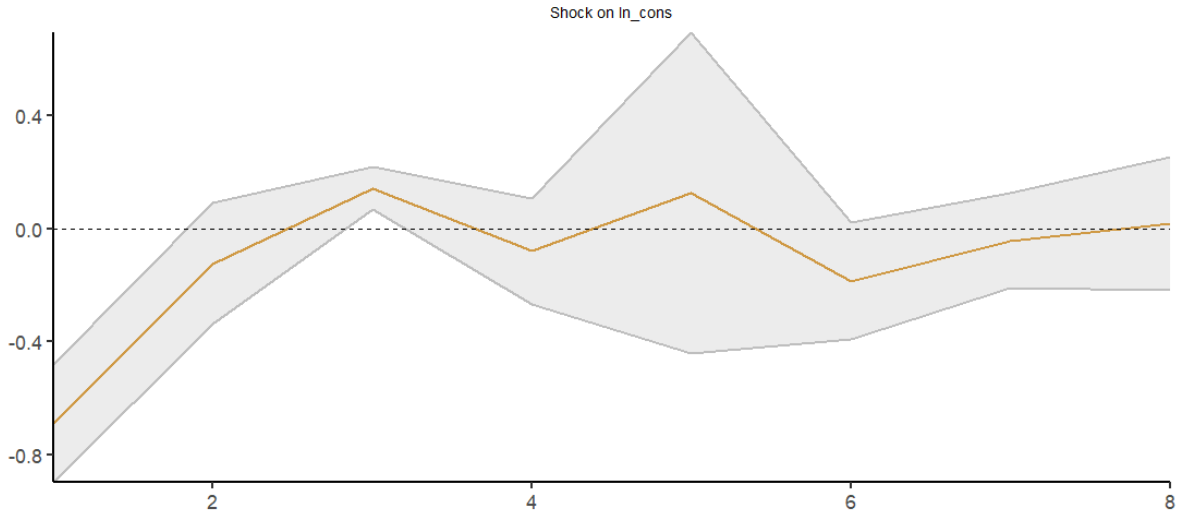
Generally, consumption reacts negatively to an MPS initially before turning positive later in both low and high inflation regimes. However, the negative responses are larger and quicker in the high household debt regime. Specifically, in the low household debt regime, a high interest rate causes a drop in consumption until the third quarter after the shock, and the impact is statistically insignificant only in the first quarter. The maximum negative reaction was detected in the third quarter. This result shows the typical impact of a contractionary monetary policy on consumption. Nonetheless, the reaction turns positive from the fourth quarter onwards, and the impacts are statistically significant in quarter 4 and quarter 8. The positive reaction of consumption to a higher interest rate could be due to the late dominance of the income effect of a higher interest rate over the substitution effect during a low household regime. To recap, the income effect causes consumption to react positively to a higher interest rate because of a higher saving value following a rise in the interest rate (Lehrer & Light, 2018). However, this effect is temporary.

Otherwise, an MPS has a statistically significant negative impact on consumption a quarter after that shock when the household debt is in the high debt regime. Moreover, the impact size is larger than that of the low household debt regime for the same quarter. Although statistically insignificant, the negative reaction to consumption continued until quarter 2. Then, the income effect dominates in quarter 3, and the impact is statistically significant. It fluctuates between positive and negative after turning positive in quarter 3, showing consumption to be more sensitive in the high household debt regime. In summary, the larger consumption

response a quarter after a rise in interest rate shows that high household debt causes household consumption to be more sensitive to rising interest rates. Moreover, the cash flow channel proposed by Kim and Lee (2020) is partially supported, as an immediate effect of a positive interest rate shock causes consumption to drop more in households with high debt.



A1: Reaction of consumption at low household debt regime



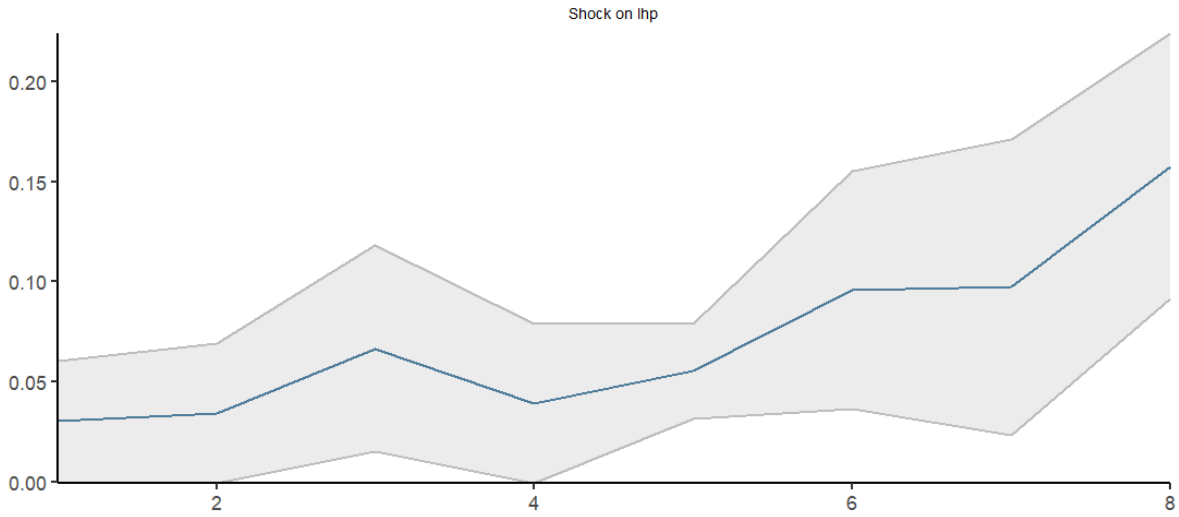
A2: Reaction of consumption at high household debt regime

5.2 House price reaction

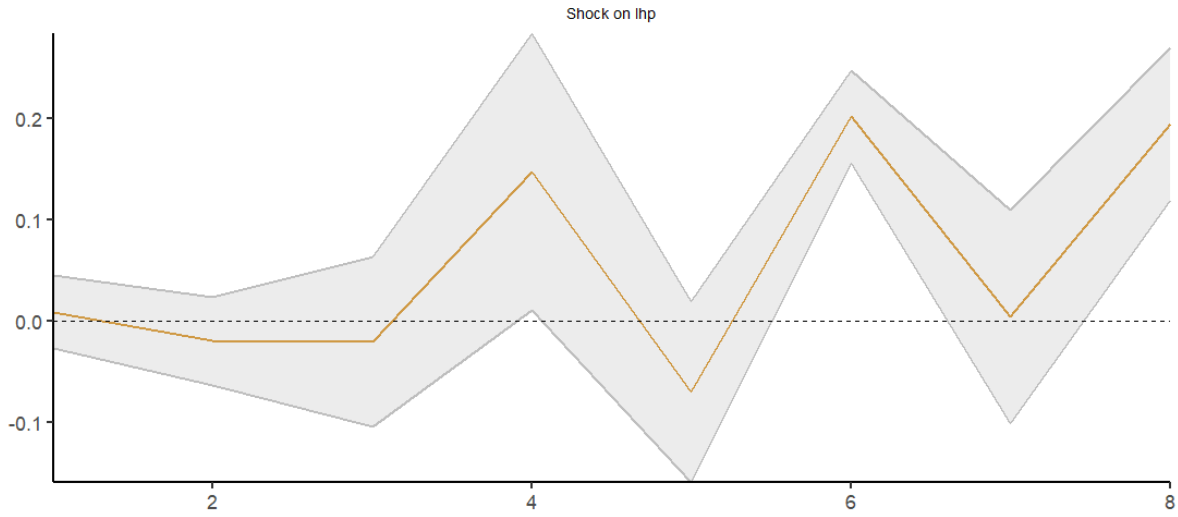
Regarding the house price reactions in both regimes, one can conclude that the house price will have a statistically significant increase after an MPS, with the effect being more profound in the low household debt regime. In detail, instead of causing a drop in the house price, an increase in monetary policy shock raises the house price during the low household debt regime

throughout the examined period after an MPS. The income effect dominance proposed in Section 5.1 could explain this unexpected finding. In this case, the rise in the saving value after a higher interest rate creates more demand for house prices. A positive impact of interest rates on house prices in Malaysia was found by Yeap and Lean (2017) as well. However, this effect is statistically significant only from quarter 3 onwards.

We also find evidence that in a high household debt regime, the reaction of housing prices is more volatile when an MPS occurs. Specifically, after an MPS, the house price increases in quarter 1 before changing the trend to become negative in quarter 2 and quarter 3. After that, the trend has fluctuated. Nonetheless, we could conclude that the house price reaction is statistically significant only in quarter 4, quarter 6 and quarter 8; the reactions are positive for those quarters. One possible reason for the relatively late statistically significant reactions during the high household debt period is that high household debt has caused households to be more hesitant to increase the demand for housing when the household debt is high. It also implies that the dominance of the income effect is weaker in the household debt regime in the longer horizon.



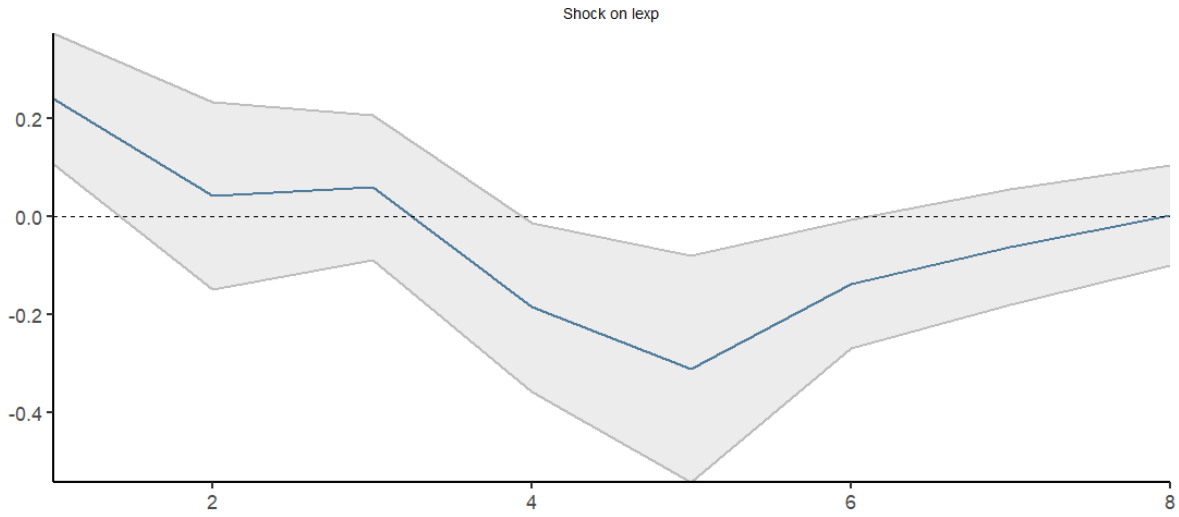
A3: Reaction of house price at low household debt regime



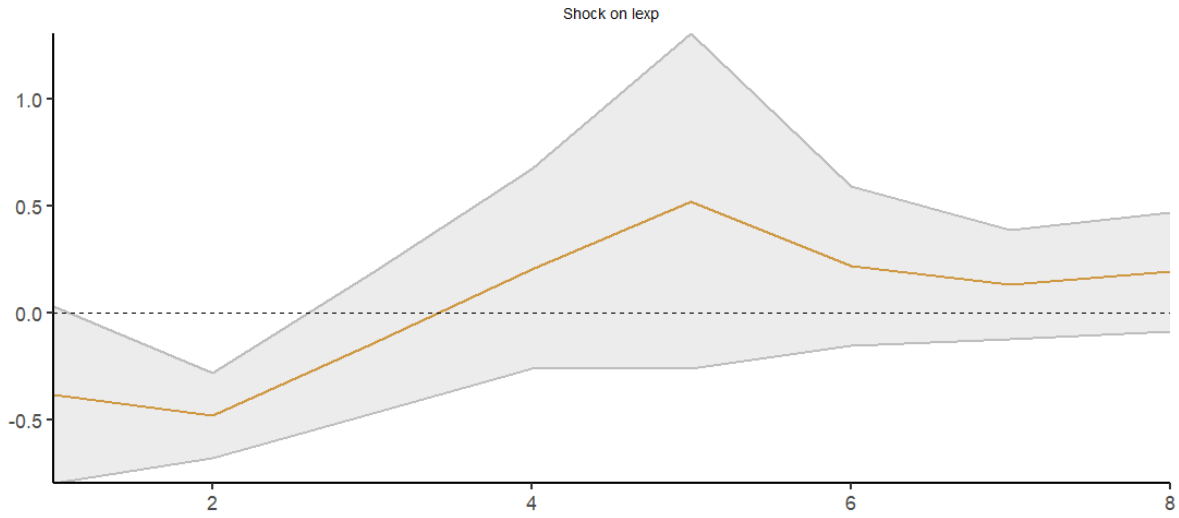
A4: Reaction of house price at high household debt regime

5.3 Export reactions

On the one hand, an MPS has a different impact on export, which causes export to increase before a decline in the low household debt regime. It is the opposite during the high household debt regime. Figure A5 shows that exports increased a quarter after the MPS in the low household debt regime. The peculiar statistically significant positive reaction of export suggests that when appreciation happens after a rise in the treasury bill, the export industry could benefit from a lower import price of the production inputs. However, the impacts disappear and become negative after that; the impact is statistically significant in quarter 3 to quarter 6. On the other hand, the high household regime's impulse response functions show that the statistically significant export reaction only occurs in the second quarter after an MPS. This negative reaction implies that the conventional wisdom that a higher interest rate hurts export performance is supported by the high household debt regime. However, the magnitude of the decline is larger than that recorded in the low household debt regime.



A4: Reaction of export at low household debt regime

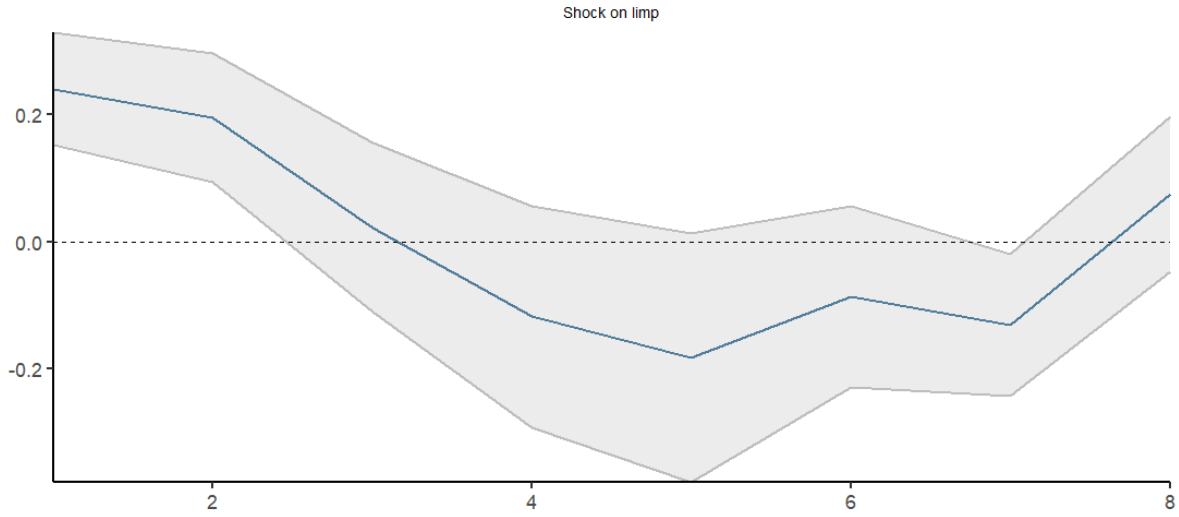


A6: Reaction of export at high household debt regime

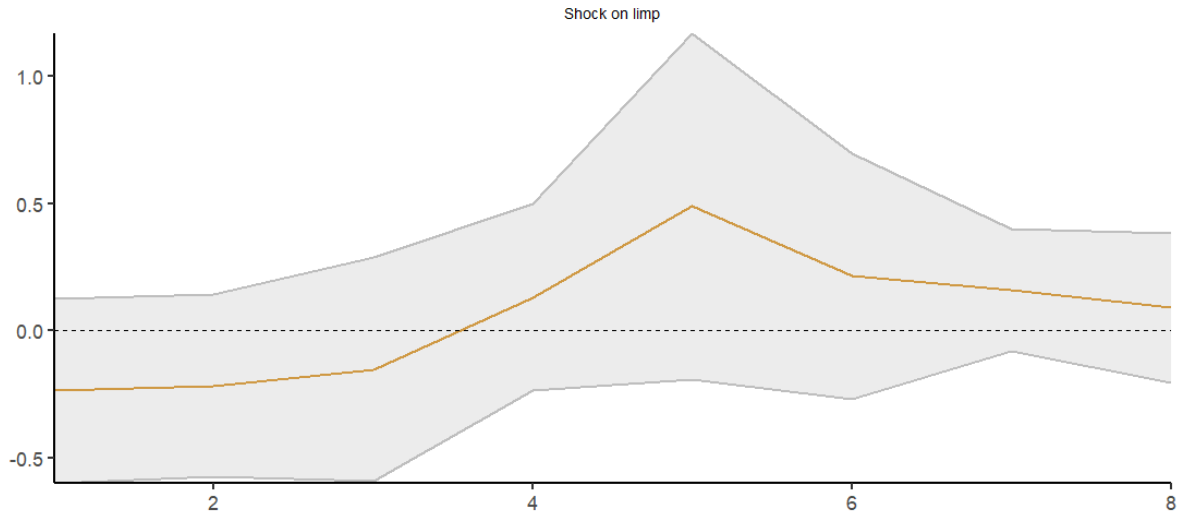
5.4 Import reactions

As for the imports, an MPS has statistically significant effects only when the household debt regime is low, with statistically significant reactions that are positive initially before turning negative. Figure A7 illustrates that the positive reactions were statistically significant in the first and second quarters after a monetary policy shock during the low household debt regime. While the positive reaction is found in quarters 3 and 8, they are statistically insignificant. The positive reactions are as expected by conventional wisdom, in which appreciation of the domestic currency after a rise in the interest rate caused imported products to be cheaper in domestic currency, causing more demand for imported goods and services. Additionally, the import declined from quarter 4 to quarter 7, with the reaction being statistically significant in

quarter 7. Otherwise, the impact of MPS on imports is negative in quarter 1 to quarter 3, before turning to positive afterwards. Nonetheless, there is no evidence that the conclusion in that case is statistically significant.



A7: Reaction of import at low household debt regime

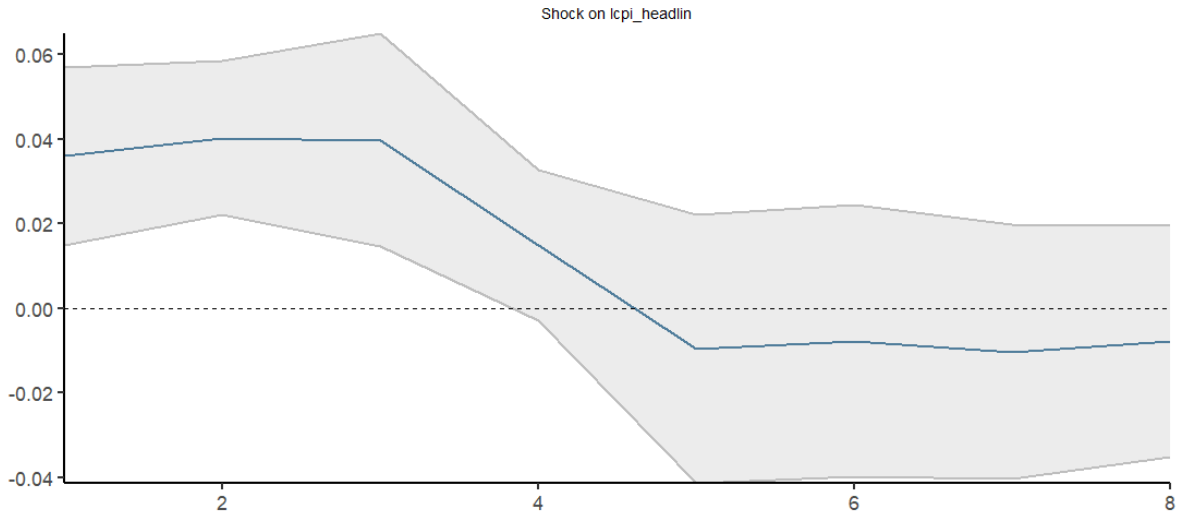


A8: Reaction of import at high household debt regime

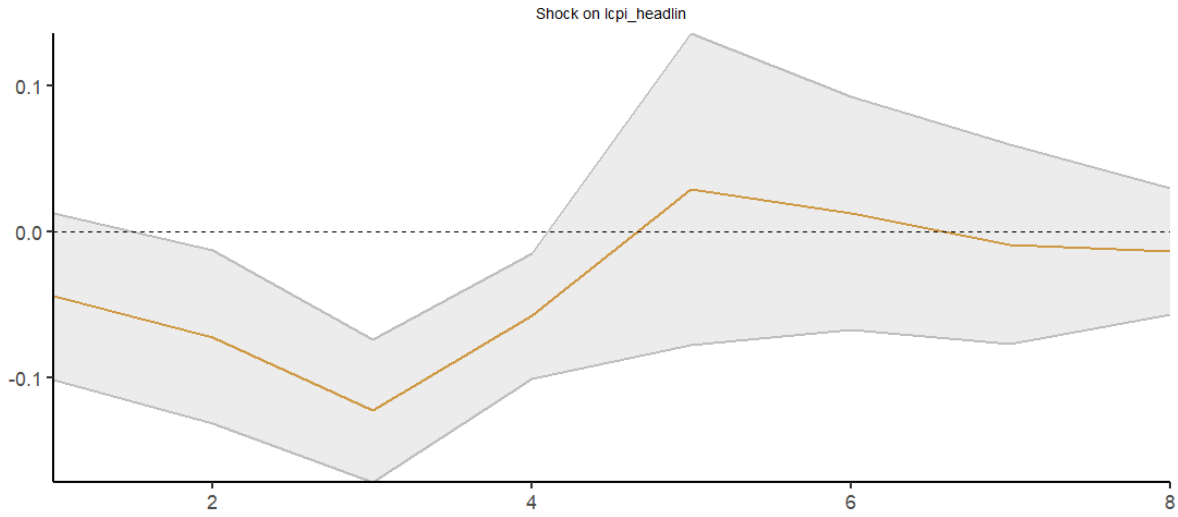
5.5 Headline CPI reaction

The reactions of the headline CPI to an MPS have been in the opposite direction during the low and high household debt regimes, with the reactions being positive in the former and negative in the latter. More specifically, the local projection suggests that the price puzzle has been found during the low household debt regime. In particular, a rise in the treasury bill rate caused the CPI headline to increase from quarter 1 to quarter 4 at a declining trend. A rise in interest rate only causes the CPI to drop from the fifth quarter onward. The impact on CPI is statistically significant only in quarter 1 to quarter 3 after an MPS. Hence, one can summarise that the price

puzzle is found in most periods. The existence of a price puzzle in Malaysia is also confirmed by Caporale (2020), even though they had included a commodity price indicator in their estimations. Tas (2011) suggests that the interest rate could be interpreted as a step a central bank takes to cool down inflation. This effect is possible if the information set is asymmetric between central banks and the public. On the other hand, the reactions of headline CPI during the high household debt regime demonstrated a reduction in the price level from quarter one to quarter four. Nonetheless, the effect is statistically significant only in the first 3 quarters after an MPS. Besides, prize puzzle happens later than during the high household debt regime, but the impacts are statistically insignificant. A lack of price puzzle effect in households with high debt is possible if high debt levels induce a pessimistic view of the price level, leading households to perceive a higher interest rate as a reflection of potentially increased inflation in the future.



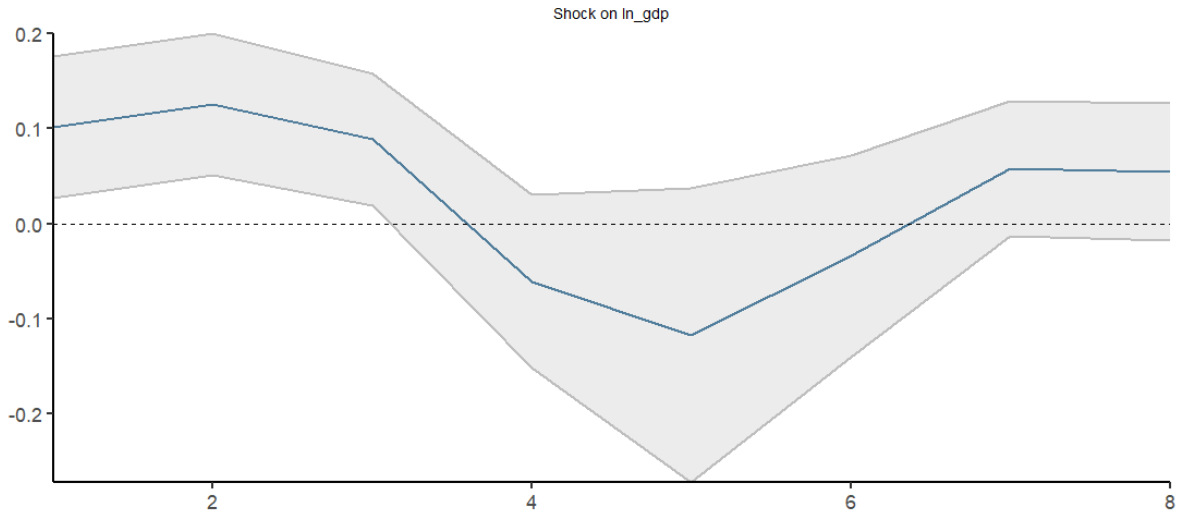
A9: Reaction of CPI at low household debt regime



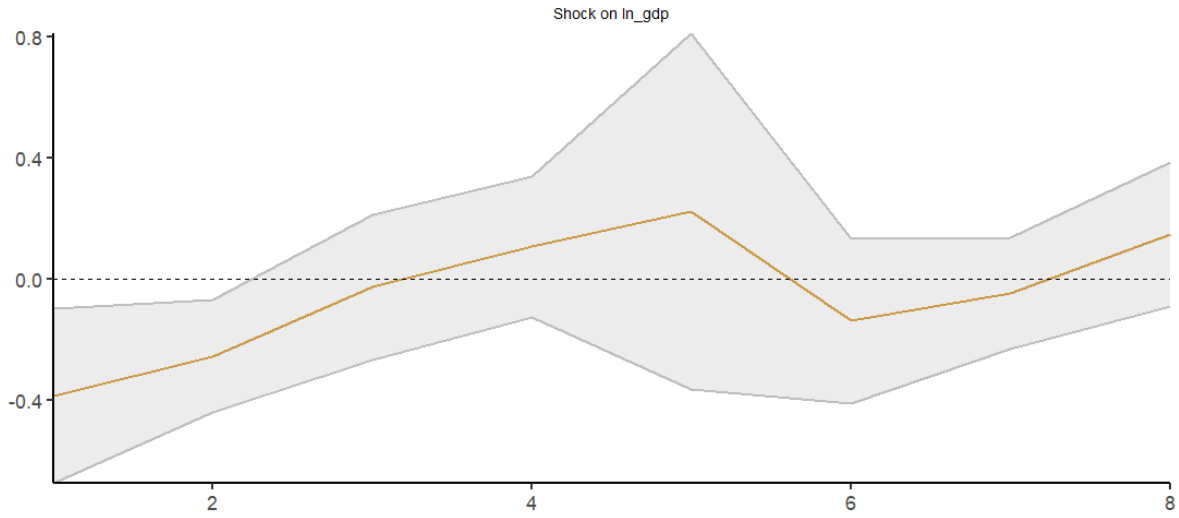
A10: Reaction of CPI at high household debt regime

5.6 GDP reaction

The reactions of GDP is also asymmetrical when comparing the high and low household debt regimes with the GDP rises in the former regime and drops after an MPS. When the household debt is low, an MPS has been linked with a rise in the GDP from the first to the third quarter. The reactions turn negative afterwards until quarter 6. Afterwards, the GDP reactions are positive. The statistically significant reaction is only found in the period from quarter 1 to quarter 3. Indeed, the reaction is the largest in quarter 2. A rise in GDP is against the assumption that a tight monetary policy will reduce GDP. One possible explanation is that a higher interest rate creates income effects, causing a rise in GDP. On the other hand, a rise in the interest rate has been linked to a drop in the GDP from the first to the third quarter after an MPS during the high household debt regime; the reactions are statistically significant in the first two quarters only. The negative reaction aligns with the conventional assumption that GDP reduces following an increase in interest rate, implying that the income effect will not be detected in the high household debt regime. While the impacts of MPS fluctuate after quarter 4, those impacts are statistically insignificant.



A11: Reaction of GDP at low household debt regime

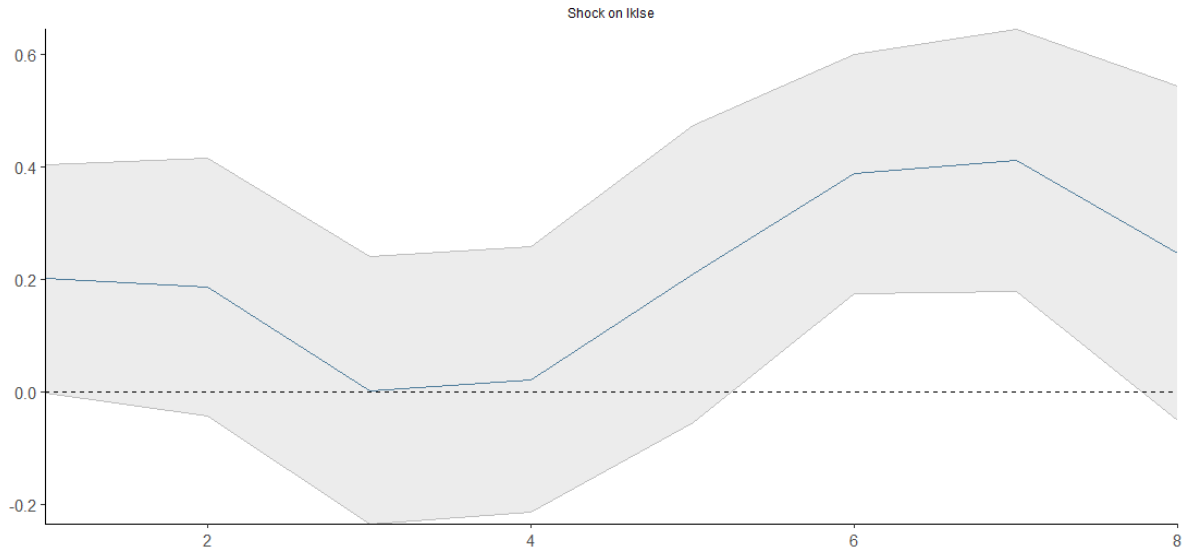


A12: Reaction of GDP at high household debt regime

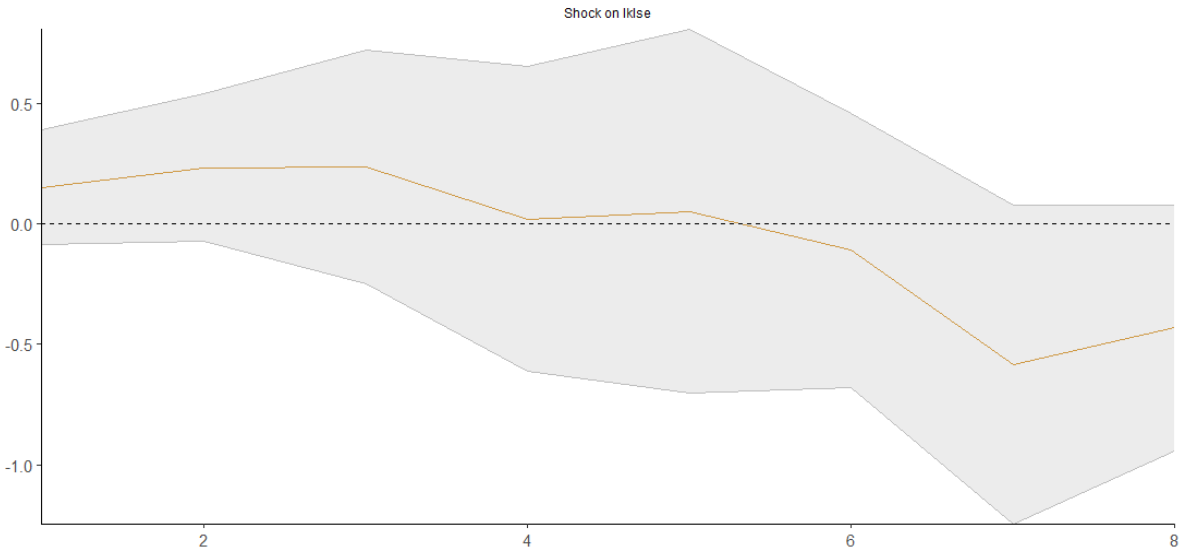
5.7 Stock market reactions

Finally, statistically significant lagged positive reaction is only found in the stock market if the household debt falls into the low regime. As showed by Figure A13, the stock market increased after a monetary policy shock in the low household debt regime throughout the examined periods. However, this positive association is statistically significant in quarter 6 and quarter 7. It means that a rise in interest rates during a low household income period leads to income effects that could increase the demand for the stock market, resulting in better stock market performance, albeit with a delayed effect. The delayed effect could be due to the lagging effect of monetary policy on the listed firm performance. As for the high household debt regime (see

Figure A14), while the reaction of the stock market to an MPS is positive from quarter 1 to quarter 5 before becoming negative after that, the impacts of the MPS are statistically insignificant in all horizons.



A13: Reaction of stock market at low household debt regime

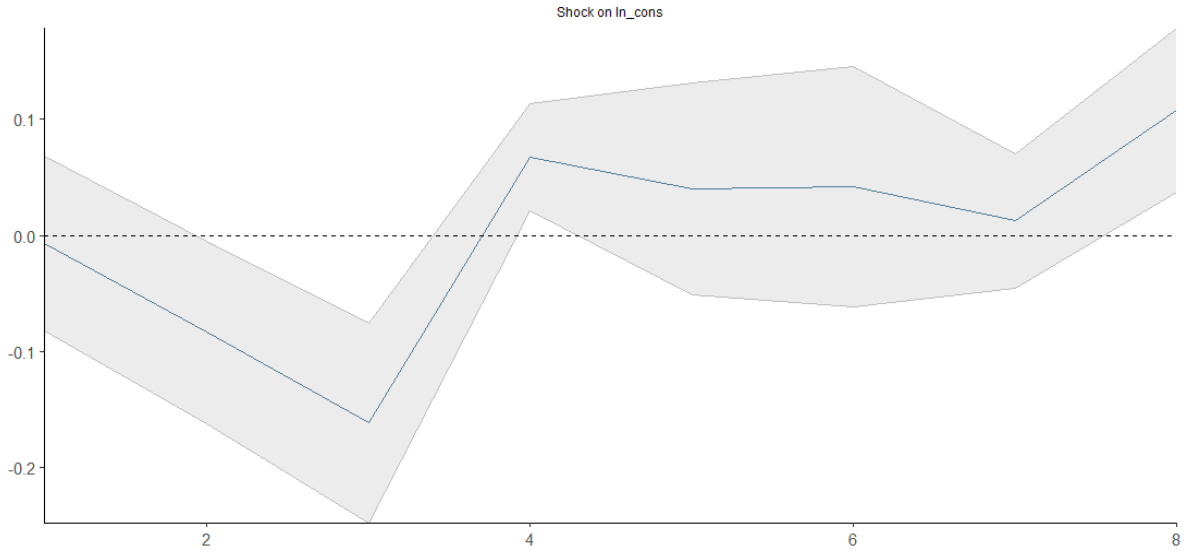


A14: Reaction of stock market at high household debt regime

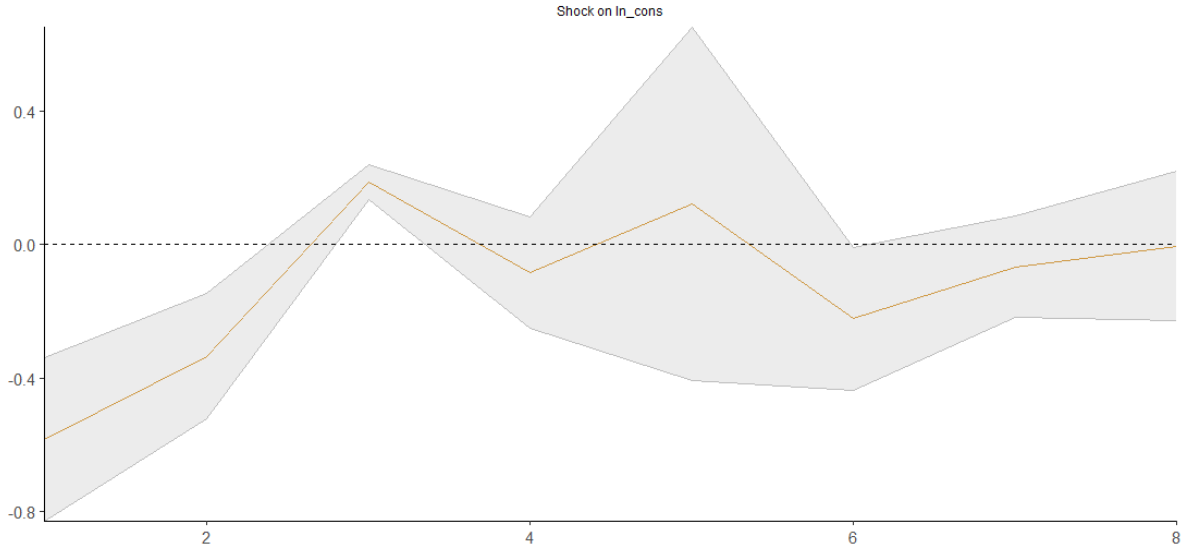
5.8 Robustness analysis: Alternative measurement of shocks

According to Figures B1 and B2, the impulse response functions show that the reactions of household consumption to an MPS in the low and high household debt regimes and the statistical significance established in the baseline model are confirmed by the alternative MPS measurements. In other words, the larger impact of rising interest rates on household consumption when household debt is higher than the fundamental level substantiates the

arguments that a high household debt regime increases the sensitivity of household consumption to a change in interest rate.



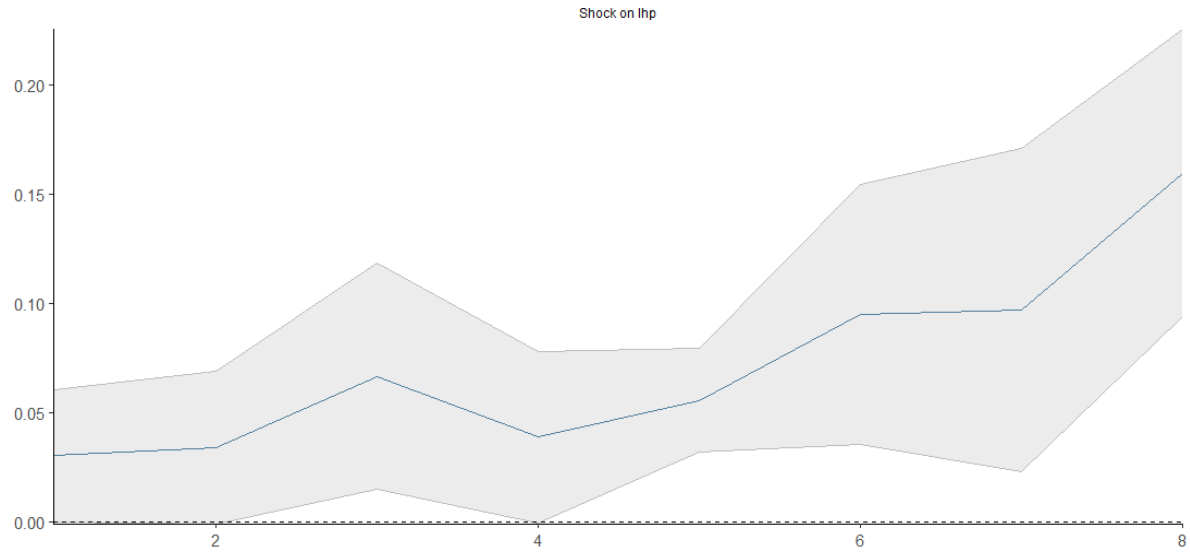
B1: Reaction of consumption at low household debt regime



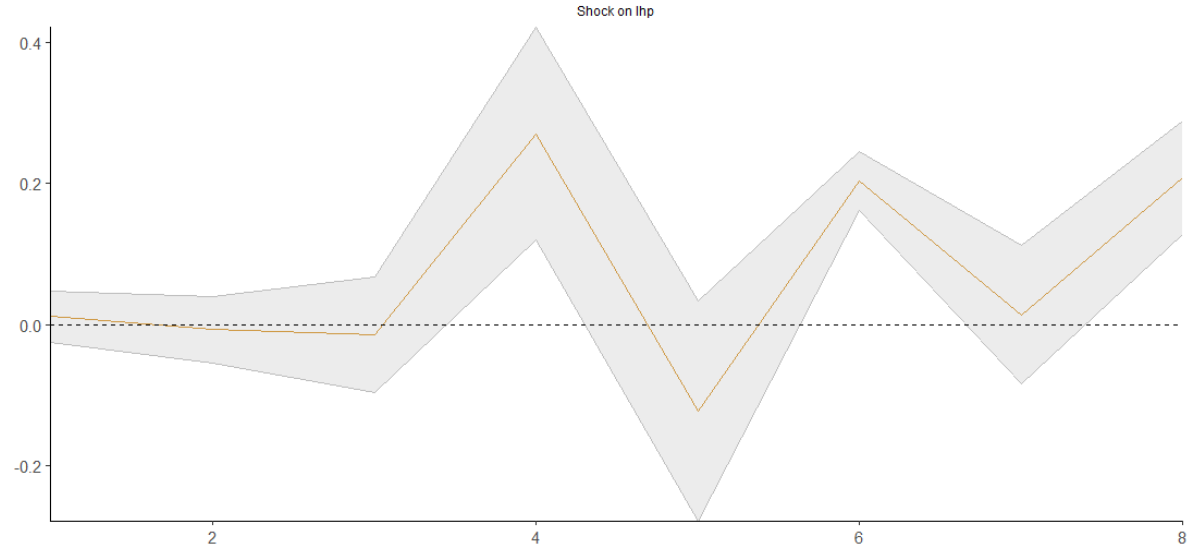
B2: Reaction of consumption at high household debt regime

On the other hand, Figures B3 and B4 below also report that the robustness analysis produces conclusions that support the baseline estimations of the house price reactions to MPS, suggesting that the house price reactions to MPS will be relatively late and volatile when household debt is high. The export, otherwise, found that reactions during the low and high household debt regimes are the same as the baseline model in this robustness exercise; see Figures B5 and B6. The only difference is that the negative reaction of export to the MPS in the first quarter in Figure B6 is statistically significant, which is not the case in the baseline

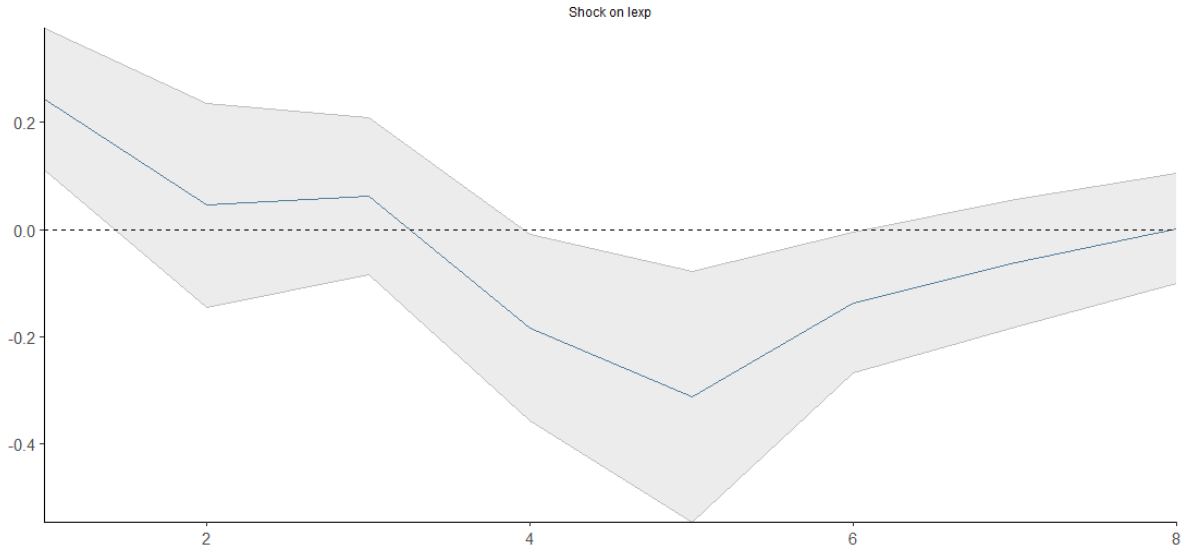
model (See Figure A6). The import, CPI, GDP, and stock market's impulse response functions also establish the same conclusion in this robustness analysis.



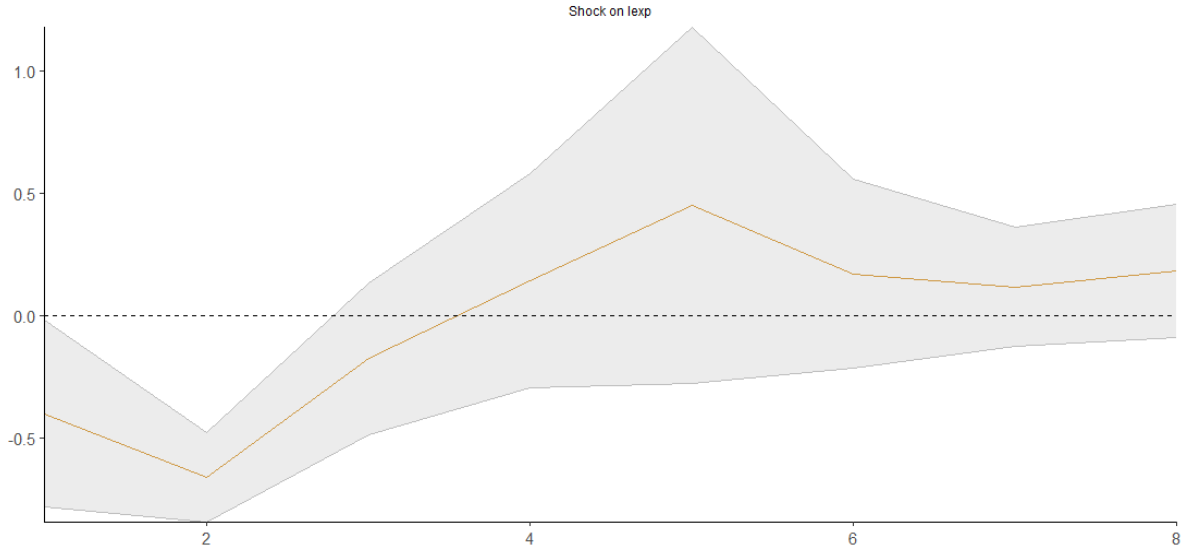
B3: Reaction of house price at low household debt regime



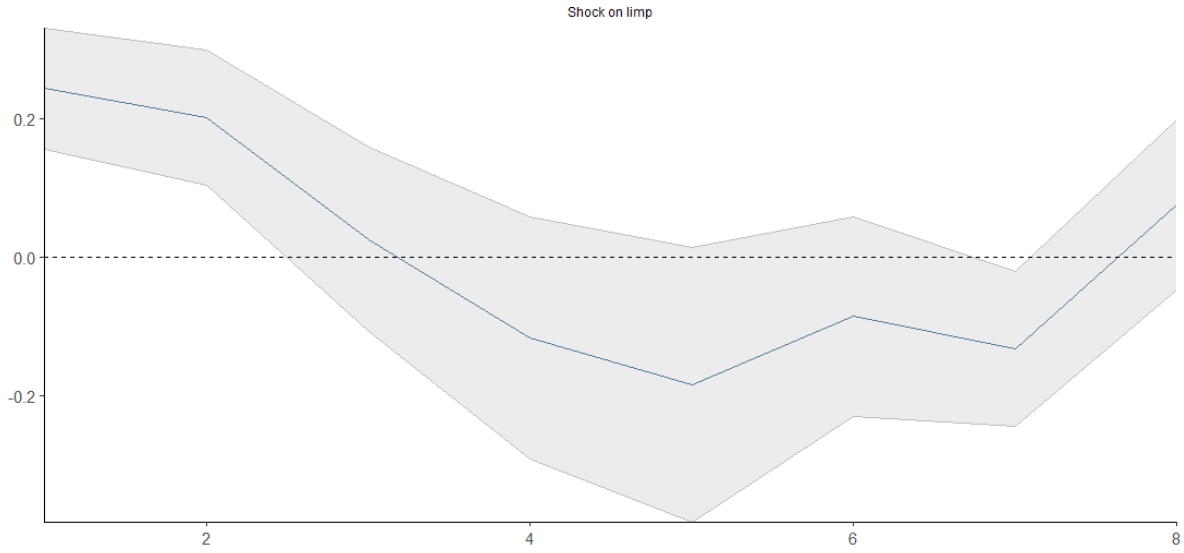
B4: Reaction of house price at high household debt regime



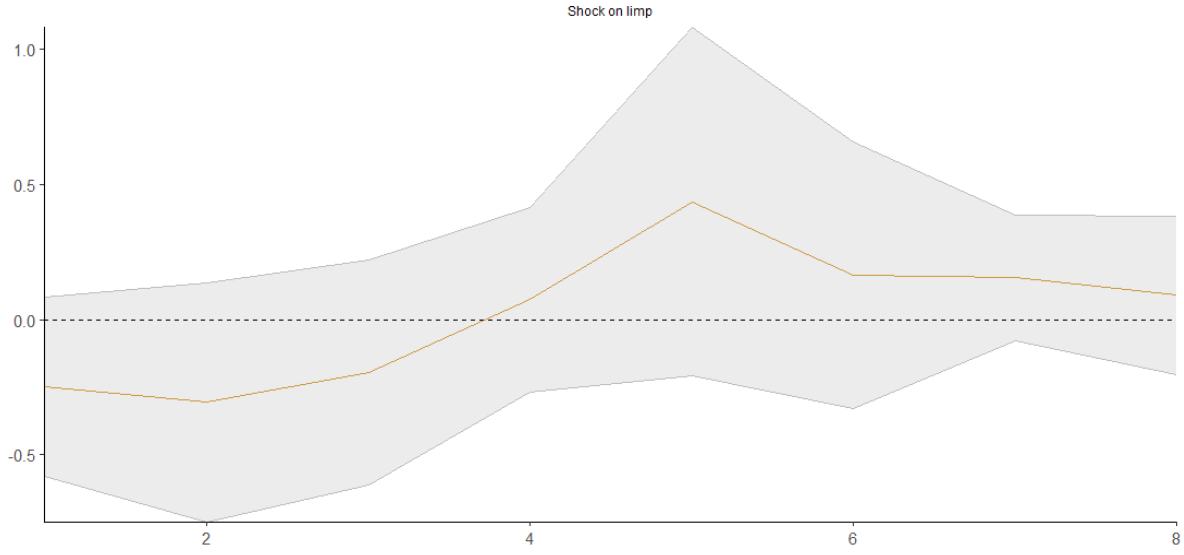
B5: Reaction of export at low household debt regime



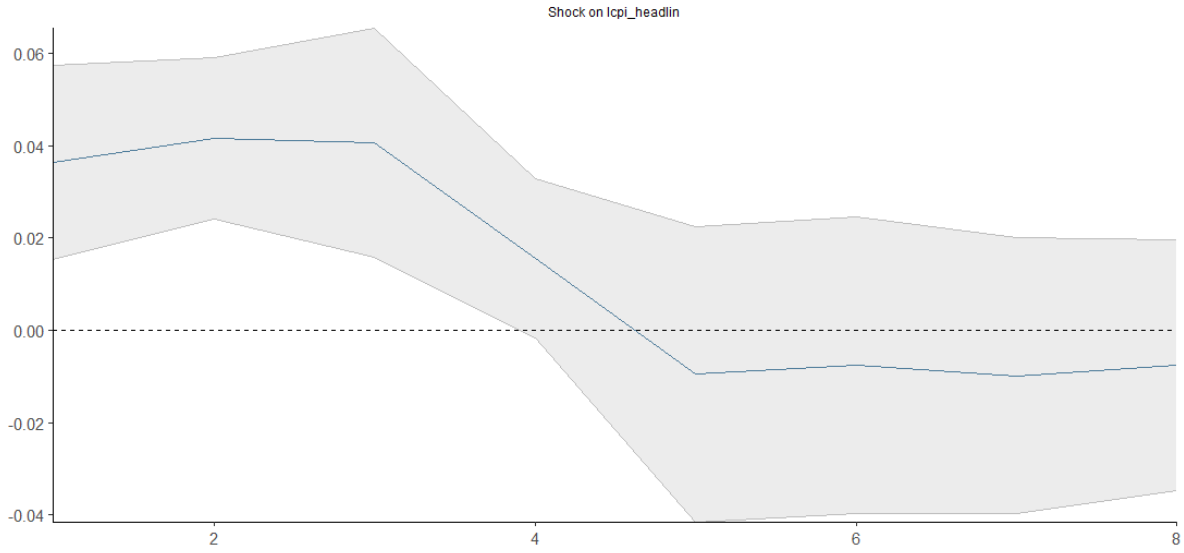
B6: Reaction of export at high household debt regime



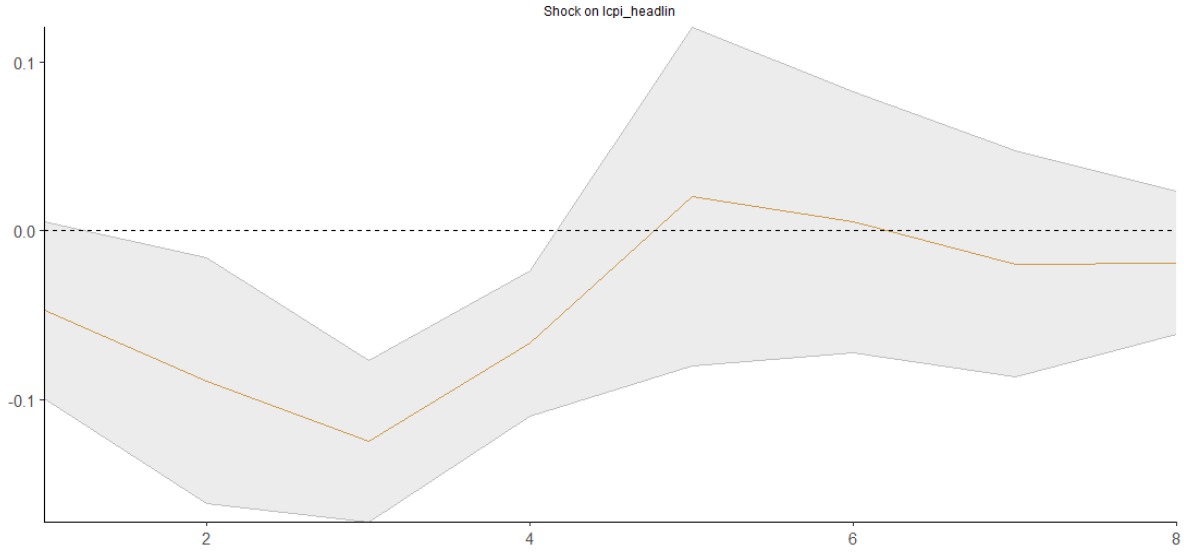
B7: Reaction of import at low household debt regime



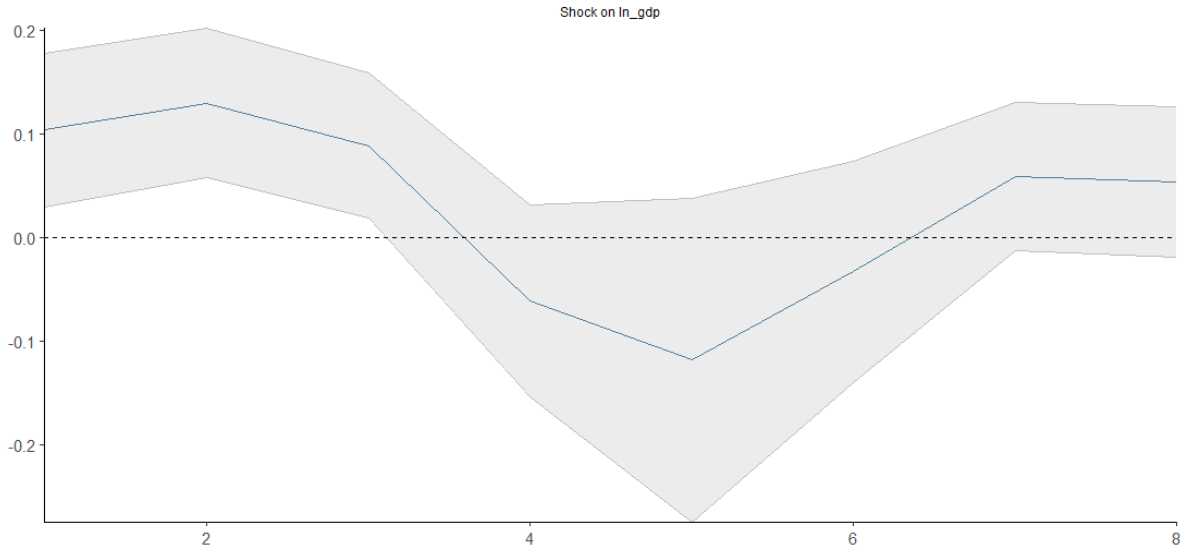
B8: Reaction of import at high household debt regime



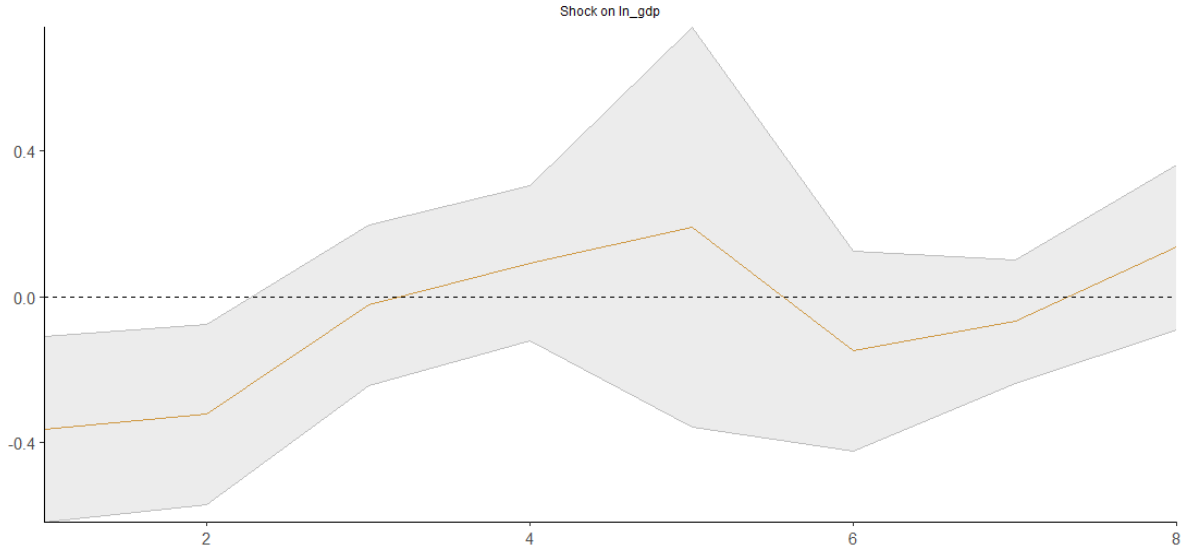
B9: Reaction of CPI at low household debt regime



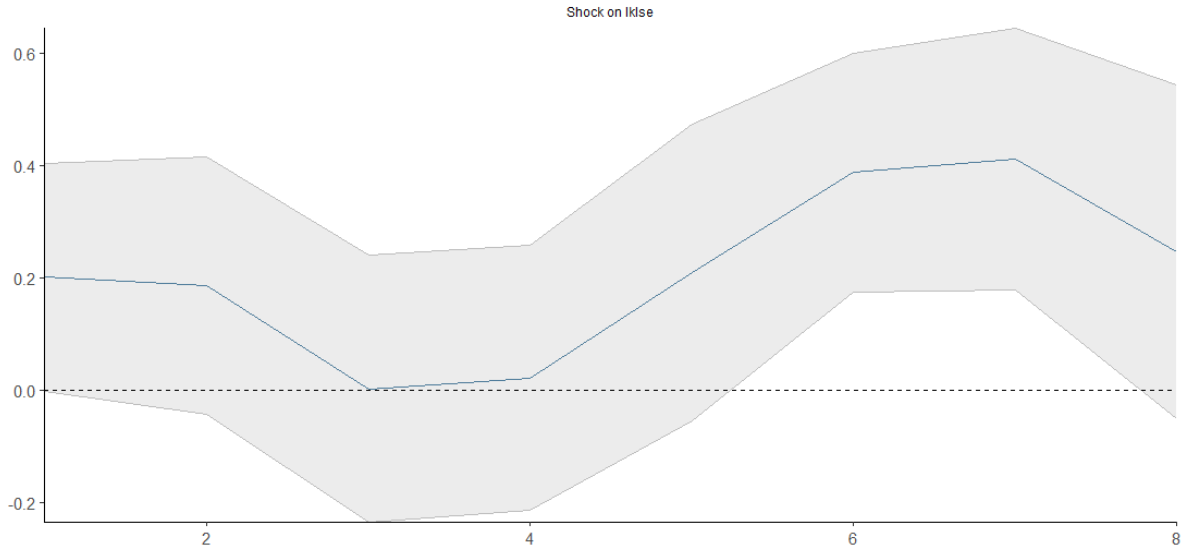
B10: Reaction of CPI at high household debt regime



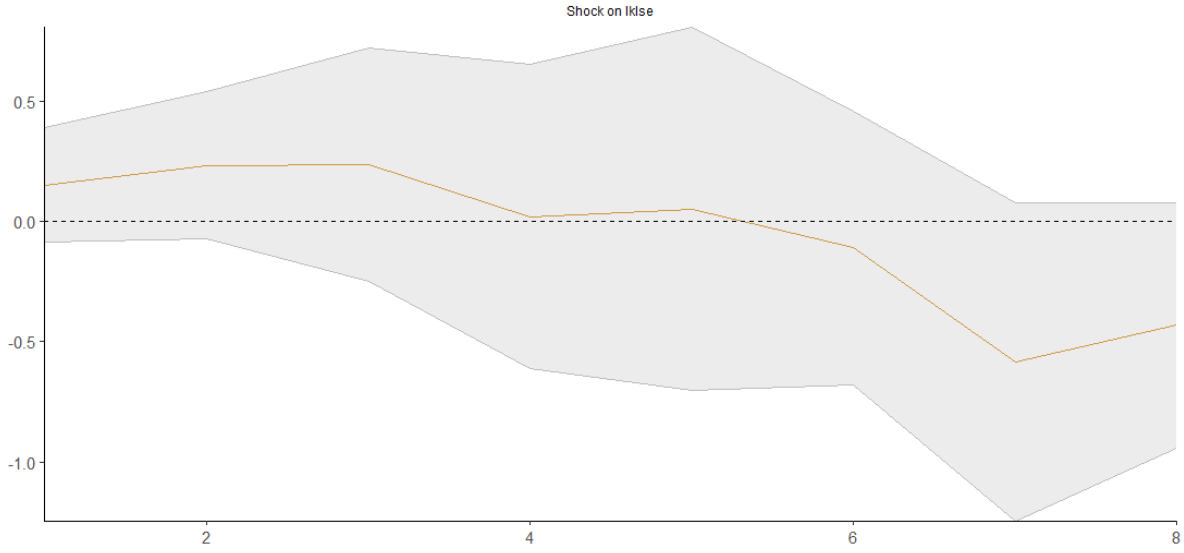
B11: Reaction of GDP at low household debt regime



B12: Reaction of GDP at high household debt regime



B13: Reaction of stock market at low household debt regime



B14: Reaction of stock market at high household debt regime

6. Conclusion

It is reasonable to believe that monetary policy could have different impacts on the economy, subject to the economic environment. This research is the first attempt to use the state-dependent impulse response function proposed by Jorda (2005) to determine the impulse response functions of consumption and other significant economic variables to an MPS in Malaysia. The MPS applied in the estimations is identified from the existing database, supplemented by the treasury bill data compiled by the authors.

The analysis indicates that the consumption has a stronger reaction to a change in the MPS when comparing the magnitude of the responses found in the impulse response functions. Furthermore, the relative strength between income and substitution effects could influence the reactions of consumption, housing price, GDP and stock market at different horizons. The price puzzle is found even by adding the oil price to the model. These results are robustly found in the robustness analysis, too.

Two policy implications can be derived from the findings. First, the findings suggest that high household debt could cause instability in the consumption and house prices among Malaysians. Hence, the excessive household debt should be contained to ensure a sustainable consumption and housing market. Second, the varying income and substitution effect among some asset variables in the system imply challenges in conducting an effective monetary policy. The difference in the strength of income and substitution effect could reflect the households' expectations about asset performance. Hence, a more transparent monetary policy is useful to guide household expectation formation. In terms of future research directions, we explore the impact of monetary policy on different consumption quantiles by applying quantile regression. Besides, the threshold effect of household debt on the consumption-interest rate policy in Malaysia is also worth investigating. Lastly, the asymmetrical impacts of a rise and drop in the monetary policy interest rate could be examined to differentiate their impacts on consumption and other important economic variables.

References

Agenor P. R. (2002). Asymmetric effects of monetary policy shock. The University of Manchester.

Aizenman, J., Cheung, Y.-W., & Ito, H. (2017). The interest rate effect on private saving: Alternative perspective (ADBI Working paper No 715). https://www.adb.org/sites/default/files/publication/239546/adbi-wp715.pdf

Alpanda, S., Granziera, E., & Zubairy, S. (2021). State dependence of monetary policy across business, credit, and interest rate cycles. *European Economic Review*, *140*, 103936.

Alpanda, S., & Zubairy, S. (2019). Household debt overhang and transmission of monetary policy. *Journal of Money, Credit and Banking*, *51*(5), 1265–1307.

Angrist, J. D., Jorda, O., & Kuersteiner, G. M. (2018). Semiparametric estimates of monetary policy effects: String theory revisited. *Journal of Business & Economic Statistics*, *36*(3), 371–387.

Bank Negara Malaysia. (2021). Financial Stability Report 2nd Half 2021.

Beraja, M., Fuster, A., Hurst, E., & Vavra, J. (2019). Regional heterogeneity and the refinancing channel of monetary policy. *The Quarterly Journal of Economics*, *134*(1). 109-183

Cai, Y., Selamah, A. Y., Ruzita, M. A., & Mohd Nahar, M. A. (2020). Household debt and household spending behavior: Evidence from Malaysia. *Jurnal Ekonomi Malaysia*, *54*(1), 111-120.

Calza, A., Monacelli, T., Stracca, L. (2013). Housing finance and monetary policy, *Journal of the European Economic Association*, *11*, *Supplement 1*, 101–122.

Caporale, G. M., Catik, A. N., Helmi, M. H., Ali, F. M., & Tajik, M. (2020). The bank lending channel in the Malaysian Islamic and conventional banking system. *Global Finance Journal*, *45*, 100478.

Chen, N.-K., Chou, Y.-H., & Wu, J. L. (2013). Credit constraint and the asymmetric monetary policy effect on house prices. *Pacific Economic Review*, *18*(4), 431–455.

Choi, S., Willems, T., & Yong, S. (2023). Revisiting the monetary transmission mechanism through an industry-level differential approach. Staff Working Paper No. 1024. Bank of England

Cumming, F., & Hubert, P. (2019). The role of households' borrowing constraints in the transmission of monetary policy. Hal-03403257. https://sciencespo.hal.science/hal-03403257.

Cumming, F. & Hubert, P. (2023). The distribution of household indebtedness and the transmission of monetary policy. *Review of Economics and Statistics*, *105*(5), 1304–1313.

Floden, M, Kilstrom, M., Sigurdsoon, J., & Vestman, R. (2021). Household debt and monetary policy: Revealing the cash-flow channel. *The Economic Journal*, *131*(May). 1742-2021.

Florio, A. (2004). The asymmetric effects of monetary policy. *Journal of Economic Survey*, *18*(3). 409–426.

Florio, A. (2005). Asymmetric monetary policy: Empirical evidence of Italy. *Applied Economics*, *37*(7). 751–764.

Gogas, P., Pragidis, I., Tabak, B. M. (2018). Asymmetric effects of monetary policy in the U.S. and Brazil. *The Journal of Economic Asymmetries*, *18*, e00108.

Ha, J. (2020). Nonlinear transmission of U.S. monetary policy shocks to international financial markets. *International Finance*, *23*(3), 350-369.

Hamilton, D. J. (2018). Why you should never use the Hodrick-Prescott Filter. The Review of Economics and Statistics, 100 (5), 831–843. https://doi.org/10.1162/rest_a_00706

Harding, M., Klein, M. (2019). Monetary policy and household deleveraging. DIW Discussion Paper No. 186, DIW, Berlin.

Jorda, O. (2005). Estimation and Inference of Impulse Responses by Local Projections. *American Economic Review*, *95*, 161–82.

Kim, Y., & Lim, H. (2020). Transmission of monetary policy in times of high household debt. *Journal of Macroeconomics*, *63*, 103168.

Polyzos, E. (2022). Examining the asymmetric impact of macroeconomic policy in the UAE: Evidence from quartile impulse response and machine learning. *The Journal of Economic Asymmetries*, *26*, e00267.

Ramey, V. A., & Zubairy, S. (2018). Government spending in good times and in bad: Evidence from U.S. Historical Data. *Journal of Political Economy*, *126*, 850–901.

Santoro, E., Petrella, I., Pfajfar, D., & Gaffeo, E. (2014). Loss aversion and the asymmetric transmission of monetary policy. *Journal of Monetary Economics*, *68*, 19–36.

Sensier, M., Osborn, D. R., & Ocal, N. (2002). Asymmetric interest rate effect for the UK real economy. Oxford Bulletin of Economics and Statistics, 64(4), 315–339.

Shen, C.-H. (2000). Are the effects of monetary asymmetric? The case of Taiwan. *Journal of Policy Modeling*, *22*(2), 197–218.

Stockwell, T. (2023). Should models of monetary policy asymmetric include interaction terms? *The Journal of Economic Asymmetries*, *27*, e00300.

Tan, S.-H., & Muzafar, S. H. (2007). Business cycles and monetary policy asymmetry: An investigation using Markov-switching models. *Physica A*, *308*, 297-306.

Tan, S.-H., Muzafar, S. H., Azali, M. (2010). Asymmetric effects of monetary policy in ASEAN-4 Economies. *International Research Journal of Finance and Economics*, *44*, 30-41.

Tang, T. C., Puah, C.-H., & Liew, V. K.-S. (2015). The interest rate pass-through in Malaysia: An analysis of asymmetric adjustment.

Tas, B. K. O. (2011). An explanation for the price puzzle: Asymmetric information and expectation dynamics. *Journal of Macroeconomics*, *33*(2), 259-275.

Telatar, E., & Hasanov, M. (2006). The asymmetric effects of monetary shocks: The case of Turkey. *Applied Economics*, *8*(18), 2199-2208.

Tenreyro, S., & Thwaites, G. (2016). Pushing on a string: US monetary policy is less powerful in recessions. *American Economic Journal: Macroeconomics, 84*(4), 43–74.

Zulkhibri M. (2012). Bank-characteristics, lending channel and monetary policy in emerging markets: bank-level evidence from Malaysia. *Applied Financial Economics*, *23*(5), 347-362.