An Investigation of the Asymmetric Impacts of the Thai Monetary Policy on the Real Estate Market

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ABSTRACT

This paper's objective is to investigate how monetary policy changes impact the housing loans and residential housing markets. To estimate the impulse response functions, the quarterly seasonally-adjusted times-series data during Q1/2000-Q2/2023 are utilized in both VAR and MS-VAR frameworks to explore whether the Thai housing loans and real estate markets have a unique reaction to the changes in monetary policy instruments or not. The two housing market variables, namely housing loans and house prices, the interest rate charged on housing loan contracts, as well as the Bank of Thailand's policy rate, are included in the model as endogenous variables, while other three variables, namely the economic growth rate, headline inflation rate, and money supply growth rate, are also incorporated into the model as exogeneous variables. The empirical results from the MS-VAR model help clarify that there exist two different and independent states for the Thai housing market, resulting in asymmetric effects of monetary policy that are transmitted to the housing market. In addition, the monetary policy shock becomes significant and noticeable during the low-volatility period. Due to the existence of the nonlinear relationship among housing variables and the monetary policy instrument, the monetary authority should be cognizant of the negative impact of tightening monetary policy on the housing market. Furthermore, the traditional monetary policy instrument, the policy interest rate, may not be the most effective instruments for containing the overheated scenario in the housing and real estate markets.

Keywords: Monetary Policy, Policy Rate, Housing Loans, Residential Housing Markets

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Background and Significance of the Research Problem

The housing market is an important sector of many countries, including Thailand. Although the Thai real estate activities accounted for 2.5% of the nominal gross domestic product (Nominal GDP) during 2012–2022 on average, residential mortgage debt represented approximately 27.0% of the nominal GDP in the second quarter of 2023, which was above the level seen before the 1997 crisis. Meanwhile, data retrieved from the 2021 Household Socio-Economic Survey from the National Statistical Office of Thailand showed that one significant portion of a household's financial sheet was made up of housing assets. The household’s value of houses, land and buildings for living accounted for 62.7% of the overall household assets. As for the financial sector, loans to households for real estate purchases accounted for 33.7% of total household debts in the second quarter of 2023, increasing from 29.0% in 2012. Housing loans are also a key retail loan product of both commercial banks and special financial institutions, accounting for 17.6% and 31.0% of their total loans in the second quarter of 2023, respectively. Subhanij (2009) stated that for Thai households, the high proportion of real estate in their asset and liability portfolios could lead to the case that the Thai households would likely be particularly exposed to real estate price volatility.

Theoretically, Ando and Modigliani (1963, 1964) allow the wealth effect to play a central role in the life-cycle theory of consumption. Consumption spending is determined by the consumer’s lifetime resource, in which the financial wealth includes common stocks, real estate and other assets. Therefore, the expansionary monetary policy could raise asset prices and the consumer’s lifetime resource, thereby supporting consumption and the overall economy, respectively. The housing and land price channel are included in the asset price channel, together with the exchange rate, and equity price channels in Mishkin (1996). As for the credit channel, the monetary policy could affect the adjustment of the external finance premium in the credit markets through two possible channels, namely the balance sheet channel and bank lending channel. For the balance sheet channel, Bernanke and Gertler (1989) highlighted an important role of agency costs in a frictional credit market. The policy-induced increase in interest rate can have a negative impact on asset prices and collateral values that borrowers use when apply for bank loans, thus raising the external finance premium which is the gap between borrower’s cost of funds raised externally and funds formed internally. Therefore, the higher cost of the external finance magnifies the consequences on household consumption and business investment. Meanwhile, the bank lending channel focuses on the lending activities of financial intermediaries when the central bank changes its monetary policy. Bernanke and Blinder (1988a, 1988b) allowed roles for both money and bank loans in the extended IS-LM models. Banks, confronting asymmetric information problems, play a more vital role in the economy, since they not only raise deposits as their liabilities, but also originate loans as their assets. Therefore, the monetary contraction will lead to a reduction of the volume of bank reserves, limiting the availability of bank loans that are principal sources of external funds for firms and households. Consequently, a decrease in bank loan supply will put more pressure on the aggregate spending.

As for the financial stability perspective, there are different views on whether the monetary policy should respond to asset prices or not. Bernanke and Gertler (2000) suggested that the underlying inflationary pressures should be a major focus for the central bank, while the inclusion of asset prices into the policy rule may lead to undesirable side effects. The asset price movement may be meaningful only if they can signal potential inflationary or deflationary pressures. Meanwhile, Iacoviello (2005) stated that even if asset prices' current movements are included in the policymaker's knowledge set, responding to them will not help the central bank minimize the output and inflation fluctuations. However, the study for Indonesia of Santoso and Sukada (2009) suggested that because the household sector can act as a surplus sector when allocating their funds and a deficit sector when receiving funds from other sectors to finance consumption and investment spending, monetary policy affects households and, in turn, monetary policy affects households via several transmission channels, including the interest rate channel, bank-lending channel, exchange rate channel and wealth channel. On the contrary, for Thailand, Subhanij (2009) stated that even though the Bank of Thailand (BOT) does not explicitly consider the movements of household debt or house price when deciding on short-term interest rates, it recognizes that changes in the policy rate can have a significant impact on home prices, household borrowing, and total consumption. Under the flexible inflation targeting framework that the BOT has implemented since May 23, 2000, the Monetary Policy Board (MPB) is appointed and has authority to decide the direction of monetary policy by adjusting the policy rate, which currently is the 1-day bilateral repurchase rate. To tackle with the economic downturn, lowering policy rate could help support the overall economic activities, including the demand for housing. Conversely, the policy rate would be raised when the economy was challenged by high inflationary pressure.

For the empirical studies, the behavior of house prices can affect both business cycle dynamics and the financial system performance (Tsatsaronis & Zhu, 2004). After the global economy entered into a severe recession, triggered by the US subprime crisis in 2007-2008, there are many studies exploring the relationship between the housing or real estate markets and economic variables. Goodhart and Hofmann (2008) used a fixed-effect panel VAR model with dummy capturing the boom-bust phase of the house price cycle for seventeen industrialized countries to assess the linkages among variables, including real output, consumer prices, short-term interest rate, house price, broad money and bank credit. The results indicated that the interest rate shock has a significant effect on house prices, money and credit, while, due to the effects of financial system liberalizations resulting in strong linkages between house prices and monetary variables during 1985-2006, the shock to monetary and credit variables has apparently had significant impacts on housing prices.

Vargas-Silva (2008) explored the impact of monetary policy shocks on the US housing market, using a VAR with imposing sign restriction, and found that the contractionary monetary policy shocks have a negative impact on the US housing starts and residential investment. Gupta et al. (2010); Gupta and Kabundi (2010) used a large information set and a factor-augmented vector autoregression (FAVAR) to investigate the response of the real house price growth to monetary policy shock in South Africa and the nine census divisions of the US economy, finding that the positive monetary policy shock has a negative impact on house price inflation.

By employing the VAR models, using ten OECD countries, Demary (2010) found a crucial role of the housing sector on the economy, while the positive shock of interest rate put pressure on real house prices. Additionally, the paper indicated that although the output movements are major drivers for the house prices in many countries, the positive shock of the housing market has a stronger impact on macroeconomic variables than the case of the positive shock of macroeconomic variables affect the housing market. Meanwhile, Iacoviello and Neri (2010) explore the interactions between the housing market and the overall economy by estimating a dynamic stochastic general equilibrium (DSGE) model of the US economy, arguing that there is a spillover from housing wealth to the non-housing consumption while the monetary factors can drive the cyclical volatility of both housing investment and prices. Recently, Tunc and Gunes (2022) used panel structural VAR model to study the interaction between monetary policy instrument and house prices and found that the impulse responses, both in the panel setting and in the country-specific setting for seven emerging-market nations, point to a negative response of housing prices to a contractionary monetary policy shock. The size of the effect is, however, rather small for the cases of emerging-market economies as compared to equivalent reactions in industrialized nations. Similarly, the responses of monetary policy to the positive shock of house prices remained weak in the cases of emerging-market countries compared with the cases of advanced countries.

As for the nonlinear behavior, there have been more studies using non-linear models after Bemanke and Gertler (1989), and Kiyotaki and Moore (1997) exhibit the roles of agent cost in their models. They highlighted the role of asymmetric information that can influence agency cost of financial intermediaries, or underpin the effect of financial constraints becoming more binding in the downturn economic cycle. Simo-Kengne et al. (2013) utilized the MS-VAR models to investigate the relationship between 3-month Treasury bill rate, used as proxy for the policy rate, and house prices of the middle segment in South Africa, and found that there were asymmetric impacts of monetary policy on house prices. The negative impact on house prices becomes larger in bear regime, when compared to that of the bull regime. This is consistent with theoretical models of Bemanke and Gertler (1989) and Kiyotaki and Moore (1997), suggesting that the financial constraints are reinforced by the role of information asymmetry during the bear regime. For the UK housing market, the studies of Chowdhuri and Maclennan (2014a) and Chowdhuri and Maclennan (2014b) used the MS-VAR models to explore the role of the bank lending channel in the monetary transmission mechanism. They found that monetary policy shock with the same magnitude can have unequal impacts on the housing market, due to a state-dependent bank lending channel. With the TVP-VAR model, Simo-Kengne et al. (2016) studied the response of the US housing and stock returns to the interest rate shock, and found that there were larger effects on both housing and stock returns during the low-volatility regime than those of the high-volatility regime. Plakandaras et al. (2020) employed the Time-varying VAR models with over 150 years of data to study the effect of macroeconomic shocks, including the interest rate shock, on the house prices in the US and UK, and concluded that the monetary policy shock has a negative impact on the housing sector in the UK, more obviously than is the case in the US, where other shocks such as the technology shock are much more important. Beirne et al. (2023) examined the role of non-bank sector, including non-bank finance, as well as fintech and big tech credit players in seven Asian economies, using data from 2006Q1 to 2019Q4 with a panel structural vector auto regressive (PSVAR) model. The results demonstrated that instead of replacing the traditional banking sector, the non-bank sector acts as a complement to fill the funding gaps of the private sector in emerging economies. In addition, monetary policies, conducted by the central banks, had a significant role on the non-bank sector, affirming the counter-cyclicality of monetary policy. The response of credits originated by non-bank players to the tightening monetary policy shock is statistically and negatively significant, while the impacts were rather persistent. However, for the determinants of fintech and big tech credits, there was a puzzle due to some friction, as the interest rate had no significant effect on fintech and big tech credits. Meanwhile, the response of credits originated by fintech and big tech players to the tightening monetary policy shock became significant with some delay.

For the studies in Thailand, home financing is a vital factor in setting the housing prices since financial institutions have played a role in supporting both pre-financing and post-financing for housing developers and home buyers, respectively. Therefore, the housing market variable has been incorporated into the model to help exploring the relationship between it and the monetary policy instruments as well as other economic variables. Moenjak et al. (2004) studied an issue on monetary policy and financial stability. In the paper, they examined the inter-relationships among five economic variables, including the real output, consumer price index, policy rate, private credits, equity price and house prices, by using VAR model that was adopted from the model of Disyatat and Vongsinsirikul (2003). The condominium prices are used to be a proxy for the house prices, and the results suggested that condominium prices react to an increase in policy interest rates more significantly than stock prices, and the negative effect on condominium prices appears to continue longer than that of equity prices.

Sriphayak and Vongsinsirikul (2007) used the BOTMM and cross-correlation analysis to study the Thailand's monetary policy transmission via the asset price channel. From the BOTMM, an increase in the monetary policy rate affects both physical wealth (property wealth) and financial wealth (equity wealth), and in turn, consumption. However, the negative impacts found via equity wealth are larger than those found via physical wealth. The study also found the existence of the asset price channel, though it was weaker than other channels. The results from the cross-correlation analysis found that, due to the strong housing demand and demographic factors during 1999–2002, the puzzle was found since there was a gradual increase in house prices along with a moderate policy rate hike. Subhanij (2009) examined how monetary policy and the movement of house price relate to the output fluctuations. The results showed that the policy rate hike negatively affects the house price and housing loans, as well as consumption and real output. In addition, the mortgage rate movement coincides with the short-term interest rate. Therefore, a lower short-term rate will cause a lower interest rate for housing loans, boost demand for housing, and lead to higher housing prices.

Recently, Chamornchan (2019) employed the Threshold-Structural Vector Autoregression to study the effectiveness of the monetary policy in two different situations: high and low debt levels. The house prices are incorporated into the model, while the results for the impulse response of the house prices to the interest rate shock suggested that the interest rate hike can cause a decrease in house prices in the long run only in a regime of low household debt. In the country-specific studies, Tunc and Gunes (2022) used the SVAR models to explore the two-way interplay between monetary policy and property prices in each emerging-market countries, including Thailand. The study found that house prices react negatively to the tightening monetary policy shock; however, there was a puzzle in the response of the Thai monetary policy to the positive shock of real house prices since the policy rate initially declined before turning out to be positive later. Nguyen and Le (2023) also selected five emerging-market countries, including Thailand, to study impacts of monetary policy on housing prices during the COVID-19 pandemic. Instead of extrapolating into distant periods from a specified model, the monthly panel data set of the selected countries from January 2020 to July 2021 was used in estimating the local projections for each period. The results demonstrated that the unconventional monetary policy had a positively significant impact on housing prices; however, those impacts faded later, after one month. On the other hand, the traditional or conventional monetary policy strategy of cutting policy rates had a lesser magnitude but a long-lasting influence on housing prices. In contrast to the previous studies using house prices, Sethapramote and Thepmongkol (2022) developed the Thailand's Real Estate Bubble Index (RBI) and incorporated it into the BVAR models to assess the response of the RBI to macroeconomic variables. The results indicated that private consumption, investment and the minimum loan rate have impacts on the RBI, but the policy rate as well as the LTV measures have limited impacts on reining in the bubble.

Most recent studies that employed linear models suggested that contractionary monetary policies could lead to a decline in housing prices, while those using non-linear techniques contributed further findings that the negative relationship between monetary policy and house prices could be greater in low-volatility environments. Due to the global interest rates, including Thai policy rates, returning to an uptrend to thwart inflationary pressures in the post-COVID era, this paper therefore reinvestigates the response of housing market to monetary policy. The main contribution of this paper is to use the non-linear technique to show that the impacts of monetary policy on the real estate market become different during high- and low-volatility periods. To estimate the impulse response functions, both standard VAR and MS-VAR frameworks are used, and two housing market variables, namely housing loans and house prices, as well as other economic variables and the 1-day repurchase rate are included in the models. Instead of the structural VAR model, the standard VAR model was deployed in this paper in order to compare the results received from the MS-VAR model, which can capture regime-dependent VAR results where different reactions of the Thai housing market variable to the changes in monetary policy rate under different and independent regimes.

The structure of this paper is organized as follows: objective of the study, scope of research that describes data used in the empirical works, research methodology that the VAR and MS-VAR frameworks are explained. Later, the empirical results are presented, followed by the conclusion and policy implications of the study.

Research Objectives

1. To use the non-linear technique, which is the Markov Switching VAR Model (MS-VAR), to contribute to understanding how the Thai monetary policy instruments affect the housing markets

2. To revisit an issue on the effect of monetary policy on housing market by using the MS-VAR model in order to explore whether there is an asymmetric response of housing variables to the monetary policy shock.

Scope of Research

Quarterly seasonally adjusted data for economic variables is utilized in terms of percentage growth rate, except for the minimum retail rate and the 1-day repurchase rate (the Thai policy interest rate), which are expressed as a change in level compared to the prior quarter. For the VAR and MS-VAR models, the vector of endogenous variables includes four economic variables, namely housing loans, nominal house price, minimum retail rate, and the 1-day repurchase rate, in order to examine the relationship between monetary policy and housing market activities. Due to the limitation of the estimating process for all variables as endogenous variables, three variables are incorporated into the model, acting as exogenous variables to control the economic environment. Those are the real output, the consumer price index, and the broad money which covers narrow money and quasi-money and represent the aggregate liquidity held by money holders in the system.

Almost all time-series data, including the 1-day repurchase rate, minimum retail rate, broad money data, and housing loans, are gathered from the website of the Bank of Thailand, except the nominal house price index, the real output and consumer price index. In details, the nominal house price index is collected from the Bank for International Settlements (BIS) website. Meanwhile, the real output data is the gross domestic product chain volume measures, obtained from the website of the Office of the National Economic and Social Development Council (NESDC). For the consumer price index, headline CPI is selected and retrieved form the website of the Ministry of Commerce's Trade Policy and Strategy Office (TPSO). The sample period for both models covers from the first quarter of 2000 to the second quarter of 2023 (Q1/2000 to Q2/2023).

As for details of housing loan statistics, this study uses the series of housing loans for personal consumption extended by all financial institutions, including commercial banks, depository specialized finance institutions, insurance corporations, finance companies and credit foncier companies. According to the Bank of Thailand, this housing loan series consists of loans for land holding, land for housing construction, and housing loans for personal consumption.

Research Methodology

The Vector Autoregressive (VAR) model

The VAR model, pioneered by Sims (1980), is a dynamic multivariate model that is n numbers of equations and n numbers of linear models. The VAR model treats a set of variables simultaneously and equally. Under the VAR framework, the dependent variables at the current state are explained by their own lagged variables, as well as the lags of other variables in a finite-order system. Therefore, the VAR model has grown in favor in the transmission mechanism literature as a convenient approach of expressing dynamic interactions between variables. The VAR representation is written in the form of matrix as follows.

$$\mathrm{Y_t = A(L)\,Y_{t-1} + B(L)\,Z_t + \varepsilon_t} \qquad (1)$$

where $\mathbf{Y_t}$ indicates a (n x 1) vector of endogenous variables, and n is the number of endogenous variables. $\mathbf{Z_t}$ indicates a (m x 1) vector of exogenous variables, and m is the number of exogenous variables. $\boldsymbol{\varepsilon_t}$ or the error term is a vector of serially uncorrelated disturbances with a zero mean and a time invariant covariance matrix. $\mathbf{A}$ is the estimated coefficient matrices for endogenous variables. $\mathbf{B}$ is the estimated coefficient matrices for exogenous variables. $\mathbf{L}$ is the lag operator. Meanwhile, the equation (1) can be rewritten to be a VAR in reduced form, including exogeneous variables, where a is a vector of constant terms, $\mathrm{A_n}$ indicates the coefficient matrices corresponding to the lag of the endogenous variables $(n = 1, \ldots, k)$, B_h represents the coefficient matrices associated with the exogenous variables $(h = 0, \ldots, r)$, and u_t is a vector for the estimation errors, as follows.

$$Y_t = a + A_1 Y_{t-1} + \cdots + A_k Y_{t-k} + B_0 X_t + \cdots B_r X_{t-r} + u_t$$

Markov-Switching Vector Autoregressive Model (MS-VAR model)

In addition to the standard VAR analysis, this study employs the Markov Switching vector autoregressive (MS-VAR) framework to examine whether there are any monetary transmission asymmetries under discretely different regimes. The Markov switching process was initially introduced into the regression model in Goldfeld and Quandt (1973). Later, Hamilton (1989, 1990) and Krolzig (1997, 1998) extended to make substantial contributions by integrating switching models into the vector autoregression, and in turn, a Markov Switching VAR was developed.

According to Hamilton (1989), the Markov Switching Autoregressive model of two states or regimes with an AR process of order p is written as below:

$$y_t = \mu(s_t) + \left[\sum_{i=1}^{p} \alpha_i \left(y_{t-i} - \mu\left(s_{t-i}\right)\right)\right] + u_t \quad (2)$$

$$u_t | s_t \sim \text{NID}\,(0, \sigma^2) \quad \text{and} \quad s_t = 1, 2$$

Given α_i being the autoregressive parameters with $i = 1, 2, \ldots, p$, y_t, thus, is a time series that is normally distributed with μ in each of two possible states. From equation (2), the MS-VAR model with M regimes where the mean and variance are allowed to simultaneously alter across regimes can be expressed as the mean-adjusted MS-VAR process of order p and is shown in equation (3) as below.

$$Y_t - \vartheta(s_t) = A_1(s_t)\left(Y_{t-1} - \vartheta(s_{t-1})\right) + \cdots + A_p(s_t)\left(Y_{t-p} - \vartheta\left(s_{t-p}\right)\right) + \varepsilon_t \quad (3)$$

where Y_t represents the n dimensional time series vector [or Y_t = $(Y_{1t}, \ldots, Y_{nt})$] and a change in the behavior of Y_t from one regime to another is triggered by a random variable s_t. ϑ represents the vector of means that can change depending on the regime. $A_1, \ldots, A_p$ are the matrices storing the autoregressive parameters that can change depending on the regime.

$$\varepsilon_t | s_t \sim \text{NID}(0, \Sigma(s_t))$$

According to Krolzig (1997), the intercept form of MS-VAR model which differs from the mean-adjusted form of MS-VAR model is shown in equation (4) as below.

$$Y_t = \gamma(s_t) + A_1(s_t) Y_{t-1} + \cdots + A_p(s_t) Y_{t-p} + \varepsilon_t \quad (4)$$

where $\gamma(s_t) = \vartheta(s_t)(I - \sum_{j=1}^{p} A_j(s_t))$

Therefore, the dynamic reactions of dependent variables to a regime shift in the equation (3) and equation (4) are different. The equation (3) indicates a sudden adjustment of dependent variables to a new level, while the equation (4) allows a smooth and dynamic change of the intercept, caused by a regime shift. In general, all parameters in MS-VAR specifications are regime-dependent. A common notation for expressing the models in which numerous parameters are subject to shifts with the changing state is established in Krolzig (1997). M denotes for Markov-switching mean. I denotes for Markov-switching intercept term, A denotes for Markov-switching autoregressive parameters, and H denotes for Markov-switching heteroskedasticity.

For all MS-VAR specification, s_t is the unobservable regime, following a first-order Markov process, which is determined by the transition probabilities in equation (5) as follows.

$$\mathrm{p_{ij}} = \Pr[\mathrm{s_t} = \mathrm{j} |\ \mathrm{s_{t-1}} = \mathrm{i}] \quad (5)$$

According to equation (5), p_{ij} represent the transition probability from one regime (regime i) to another (regime j). Therefore, if m regimes are considered, the (mxm) transition matrix, containing all transition probabilities, can be written as P in equation (6).

$$P = \begin{bmatrix} p_{11} & p_{12} & \cdots & p_{1m} \\ p_{21} & p_{22} & \cdots & p_{2m} \\ \cdots & \cdots & \cdots & \cdots \\ p_{m1} & p_{m2} & \cdots & p_{mm} \end{bmatrix} \quad (6)$$

Where $\mathrm{i} = 1,2, \ldots \mathrm{m}$, $\sum_{\mathrm{j}=1}^{\mathrm{m}} \mathrm{p_{ij}} = 1$ and $0 \leq \mathrm{p_{ij}} \leq 1$.

The transition probabilities also offer the expected duration, which is the amount of time that the system is expected to remain in a certain regime. If D is denoted as the duration of regime j, the expected duration of the regime j or $\mathrm{E(D)}$ is calculated as follows.

$$\mathrm{E(D)} = \frac{1}{1-\mathrm{p_{ij}}} \quad \text{with j = 1,2,...} \quad (7)$$

To estimate the MS-VAR model, the estimation technique, which is called as the Expectation Maximization (EM) algorithm, is implemented. For the probabilistic models, that rely on unobserved latent variables, the EM algorithm is used to find maximum likelihood estimates of parameters. Under this EM algorithm technique, two steps, namely the expectation step (E) and the maximization step (M), are iteratively computed until parameter estimates converge. The expectation step is initially conducted to deliver an estimate of the smoothed probabilities of the unobserved regime variable or $\mathrm{s_t}$. Meanwhile, in the maximization step, it maximizes the expected likelihood obtained from the expectation step to calculate the maximum likelihood estimates of the parameters (Krolzig,1997).

The possibility of regime-dependent Impulse Response Functions (IRFs), is one of the main draws of the MS-VAR model. For the standard VAR model, the Impulse Response Functions express how endogenous variables in the system response to a shock of fundamental disturbances. However, for the MS-VAR model, the regime-dependent IRFs are estimated, while the dynamic relationships among the endogenous variables as well as fundamental disturbances can be described for each Markov-switching regime. The regime-dependent IRFs are conditional and depend on a specific regime prevailing at the moment of the disturbance and throughout the duration of the response.

Results

Before the estimation process, the results of the unit root tests are showed in Table 1, while the overview for descriptive statistics of variables is detailed in Table 2. As for the stationary tests, the results derived from the ADF and Phillips-Perron tests for all variables suggest that all economic variables, except housing loans, contain the unit root. However, the null hypothesis for testing all variables in the form of the first differencing series can be rejected, all selected series are stationary at their first difference.

This section preliminarily shows the effects of the monetary policy tightening on the housing market, represented by housing loans and a proxy for the house prices, by utilizing a standard VAR model. Later, a MS-VAR model is estimated to capture the nonlinearities in the relationships among variables. The VAR and MS-VAR frameworks are estimated using quarterly seasonally-adjusted data in the form of over-quarter percentage growth to help depict the dynamic responses of economic and housing activities to the shock of the policy interest rate. The vector of endogenous variables includes housing loans, the nominal house price, the minimum retail rate, and the 1-day repurchase rate, while the vector of exogenous variables includes real output, the consumer price index, and broad money.

Table 1 The Results of the Unit Root Tests (with constant and trend)

	ADF Statistic				Phillips-Perron			
	Level		First Difference		Level		First Difference	
HPRICE	-0.710		-15.707	***	-1.068		-15.795	***
HLOAN	-3.869	**	-5.763	***	-3.630	**	-6.007	***
MRR	-1.918		-4.090	***	-1.875		-5.594	***
REPO	-3.089		-5.491	***	-2.551		-5.536	***
GDP	-2.471		-12.731	***	-2.471		-12.734	***
CPI	-1.885		-7.641	***	-1.297		-7.343	***
BROADM	-0.986		-3.410	*	-0.373		-7.925	***

Notes: *, **, and *** indicate significance at 10%, 5% and 1%, respectively. The lag length for the tests is based on Akaike Information Criteria (AIC)

Source: Authors' Study

Table 2 Descriptive Statistics of Variables

	RHPRICE	RHLOAN	DMRR	DREPO	RGDP	RCPI	RBROADM
Mean	0.87	2.16	-0.02	0.00	0.81	0.51	1.58
Maximum	5.08	9.21	0.88	1.00	9.38	2.91	4.59
Minimum	-7.43	-3.33	-0.64	-1.25	-9.23	-3.11	-2.00
Std. Dev.	1.64	1.91	0.24	0.34	2.04	0.83	1.08
Skewness	-1.51	0.14	0.41	-0.43	-0.80	-0.66	0.59
Kurtosis	9.34	5.12	5.51	6.05	12.81	8.20	4.60
Jarque-Bera	189.01	17.60	26.83	38.37	378.73	110.48	15.19
Probability	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Observations	92	92	92	92	92	92	92

Source: Authors' Study

As for the lag duration, the standard information criteria, including the Sequential Modified Likelihood Ratio (LR), the Final Prediction Error (FPE), the Akaike Information Criterion (AIC), the Schwarz Information Criterion (SIC), and the Hannan-Quinn Information Criterion (HQ) are used to determine the optimal lag length. All information criteria, except the SIC concurrently suggest that the optimal lag terms should be one. Therefore, this study selects the lag length of one to become the optimal lag length for the VAR and MS-VAR models.

The Result of the VAR model

The estimated impulse responses of the housing loans and house prices to one standard deviation of the monetary policy shock are displayed in Figure 1. As for the responses of the activities in the housing market, the unanticipated policy rate hike only has an adverse impact on housing loans and house prices. Housing loans originated by all financial institutions drops and reaches its bottom in the second quarter. It appears that the negative response to housing loans tends to persist for two years after the interest rate shock. Meanwhile, housing prices also reaches its bottom in the second quarter in the aftermath of the interest rate shock. However, the puzzles are found in the reactions of housing loans and house prices to the shock of the minimum retail rate. Following the minimum retail rate shock, both housing loans and house prices continues to grow for two quarters before returning to the baseline in the seven quarter. To summarize from the standard VAR framework, the tightening monetary policy stance tends to result in an adjustment of the lending activities of the financial institutions, while the change in minimum retail rate cannot directly have a negative impact on housing loans and house prices. However, a question arises: Will these effects on economic and housing market variables differ or alter when the economic cycle changes?

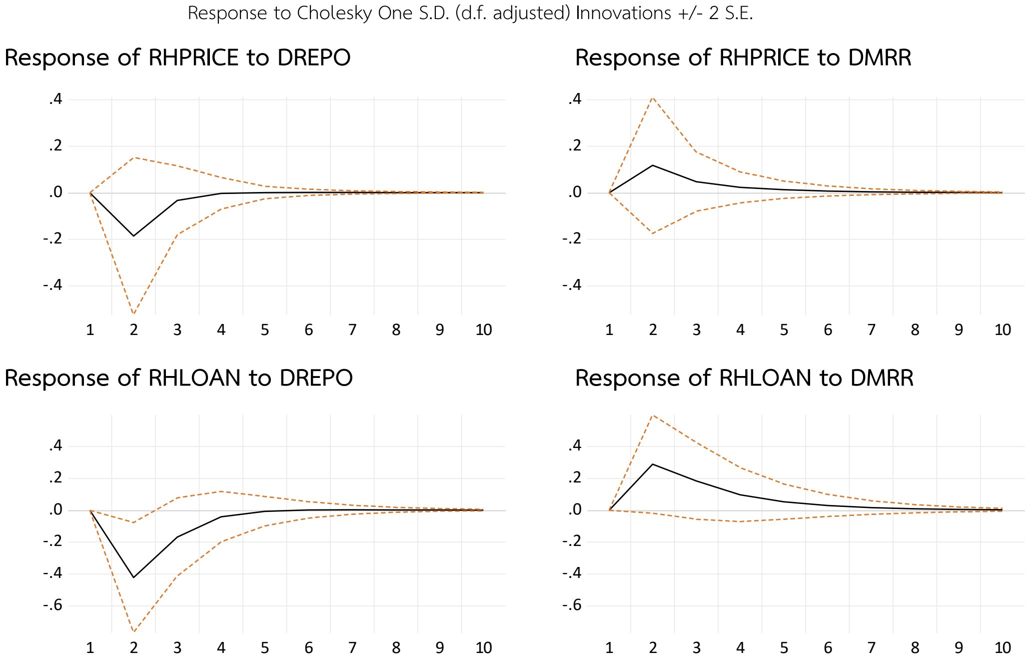

Figure 1 The Impulse Response to Interest Rate Shock Innovations (VAR model)

Source: Authors' Study

The Results of the MS-VAR model

This study employs a two-regime MSAH-VAR model which allow changes in parameters of autoregressive and the variance-covariance matrix (Krolzig, 1998). Two regimes represent the high-volatility and low-volatility periods of housing market activities. The result of the MS-VAR estimation is presented in Table 3. Overall results support the existence of two independent and different regimes. The coefficients between the two regimes are markedly different. The coefficient of SE-RHLOAN and SE-RHPRICE in the regime 1 are higher than those of the regime 2. Therefore, this study considers the regime 1 and regime 2 as the volatile regime (high-volatility period) and normal regime (low-volatility period), respectively.

The matrix of transition probabilities indicates that the probability of staying in regime 1 in both the previous and present quarters is relatively high when compared with other elements of the transition probability matrix. The regime 1 is highly persistent with a corresponding probability of 70.5%. Contrarily, the transition probability of remaining in regime 2 is 59.9%, indicating that the regime 2 is less persistent than the regime 1. As for the transition probability of regime switching, there is a probability of 29.5% for switching from regime 1 to regime 2, while a probability for switching from regime 2 to regime 1 is 40.1%. Therefore, there is a higher chance that the housing market activities will flip into regime 1 in the current period if they were in regime 2 in the prior period. For the case of Thailand, the housing market is likely to be in the regime 1 rather than the regime 2 during the sample period of Q1/2000- Q2/2023.

Table 3 The Results of the MS-VAR Model

Regime 1	RHPRICE		RHLOAN		DMRR		DREPO	
RHPRICE(-1)	-0.199	[-1.347]	-0.067	[-0.429]	-0.024	[-1.618]	0.042	[1.981]
RHLOAN(-1)	0.056	[0.544]	0.512	[4.785]	0.007	[0.675]	0.005	[0.348]
DMRR(-1)	0.640	[0.445]	3.640	[2.374]	0.097	[0.660]	-0.107	[-0.515]
DREPO(-1)	0.272	[0.222]	-2.541	[-1.954]	0.601	[4.828]	0.869	[4.949]
SE-RHPRICE	3.704	[5.029]	0.327	[0.588]	0.029	[0.542]	0.039	[0.513]
SE-RHLOAN	0.327	[0.588]	4.230	[5.005]	-0.056	[-0.979]	-0.065	[-0.811]
SE-DMRR	0.029	[0.542]	-0.056	[-0.979]	0.038	[5.010]	0.023	[2.790]
SE-DREPO	0.039	[0.513]	-0.065	[-0.811]	0.023	[2.790]	0.077	[4.959]
Regime 2	RHPRICE		RHLOAN		DMRR		DREPO	
RHPRICE(-1)	0.386	[4.681]	0.135	[1.811]	-0.007	[-0.882]	-0.031	[-2.505]
RHLOAN(-1)	-0.063	[-0.752]	0.270	[3.569]	0.015	[1.857]	-0.011	[-0.857]
DMRR(-1)	0.637	[0.669]	0.668	[0.837]	0.185	[1.910]	0.532	[3.779]
DREPO(-1)	-1.410	[-2.959]	-0.909	[-2.220]	0.004	[0.091]	-0.106	[-1.479]
SE-RHPRICE	0.422	[3.927]	0.135	[2.078]	0.000	[0.039]	-0.016	[-1.275]
SE-RHLOAN	0.135	[2.078]	0.313	[4.215]	0.022	[3.016]	0.033	[3.071]
SE-DMRR	0.000	[0.039]	0.022	[3.016]	0.005	[4.248]	0.005	[3.638]
SE-DREPO	-0.016	[-1.275]	0.033	[3.071]	0.005	[3.638]	0.010	[4.088]
Common								
C	0.532	[2.125]	0.704	[3.318]	-0.033	[-1.339]	-0.023	[-0.636]
RGDP_SA	-0.013	[-0.184]	0.118	[1.997]	0.002	[0.254]	0.036	[3.561]
RCPI_SA	0.068	[0.476]	-0.107	[-0.879]	0.076	[5.160]	0.090	[4.236]
RBROADM_SA	0.167	[1.666]	0.327	[3.805]	-0.025	[-2.478]	-0.040	[-2.808]
Transition Probabilities								
	Regime 1		**Regime 2**					
Regime 1	0.7051 (P_{11})		0.2948 (P_{12})					
Regime 2	0.4009 (P_{21})		0.5990 (P_{22})					

Notes: Numbers in square brackets are z-statistics.

Source: Authors' Study

The Markov Switching smoothed regime probabilities of regime 1 and regime 2 are demonstrated in Figure 2. The regime 2 prevails from 2011 onwards since there were many factors that put pressure on the real estate market. The real estate activities decreased, following the 2011 flood disaster. In 2010, the Bank of Thailand warned against the excessive risk-taking behavior in some segments of the residential market, condominium projects in particular, while the financial institutions tend to provide housing loans with loan-to-value ratios (LTV) exceeding 90% of the collateral value, due to increased competition in loan extension among financial institutions. Therefore, the Bank of Thailand started to impose preventive macro prudential measures, by launching supervision measures for housing loans extended by commercial banks. The measures, effective in 2013, did not prevent commercial banks from granting loans with a high LTV ratio, but they did require financial institutions to plan for and manage their capital funds to be in compliance with the rules related to risk-weight (RW) variable. Loans with a high LTV ratio would be subject to a higher risk-weight variable, which implies a higher funding cost for those loans. The Bank of Thailand adjusted their LTV measures in 2019 by imposing ceilings on some mortgage contracts, especially second and subsequent mortgage contracts or residential units with values exceeding 10 million baht. The rising household debts put more pressure on purchasing power, while the economy has been hit most recently by the economic crisis caused by the COVID-19 pandemic and later struggled to recover due to the Russia-Ukraine tension in 2022. In addition, the tightening monetary policy cycle of the Bank of Thailand covered the period from late-2022 to mid-2023.

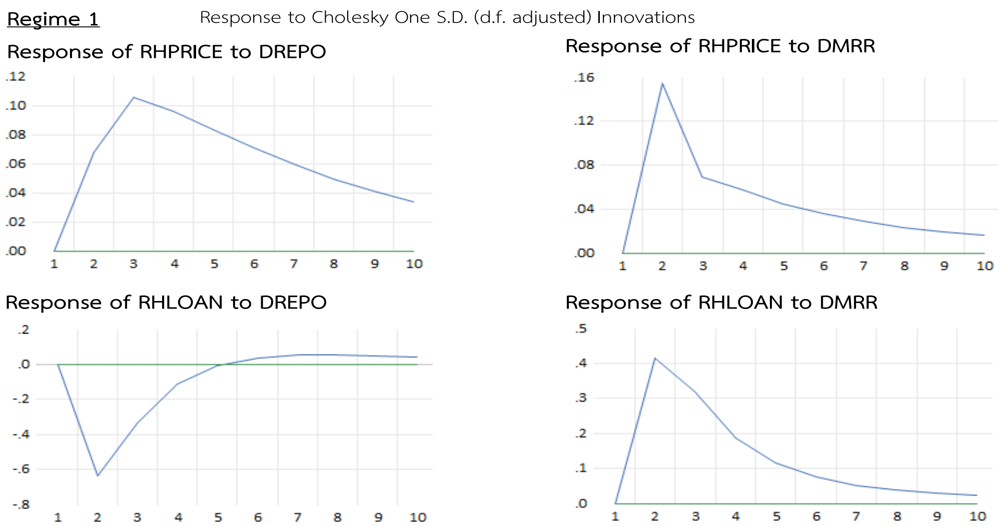

Figure 3 Impulse Response of Regime 1

Source: Authors' Study

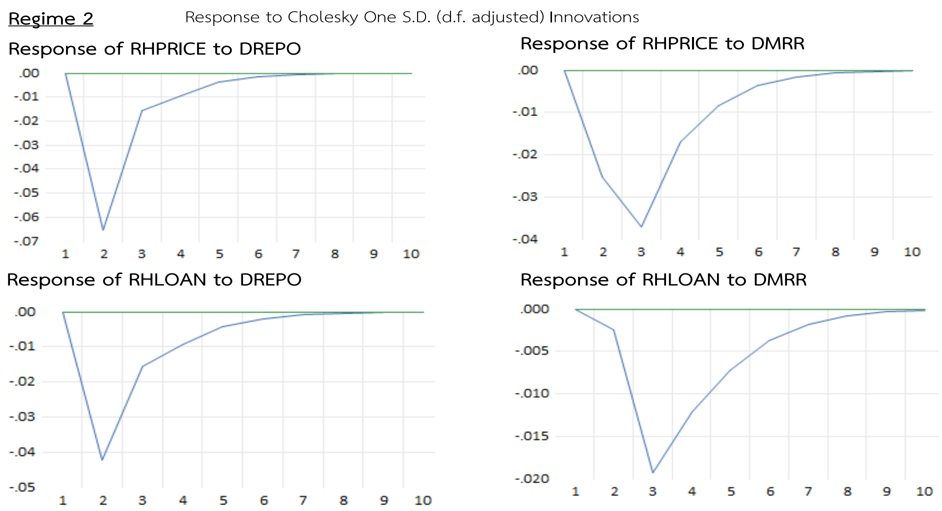

Figure 4 Impulse Response of Regime 2

Source: Authors' Study

To examine the asymmetric response of housing market activities to the monetary policy shocks, the regime-dependent impulse response functions are estimated and shown in Figure 3 and Figure 4. The responses of housing activities to the policy rate innovations are mixed in regime 1. Housing loans decrease four quarters in a row, and the adverse impact later dissipates. However, there is evidence of puzzlement over the house prices because house prices continue to rise for three quarters following the shock of the policy rate hike. Also, housing loans and house prices rose in response to the minimum retail rate shock. Considering regime 2, the positive policy rate and minimum retail rate shocks have adverse impacts on housing variables, including housing loans and house prices. Regarding the response of housing activities to the policy rate innovations, housing loans decrease and hit the bottom in the second quarter following the policy rate hike shock. Similarly, the house prices fall in response to the unexpected rate hike and reaches its bottom in the second quarter. The bear period for both housing loans and house prices lasts around eight quarters. Meanwhile, housing loans and house prices decrease and hit the bottom in the third quarter following the policy rate and minimum retail rate hike shocks, while the bear period lasts around eight quarters. The results of regime 2, while representing low volatility or a normal regime, are consistent with the findings of Simo-Kengne et al. (2013) and Chowdhuri and Maclennan (2014a), who state that the impact of the monetary policy shock becomes significant only in a normal economic period. Finally, the Portmanteau autocorrelations tests are employed and shown in Table 4. The null hypothesis of no residual autocorrelations is rejected since the p-values are higher than the significance level of 0.05.

Table 4 The VAR Residual Portmanteau Tests for Autocorrelations

Lags	Q-Stat	Adj Q-Stat
1	11.94558	12.07831
	--	--
2	24.82514	25.24730
	(0.0730)	(0.0656)

Notes: Numbers in parentheses are p-values.

Source: Authors' Study

Conclusion and Policy Implication

The objective of this paper is to reinvestigate on a particular issue relating to how changes in monetary policy affect the housing and real estate markets. Both standard VAR and MS-VAR frameworks are utilized to estimate the impulse response functions, while two housing market variables, namely housing loans and house prices, are incorporated into the models together with other economic variables as well as the 1-day repurchase rate which represent the monetary policy instrument.

The key results from the VAR estimation are that the responses of the housing market variables to the monetary policy shocks are mixed. The tightening monetary policy stance results in an adverse adjustment of the lending activities of the financial institutions, affirming that the banking system plays an important role though the credit channel. Meanwhile, the shock of monetary policy has no impacts on the property prices. However, the findings from MS-VAR estimation helps clarifies the puzzle that found in the VAR estimation. The results from the MS-VAR model suggest that the reaction between housing market variables and the monetary policy instrument is nonlinear. There exist two different and independent states for the Thai housing market, that lead to asymmetric impacts of the monetary policy that are transmitted to the housing market. Regarding the normal regime, the monetary policy shock negatively affects both housing market variables. In contrast, the effects of the monetary policy shock are found only in housing loans in the volatile regime. Additionally, there are puzzle directions expressed in the response of the housing loans and house prices to the minimum retail rate innovation, similar to the findings acquired from the VAR model.

Comparing the negative effects on the housing loans from the shock of the monetary policy instrument, represented by the policy rate, the results conclude that there is an asymmetric effect. The contraction of the housing loan market is larger and being long-lasting in the normal market than those of the volatile market. The housing loans decrease for around eight quarters after the interest rate hike when the normal regime prevails, but decrease only for five quarters when the volatile regime prevails. This finding could imply that the asset price channel and the credit channel play some roles in propagating the transmission of monetary policy to the housing market.

The findings from this research provide some policy implications. It could be useful for the monetary authorities' mission to promote a stable financial environment if they closely monitor a set of housing market variables because the dynamic responses of the housing market variables, following the change in the monetary policy instrument, become mixed and depend on the business cycle of the housing and real estate sector. Due to the existence of the nonlinear relationship among housing variables, economic variables and the monetary policy instrument, the monetary authorities should be aware adverse effect of the tightening monetary policy stance on other economic variables, such as the private consumption. Additionally, the conventional monetary policy instrument, as the policy interest rate, may not be the most effective tools to tame the overheating situation in the housing and real estate market.

Empirical evidence derived from the bull regime suggests that, while the tightening monetary policy action has an effect on housing loans extended by financial institutions, this effect is only temporary. Hence, other unconventional monetary instruments that directly have an impact on the targeted segment of concerns could be more suitable. A set of unconventional policy tools that should be explored are measures relating to more prudent credit standards for lending to customer segments that are concerned, the higher LTV ceilings for targeted segments, as well as tighter guidelines under the responsible lending framework, including Debt Service Ratio, that induce financial institutions to take more account of customers' affordability.

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