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Effects of High Household Debt on the Monetary Policy Transmission Mechanism: Some Evidence from Thailand

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Abstract

Household debt in Thailand has risen sharply in the past few years. In addition to its downsides on household consumption, the high level of household debt can affect the effectiveness of monetary policy. In this paper, I use the Threshold-Structural Vector Autoregression technique to show that Thailand's monetary transmission mechanism is weaker during the high-debt periods compared to the low-debt periods. The explanation can be drawn from three arguments which are debt overhang, borrowing constraints faced by households, and the high proportion of fixed-interest rate loans.

Keywords: Monetary Policy, Transmission Mechanism, Household Debt, Threshold-Structural Vector Autoregression

1. Introduction[1]

Loans help households smooth their consumption across their lifetime. However, when households are highly indebted, the consumption can be distorted (Lombardi, Mohanty, & Shim, 2017). Despite several studies stating the negative effect of high household debt on consumption, its impact on the monetary transmission mechanism remains controversial. On the one hand, households are more sensitive to the change in the interest rates when the household debt is high (Debelle, 2004). On the other hand, several recent studies have shown that debt overhang, the situation when the level of household debt is so high that households start deleveraging, can dampen the effects of expansionary monetary policy on household consumption. Hence, debt overhang can bring about the opposite effect (Dynan, 2012; Alpanda & Zubairy, 2017)

For Thailand, determining whether the effect of high household debt to the monetary transmission mechanism is positive or negative, has policy implications for the policymakers as Thailand's household debt has increased to a high level in recent years. As shown in figure 1, the household debt has increased from around 40% of GDP in 2003 to 80% in 2016. Moreover, the monetary transmission mechanism in Thailand is not as strong as in developed countries' (Disyatat & Vongsinsirikul, 2003). If the high household debt provides a positive impact, then it implies that the monetary pass-through in Thailand has improved. On the other hand, the weak monetary pass-through can be worsened if the high level of household debt causes negative effects.

To date, there has been no answer for Thailand. Most literature studying the relationship between household debt and the monetary transmission mechanism has been conducted on the cases of developed countries. There are various studies on the Thai monetary transmission mechanism. One study has shown a positive impact of household debt on the monetary policy pass-through (Subhanig, 2009). Nevertheless, all of them have assumed that the transmission mechanism of monetary policy remains the same across all debt levels. Therefore, there has not been any research

[1] The views expressed in this paper belong to the author and do not necessarily represent the Bank of Thailand's policies.

studying the differences in the interest rate pass-through during the high and low debt periods.

The main contribution of this paper is to show that the monetary transmission mechanism in Thailand is different during the high-debt and low-debt periods. I use a Hodrick–Prescott (HP) filter to define low-debt and high-debt regimes. Then, I compared the impulse responses of output and inflation in both regimes to the structural monetary policy shock using the Threshold- Structural Vector Autoregressive (VAR) model. Also, I repeat the same method with the data of household consumption to study the interest rate pass-through to household consumption when the household debt is high or low.

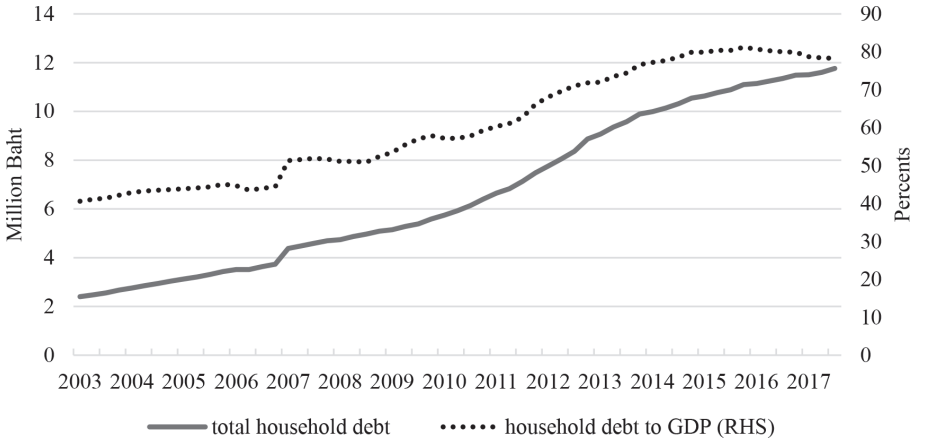
The results from the Threshold-Structural VAR have shown that the monetary policy in Thailand is less effective during the high debt periods. A shock to interest rate can decrease inflation immediately only when the household debt is low. The explanation can be drawn from three arguments. The first argument is the debt overhang. Households with high debt may hesitate to create more debts and start to deleverage even when the central bank decreases the policy rate. Secondly, households with high debt may have reached the borrowing constraints set by Thai commercial banks. Lastly, most loans to households in Thailand are fixed- interest rate loans or installment loans. Hence, the decrease in the policy rate has a small impact on household interest payment. The results from the consumption model have confirmed the arguments as it has shown that the interest rate pass-through to consumption is weaker during the high debt periods.

To improve the effectiveness of the monetary policy, one suggestion is to increase the share of flexible interest rate loans. However, this can decrease the welfare of the whole economy (Rubio, 2011) and make households more exposed to interest rate shocks (Debelle, 2004). The best implication for the Bank of Thailand is to control the household debt to be at the manageable level. Imposing the macroprudential measures and enhancing financial literacy are the policies that the Bank of Thailand have implemented and should be continued. The result from this paper also provides implications for the fiscal policymakers. The recent research has shown that the government's policy has promoted households to increase spending and be more indebted

(Muthitacharoen, Samphantharak, & Chantarat, 2017). Hence, to control household debt, it is necessary to have coordination from the fiscal policy-makers.

I divide this paper into six parts. The first part is the introduction. In the second part, I explain the related literature including Thai literature conducting on the effectiveness of Thai monetary policy. In the third part, I summarize the theoretical framework from the literature and discuss Thai contexts which are consistent and inconsistent with the theories. The fourth part is about the threshold-structural VAR model. I describe the results in the fifth part before giving the conclusions in the last part.

Figure 1: Thailand's Household Debt



Source: Bank of Thailand

2. Literature Review

In this section, I explain the literature studying the relationship between household debt, and the transmission mechanism of monetary policy before concluding with what Thai studies have done so far.

Despite many studies explaining the relationship between household debt and household consumption, there is no consensus about how the high level of household debt will affect the transmission mechanism of monetary

policy to consumption, output, and inflation. The fundamental theory has stated that the monetary policy will be more effective when households are more indebted while many empirical studies have shown the opposite. In this part, I will start with the fundamental theory before explaining the opposite argument. On the one hand, Mishkin (1996) has explained three channels of the monetary transmission mechanism which are interest channel, asset price channel, and credit channel. Asset price channel consists of exchange rate, equity price, and housing and land price channel. Even if the main implication is to apply with firms' investment, the theory also applies to household consumption. Debelle (2004) has explained that the effect of monetary policy is amplified when household debt is high. The decrease in the policy rate has more impact on households' interest payment and disposable income. Therefore, households can increase more consumption.

Walentin (2014) has studied housing collateral from Iacoviello (2005) and found that housing collateral plays an important role in the monetary policy pass-through. Also, an economy with the higher loan-to-value ratio (LTV) reacts more to the shock in the interest rate. The LTV ratio implies the level of leverage, in other words, how high households borrow compared to equity.

Most studies stating the opposite argument are based on the idea of debt overhang, namely when household debt is very high that households are unwilling to borrow and start deleveraging. Dynan (2012) has studied the case of US homeowners during 2007-2009 and shown that debt overhang has an impact on household spending. When highly-leveraged homeowners face a small deterioration in their income, they decrease their spending more than households with low leverage. Other empirical studies have also confirmed the negative impact of debt overhang on consumption. Ogawa and Wan (2007) have studied the case of Japanese households and found the negative relationship between the level of debt and consumption. At the macroeconomic level, Lombardi et al. (2017) have shown that an increase in household debt leads to a positive effect on consumption in the short run. However, the effect in the long run is negative. Moreover, it is worsened when the household debt per GDP has exceeded the 60% threshold.

Even for Thailand's cases, there is a myriad of studies stating the similar argument. Muthitacharoen, Nuntramas, and Chotewattanakul (2015) have found that the increase in debt-to-income service ratio (DSR) can significantly lead to a decrease in the households' disposable consumption. Also, households with DSR more than 40% may have difficulty paying debts. Muthitacharoen (2016) has studied factors that determine the probability of having debt anxiety. The results have shown that an increase in DSR can lead to an increase in debt anxiety. Also, households with unstable income which are the majority of indebted households in Thailand are more prone to debt anxiety than households with stable income. Lastly, Muthitacharoen et al. (2017) have illustrated that high household debt can lead to household financial instability.

All in all, these studies have shown that high household debt can change the pattern of household consumption. Some studies have stated that this change has a negative impact on the effectiveness of the monetary policy. Alpanda and Zubairy (2017) have applied the state-dependent local projection method with the US data and found that the monetary policy is less effective when the household debt is high. The additional threshold VAR model has also confirmed the similar outcomes. Alpanda and Zubairy (2017) have explained that this is due to the weakened home-equity channel. In other words, when households have reached their borrowing constraints, they deleverage their debts.

Di Maggio et al. (2017) have studied how households in the US change their spending pattern when they face the sudden drop in the interest rate during 2007. The result has shown that the expansionary effect of the interest rate decrease is dampened by the households' voluntary deleveraging. In other words, the households have spent some of their increased disposable income to pay the existing debts. Nevertheless, this trend happens more with households who have low leverage or low LTV ratios.

The high level of household debt may affect the transmission mechanism in each country differently due to the institutional factors. Some studies have shown that monetary policy is more effective in a country with flexible or more developed mortgage market (Calza, Monacelli, & Stracca, 2007). The ratio of adjustable rate mortgages (ARM) and fixed rate mortgages

(FRM) plays an important role on determining the monetary pass-through (Debelle, 2004; Jappelli & Scognamiglio, 2016; Finck, Schmidt, & Tillmann, 2018). Also, Rubio (2011) has shown that there are trade-offs between the welfare of the borrowers and lenders when changing from a fixed interest rate to variable interest rate. This is because, with more flexible rate, borrowers are more exposed to shocks in the interest rate while the lenders are worse off. Considering more weight on the borrowers, increasing fixed rate mortgages is a welfare-improvement. Debelle (2004) have also stated the same argument that with flexible- rate mortgages, borrowers are more vulnerable to the shock in the interest rate.

Since this paper is done on the case of Thailand, it is crucial to understand the monetary policy transmission mechanism in Thailand and what Thai studies have done so far. Most of the studies have been conducted on the VAR models. Disyatat and Vongsinsirikul (2003) is one of the most recognized literature about the monetary transmission mechanism in Thailand. The results have shown that interest rate pass-through is weaker compared to the case of developed countries. Inflation takes about a year to respond to the change in the interest rate. The output's response is U-shaped. Charoenseang and Manakit (2007) have studied the monetary policy in Thailand after the inflation targeting era. The results of the interest rate pass-through are consistent with Disyatat and Vongsinsirikul (2003). Charoenseang and Manakit (2007) have also found that the credit channel through bank lending is still significant compared to the other channels even if its effects are weaker after the 1997 crisis.

Waiquamdee and Boonyatotin (2008) has explained the result from the Bank of Thailand Macroeconomic Model (BOTMM). After the 1997 crisis, the pass-through from interest rate and bank lending channels has been weakened. However, they still play a significant role compared to exchange rate and asset price channels. This is consistent with Charoenseang and Manakit (2007). Sriphayak and Vongsinsirikul (2007) have studied Thailand's asset price channel and shown that the asset price channel is significant even if it is not as dominated as the interest rate and credit channels. Also, it has been found that the equity price channel is more effective than the property price channel. In some periods, there was a positive relationship between

house price index and interest rates due to the strong housing demand and demographic factors. Subhanij (2009) is the only literature that has studied the relationship between the household sector and the monetary policy. The result from Subhanij (2009) has supported the argument that the effect of monetary policy is stronger when the household debt is high. Since mortgages play an important role in households' balance sheet, the increase in house prices can lead to an increase in household debt and consumption. For these reasons, households with high debt are more sensitive to the change in the interest rate.

3. Theoretical Framework and Thailand's Contexts

In this section, I summarize theories concerning household debt and monetary transmission mechanism. Also, I explain factors that determine the effectiveness of monetary policy before analyzing these factors in the Thai contexts.

As stated in the literature review, the policy rate can affect the economy through various channels. These channels are interest rate channel, credit channel, asset price channel, and the exchange rate channel. The Bank of Thailand also includes the expectation channel which is based on agents' expectation about whether the economy will expand or contract[2]. According to the fundamental theory, when the household debt is high, the monetary policy becomes more effective because there is a stronger effect on household interest payment (Debelle, 2004).

There are several factors determining whether the monetary policy will be more or less effective when the household debt is high. Firstly, Iacoviello (2005) and Walentin (2014) have introduced housing collateral. Walentin (2014) have shown that housing collateral strengthens the pass-through of the policy rate. Secondly, Alpanda and Zubairy (2017) have stated the debt overhang. The results from Alpanda and Zubairy (2017) has shown that when households reach their borrowing constraints, they tend to deleverage. Lastly, monetary policy is more effective when debts and mortgages are in flexible

[2] https://www.bot.or.th/English/MonetaryPolicy/MonetPolicyKnowledge/Pages/TransmissionMechanism.aspx

terms (Calza et al., 2007). The first and the last factors provide a positive impact on the monetary policy transmission mechanism while the second gives the negative impact.

For Thailand, the literature has shown that the credit channel plays the dominant role for the monetary pass-through. Even the housing price channel has become stronger, it is not as dominant as the credit channel. Therefore, the increase in the house prices may not lead to a strong increase in inflation and output.

Regarding the housing collateral, Chantarat et al. (2017) have shown that housing loans are concentrated in only some groups of Thais. Also, the credit access for housing loans is very low. For the share of flexible-interest rate loans, according to the Bank of Thailand's Financial Stability Report 2017, around 37% of loans to households are fixed-interest rate loans. 29% of loans are installment loans, namely loans with flexible interest rate but fixed monthly payment. Only around 35% are flexible-interest rate loans. These imply that for Thailand, the first and the third factors are weak. For these reasons, the hypothesis for this paper is that the effectiveness of the monetary policy is low during the high-debt periods

4. Methodology

This section describes the Threshold-Structural VAR used for studying the effects of high household debt on the transmission mechanism of the monetary policy. I use Hodrick and Prescott (HP) filter to classify the data into three regimes which are baseline, low-debt, and high-debt regimes. Then, I apply the structural VAR models with each regime to compare the impulse response functions to monetary policy shock. There are two structural VAR models in this paper, the basic model and the consumption model. In the basic model, I test the effects of monetary policy shock to mainly focused variables such and inflation, GDP, and house price. In the consumption model, I follow Disyatat and Vongsinsirikul (2003) by extracting consumption from other components of the GDP to confirm the effects of high household debt on the monetary policy shock to consumption.

4.1 Data

In this paper, I use Thailand's quarterly data from 1998q1 to 2017q3. The GDP and Consumer Price Index (CPI) have been seasonally adjusted. Even though the data has been available from 1994q1, I have chosen the data only after the Asian Financial Crisis in 1997. This is because, according to several studies, there has been a structural change after the crisis. Disyatat and Vongsinsirikul (2003) have stated that the monetary policy is less effective after the crisis while Charoenseang and Manakit (2007) and Waiquamdee and Boonyatotin (2008) have stated that the credit channel has played lesser part compared to the pre-crisis period. Moreover, Thailand had changed its monetary policy scheme from exchange rate peg to money targeting after 1997 and has adopted inflation targeting since 2000. The regression including data before the crisis is shown in the appendix.

4.2 Identifying Regimes

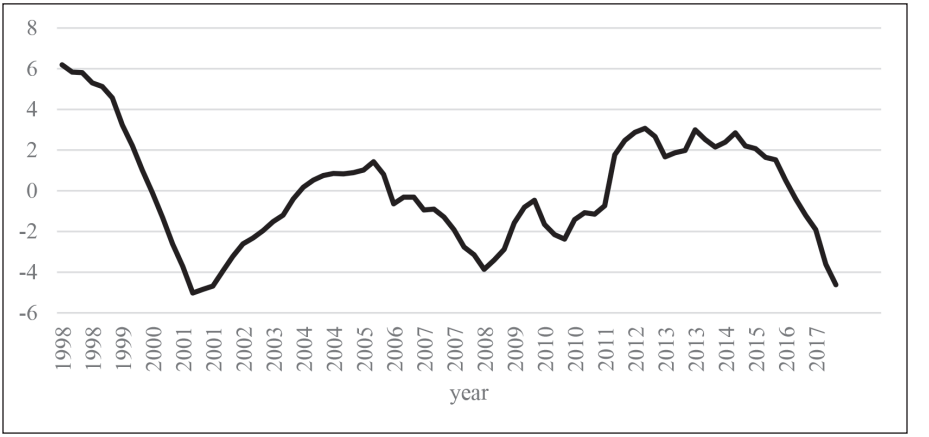
To test how the monetary policy shock affects output and inflation differently across low-debt and high debt regimes, I construct three regimes which are baseline, low-debt, and high-debt regimes. The baseline regime includes all observations. For the other regimes, I apply HP filter to Thailand's household debt-to-GDP ratio to extract cycles from the long-term trend. I classify the periods when cycles are more than 0 into the high-debt regimes and otherwise. In this paper, I prefer household debt-to-GDP to total household debt. This is to take into account the argument that household debt may go along with income. Using the debt-to-GDP ratio also shows whether the debt is growing faster lower than the ability to pay. The results from the baseline regime are used to compare with other Thai literature.

Applying the HP filter to identify the high-debt period is similar to Alpanda and Zubairy (2017). The HP filter is also the method that BIS uses to compute credit-to-GDP gaps to define the optimal countercyclical capital buffer (Drehmann, &Tsatsaronis, 2014). Hence, the HP filter is suitable for this paper since it can capture whether the debt is growing too much or too low compared with the trend.

For the smoothing parameter, I follow Alpanda and Zubairy (2017) by using $\lambda = 10{,}000$ for this is close to the optimal by what Ravn and Uhlig (2002) have suggested for the quarterly data.

Thailand's household debt cycles are shown in figure 2. From the figure, the numbers of observations per regime for both regimes are not too different. Hamilton (2017) has stated that there is a problem at endpoints when using HP filter. Due to this problem, some studies such as Alpanda and Zubairy (2017) and Saldias (2017) have dropped the last observations. In this paper, I do not drop the observations because the cycles in the last two years have been under 0 consecutively. Hence, there is a low probability that the cycles of the last periods will be positive instead of negative. Moreover, the cycles are used for identifying regimes but not for the regressions.

Figure 2: Thailand's Household Debt Cycles from HP-Filter



4.3 The Basic Model

For the baseline regimes, the VAR model can be defined as follows.

$$Y_t = \sum_{i=1}^{p} \beta_i Y_{t-i} + E_t \tag{1}$$

When Y_t is the vector of endogenous variables, βs are the coefficients corresponding to the lag terms and E_t is the error term. P is the number of lag terms. The vector Y_t consists of 5 variables defined as,

$$Yt = \{yt, \pi t, it, hpt, et\} \quad (2)$$

y_t is the $ln(GDP)$ referred to output. π_t is the consumer price index which I refer as inflation. These two variables are the main objectives of the central bank.

i_t is the 14-day repurchase rate (RP14D). RP14D is used as the policy rate in many Thai studies (Disyatat & Vongsinsirikul, 2003; Charoenseang & Manakit, 2007; Subhanij, 2009). Charoenseang and Manakit (2007) have stated that RP14D is one of the most active tenors of the open market operation (OMO). However, in 2007, the BOT has changed its policy rate from the 14-day repurchase rate (RP14D) to 1-day repurchase rate (RP1D). Since Subhanij (2009) has stated that RP14D and RP1D are close, I use the RP14D to make the baseline results consistent with the literature.

hp_t is the house price index. Subhanij (2009) has stated that house prices have a positive relationship with consumption and GDP. The monetary policy committee also considers house price when deciding on the policy rate. Therefore, I add house prices into the model.

e_t is the real effective exchange rate. Alpanda and Zubairy (2017) have studied the role of the high household debt on the effectiveness of the US monetary policy without controlling the exchange rate. However, since Thailand is an export-dependent country (Jitsuchon, & Sussangkarn, 2012) whose export amounts to 68.9% of GDP in 2016[3], the exchange rate may have effects on GDP. Furthermore, the policy rate can have impacts on the exchange rate by affecting the spreads between foreign and domestic returns. For these reasons, I control the exchange rate as an endogenous variable. This is consistent with the literature studying the transmission mechanism of Thailand or small open economies (Bjørnland &Jacobsen,2010; Disyatat & Vongsinsirikul, 2003).

For the low-debt and high-debt regimes, I follow Saldias (2017) and Alpanda and Zubairy (2017) by constructing the threshold VAR model. The model can be defined as follows,

[3] see:https://data.worldbank.org/indicator/NE.EXP.GNFS.ZS

$$Y_t = \left[\sum_{i=1}^{p} \beta_{1i} Y_{1t-1} + \varepsilon_{1t}\right]\left(I_{t-1}\right) + \left[\sum_{i=1}^{p} \beta_{2i} Y_{2t-1} + \varepsilon_{2t}\right]\left(1 - I_{t-1}\right) \quad (3)$$

When the Y_t consists of the same variables as the baseline regimes. From this model, the data has been split into two different regimes. $It-1$ equals to 1 when period t-1 falls into the low-debt regimes and otherwise.

To study the impulse responses function, it is necessary to identify the structural monetary policy shock. To illustrate, I start with the reduced form VAR of the baseline scheme defined as,

$$Y_t = \sum_{i=1}^{p} \beta_i Y_{t-i} + E_t \text{ with } E_t \sim \text{N}(0, \Omega) \quad (4)$$

The E_t term can be written as the structural shock term as $E_t = Be_t$ when $E_t e_t e_t^{-1} E_t^{-1} = I$ Therefore, $Be_t e_t^{-1} B^{-1} = BB^{-1} = \Omega$. There are many matrices that satisfy the condition $BB^{-1} = \Omega$. In this paper, I use Cholesky decomposition, namely I restrict that the B matrix is lower-triangular. Hence, the order of variables in the Y_t vector has economic intuition. A variable that comes later reacts simultaneously with the variables that come before.

In this paper, I assume that the central bank has taken into account the information about output and inflation before deciding the policy rate. Also, Output is the variable that takes the most time to respond to the change in other variables. For these reasons, I place output as the first variable, followed by inflation and the policy rate respectively. This is consistent with some literature studying the transmission mechanism of monetary economics (Disyatat & Vongsinsirikul, 2003; Alpanda & Zubairy, 2017; Saldias, 2017). I place the house prices after the policy rate. This is inconsistent with Subhanij (2009). However, I have the assumption that the house prices react to the policy rate, but the central bank has not yet taken into account the most updated house price index because of the delay of data. There is some evidence supporting this assumption. The monetary committee has a meeting every six weeks. However, before 2008, the house price indices were quarterly released. Disyatat and Vongsinsirikul (2003) have stated that the house price indices were delayed around three months. After 2008, the data has been changed into monthly data. However, it is still 1 or 2 months delayed. 3 For the exchange rate, I place it the last because it reacts fast to other variables.

Regarding the threshold VAR, I apply the same structural shocks. In other words, I place the same order of variables as the baseline regime.

The dickey-fuller has suggested that except the interest rate, other variables are not stationary. However, using the first-difference data causes the loss of information. With a few observations, the VAR model may not be able to capture the relationship between variables. Hence, I follow Disyatat and Vongsinsirikul (2003) by using the level data.

For the number of lag terms, the Schwarz criterion selects the lag length as 1 while Hannan-Quinn Criterion (HQ) suggests lag-length at 3. Akaike and final prediction error (FPE) suggest lag terms of 4. On the one hand, only one lag is not enough to capture the relationship between variables. On the other hand, there are not enough observations for adding many lag terms. Therefore, I use 2 lag terms for the VAR

4.4 The Consumption Model

Household debt has impacts on household consumption since the debt payment can decrease households' power to consume. Muthitacharoen et al. (2015) have found that a household with DSR higher than 40% may have difficulty paying debts. Also, an increase in DSR can lead to a decrease in household consumption. The high level of household debt may have impacts on the transmission mechanism of monetary policy by affecting the policy's impact on consumption. To have a clearer understanding of this aspect, I study the effects of the monetary policy shock on consumption using the model from Disyatat and Vongsinsirikul (2003).

The structure of the model is still similar to the basic model in the previous part. I compare the impulse responses to the monetary policy shocks in the baseline, low- debt, and high-debt regimes. Nevertheless, there is a change in the Y_t matrix. I extract the consumption from the other components of GDP. Hence, the Y_t can be re-established as,

$$Y_t = \{y - c_t, c_t, \pi_t, i_t, hp_t, e_t\} \quad (5)$$

When $y - c_t$ is the total GDP excludes the consumption, and c_t is the consumption. The other variables remain the same as the basic model.

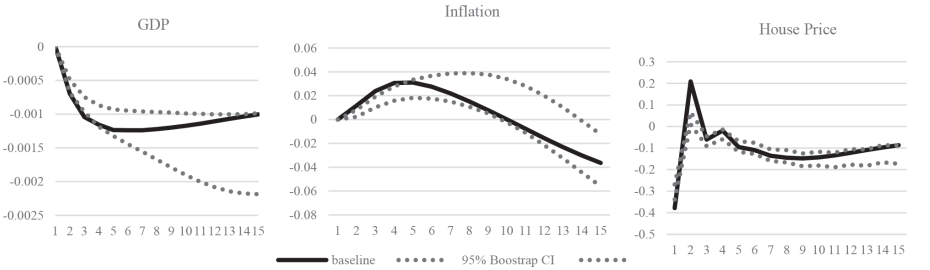
5. Results

In this part, I explain the results from the VAR model starting with the baseline regime in the basic model before comparing it with the low-debt and high debt regimes. I end this part by showing the results from the consumption model.

5.1 Baseline Regime in the Basic Model

Figure 3 has shown the baseline regime's impulse response functions to the positive structural monetary policy shock with the size of 25 basis points, implying the contractionary monetary policy.

Figure 3: Baseline Impulse Responses to Monetary Policy Shock



The U-shaped decrease in GDP responding to the monetary policy shock is consistent with Disyatat and Vongsinsirikul (2003). Inflation starts to increase first before decreasing many periods after. The explanation can be drawn from Waiquamdee and Boonyatotin (2008) as inflation usually takes some time to respond to the change in the interest rate. Also, this may be due to the price puzzle, the phenomenon when the useful information about the innovation in inflation is left out of the model (Disyatat and Vongsinsirikul, 2003). If the information is observable by the central banks, the price puzzle can disappear.

The impulse responses of the house prices have illustrated that when there is a monetary price shock, the house prices decrease before increasing in the early periods, then, start to decrease again. This can be explained by the results from Sriphayak and Vongsinsirikul (2007). The property price channel

in Thailand is not as effective as the equity price channel. Moreover, in some periods, the effect of contraction in monetary policy on property price has been overtaken by strong housing demand and demographic factors. Nevertheless, the sharp increase in the household price does not lead to the overall increase in the GDP, this can be due to the fact that asset price channel plays smaller role compared to the interest rate channel and credit channel as stated in many of the literature.

5.2 Threshold VAR in the Basic Model

The results from the baseline regime are consistent with Thai literature. In this part, I compared the baseline regime with low-debt and high-debt regimes. The impulse response functions can be shown in figure 4. Overall, the impulse responses have shown that the transmission from the monetary policy shock to output and inflation is stronger in the low-debt regimes. The effect of monetary policy during the low-debt case is stronger to the baseline case. The effect of the high debt regime is weaker than the baseline's.

For the output, all regimes provide U-Shaped impulse responses. However, for the high-debt regime, output decreases only for a few periods before going up. In the low-debt regimes, the effect of the monetary policy shock lasts longer. For the inflation, the price puzzle disappears in the low-debt regime while the inflation does not decrease at all in the high debt regime.

Regarding the house prices, a shock in the monetary policy leads to the same pattern as explained in the baseline case. The house prices in the low-debt regime respond to the shock in the first periods not as much as in the high debt regime. However, the house prices tend to decrease more during the periods after. It can be interpreted as, in the early periods, the monetary policy shock has a higher effect on the house prices when the household debt is high. Nevertheless, in every regime, the effect of shock has been overcome by housing demand as stated in Sriphayak and Vongsinsirikul (2007). An increase in interest rate can lead to the decrease in the house prices in long-run only when the household debt is low. For the other regimes, the demand for housing and the demographic factors are too strong for the central bank to pin down the house prices. The results are counterfactual compared to the fundamental theory. However, they are consistent with this paper's hypothesis. This shows

that for Thailand's case when most loans to households are the fixed-interest rate or installment loans, debt overhang dampens the transmission mechanism of the monetary policy.

Figure 4: Impulse Responses to Monetary Policy Shock in Threshold VAR Model

Figure 4.1 Impulse Responses in All Regimes

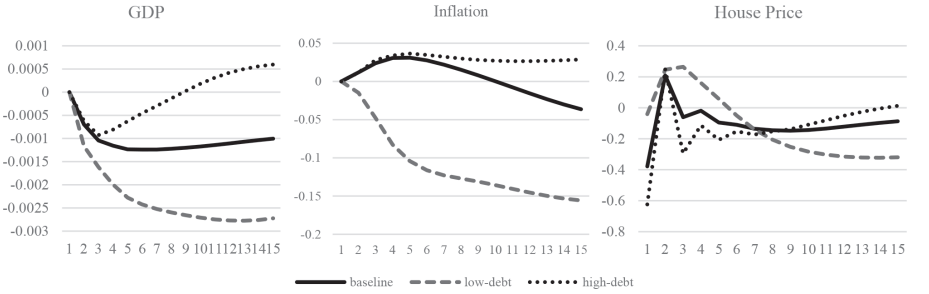


Figure 4.2 Low-Debt Regime Impulse Responses and 95% Bootstrap Confidence Intervals

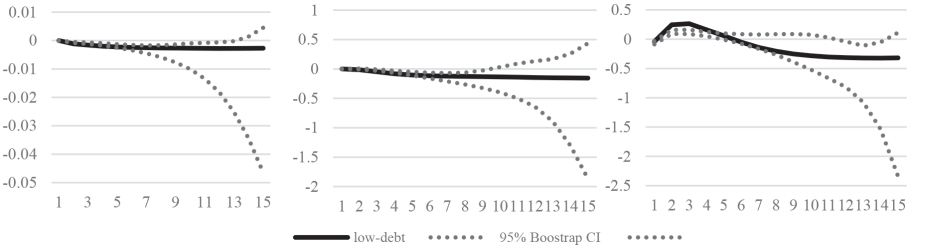
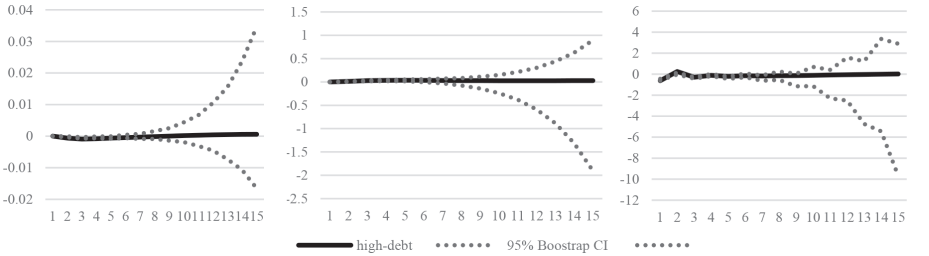


Figure 4.3 High-Debt Regime Impulse Responses and 95% Bootstrap Confidence Intervals



There is another explanation supporting the results. Highly indebted households may not be able to borrow from banks even if they are willing to even if the central bank has decreased the policy rate. This is due to the Bank of Thailand's macroprudential regulations causing Thai commercial banks to apply strict rules on borrowers. These rules are such as not providing loans to individuals' with low credit scores or not providing loans to households with high DSR.

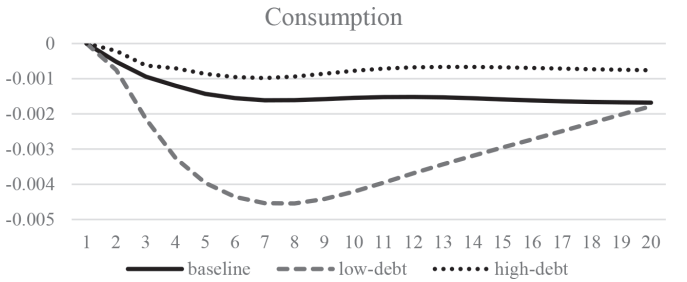
To summarize, when the central bank decreases the interest rate during high household debt periods, households may have debt anxiety and are not willing to borrow. Moreover, they may not be able to borrow even if they are willing to because they have reached their constraints. Finally, a decrease in the interest rate will not be able to change the households' interest and debt payment much because the debts are in fixed-term. For these reasons, households cannot increase their consumption. This brings about the weakened monetary transmission mechanism when the household debt is high.

5.3 Consumption Model

If the arguments stated above are valid, there should be evidence on the effect of monetary policy and consumption. Hence, in this part, I use the results from the consumption model to confirm the arguments.

Figure 5 is the impulse responses of consumption to the monetary policy shock in the consumption model. The results have shown that consumption responds to rise in the interest rate during the low-debt periods. This confirms the former arguments that monetary is less effective during the high household debt periods.

Figure 5: Impulse Responses to Monetary Policy Shock on Consumption



6. Conclusions

The results from the Threshold-Structural VAR model have shown that Thai monetary policy is less effective during the periods when household debt to GDP ratio is high. The explanations for these counterintuitive results can be drawn from three causes which are households' unwillingness to borrow when debt is high, households' borrowing constraints, and the low proportion of flexible interest rate loans.

The findings provide policy implications for the Bank of Thailand. The Bank of Thailand has taken into account the household debt as a factor that can raise instability in output and inflation. However, from this paper, the results have shown that household debt also affects the monetary transmission mechanism.

To increase the monetary policy's effectiveness, the central bank can encourage more proportion of flexible- interest rate debts. However, Debelle (2004) has stated that, with more flexible-interest rate debts, households are more exposed to interest rate risk. Also, Rubio (2011) has stated that increasing the proportion of flexible loans can decrease the total welfare. For these reasons, the Bank of Thailand should control the household debt to be at the acceptable level instead.

Currently, the Bank of Thailand has many measures to monitor and ensure financial stability. These measures include imposing regulations on commercial banks to be prudent while providing loans, expanding the Bank of Thailand's supervision on other non-commercial banks, and monitoring household debt in both the micro and the macro levels. Conducting macroprudential measures such as caps on LTV and DSR ratios is also what the Bank of Thailand has done so far (Lim et al., 2011).

There are also other aspects that can be enhanced. Chantarat et al. (2017) have studied the micro debt data from the National Credit Bureau and found that Thais have been indebted since young age and do not become debt-free until old age. The recent Financial Literacy Report also has shown that Thai financial literacy scores, especially on financial knowledge, are low. Promoting financial literacy is also another way to decrease the household debt and make households more resilient.

This paper also has an implication for the fiscal policy. To ensure the effectiveness of monetary policy, it is necessary to maintain the level of household debt not to be too high. This cannot be achieved without the coordination from the fiscal policy. The former policies applied have been about promoting household spending which can lead to fewer savings and more debts. Muthitacharoen et al. (2017) have given the solid example as the results have shown that the government's first-car tax rebate scheme led to the higher loan delinquency. The government should not promote the policies that make households more indebted, especially with debts that do not generate income.

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Appendices

Appendix A: Data

Table 1. Data Source

Data	Source
Household Debt	BIS
Interest Rates	Bank of Thailand
Housing Price Index	Bank of Thailand, CEIC
GDP, Balance of Payment	NESDB
Real Effective Exchange Rates	Bank of Thailand
CPI	Ministry of Commerce

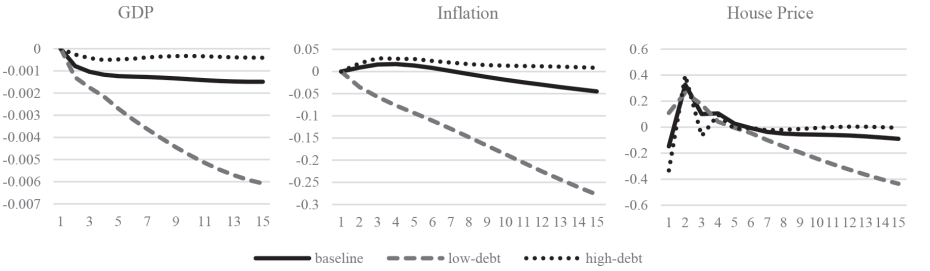
The Bank of Thailand also provides the data of household debt. However, BIS has data with more observations. Therefore, I choose BIS data for this paper. The discrepancies between the BIS and the Bank of Thailand data is around 10% and have been stable for all the periods. Therefore, BIS data is still able to capture the change in the household debt.

For the house price index, the Bank of Thailand has changed the data format and the base year in 2008. I use the index of town-house with land because it is available for all periods. Due to the change in the base year, I recalculate the index after 2008 using the previous base year before using it in the regression.

Appendix B: Robustness test

In the main model, I have cut the data before the Asian Financial Crisis because the results from several studies have stated that there is structural change after the crisis. The threshold-Structural VAR model that include the data from the pre-crisis period has shown that the finding is robust.

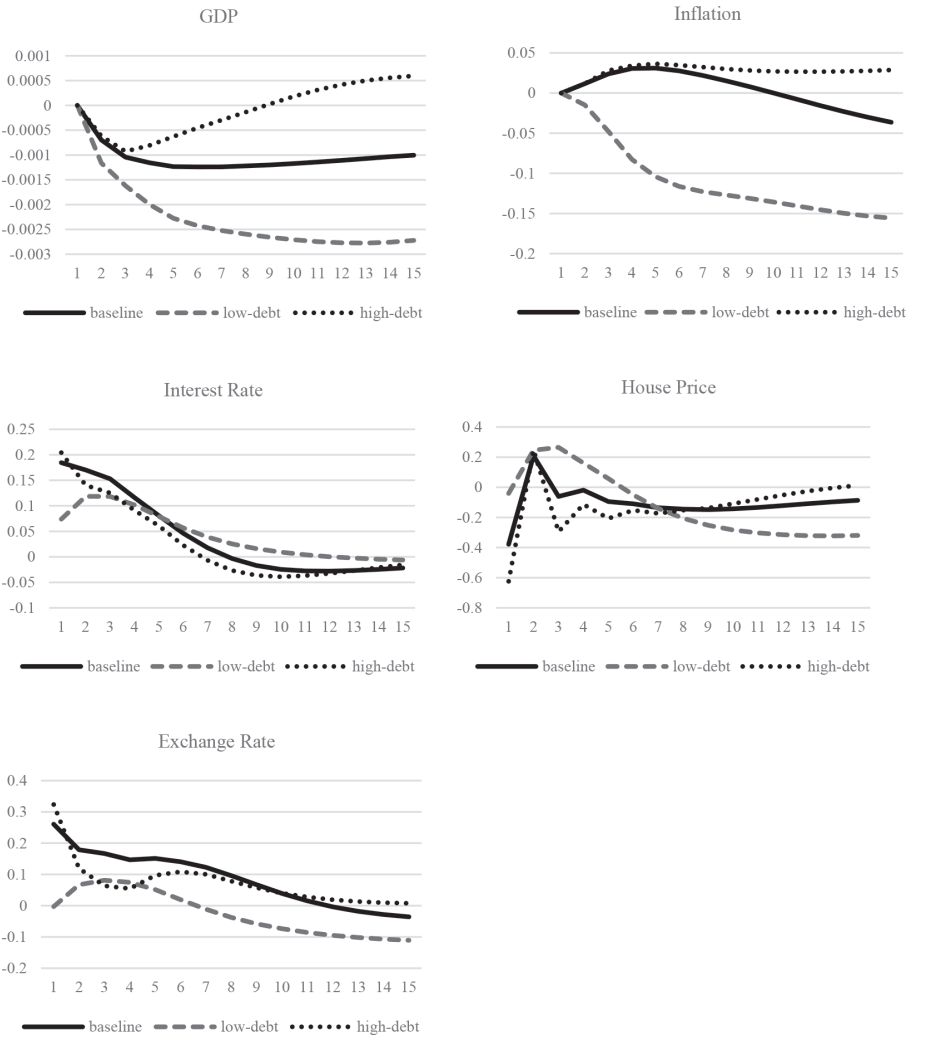
Figure 6: Impulse Responses to Monetary Policy Shock, Data before the Crisis Included



Appendix C: Full results

Basic Model

Figure 7: Full Impulse Responses to Monetary Policy Shock, Basic Model



Consumption Model

Figure 8: Full Impulse Responses to Monetary Policy Shock, Consumption Model