**WORKING PAPER 4/2018**

# HOUSEHOLD DEBT IN SEACEN ECONOMIES

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**Abstract**

This research paper focuses on the increase in household debt that many SEACEN economies have been experiencing since the 2010. In particular, the paper shed lights on the link between house prices and household debt. Simialr to advanced economies, asset prices are key drivers of household debt surge because higher house prices lead to more debt in the future, with important implications for real variables. As asset prices are found to be a good predictors for recessions, a negative shock to asset prices can lower lending and GDP growth. This paper investigates such macro-financial linkage through the lends of a dynamic stochastic general equilibrium (DSGE) model applied to Malaysia. Results show that productivity and house preference shocks generate a contemporaneous increase in household debt and house prices. Also an increase in income class, i.e., larger share of top and middle income classes, boosts house prices and household debt. Increasing household debt is also driven by accommodative monetary policy and by a slowdown in the construction sector.

From the recent experience of the global financial crisis, we have learnt that increases in household debt may raise the likelihood of a financial crisis and could lower economic growth. Therefore, monitoring household debt and house prices is important.

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# HOUSEHOLD DEBT IN SEACEN ECONOMIES

By

Maria Teresa Punzi

## 1. Introduction

This study focuses on the increase in household debt that many SEACEN economies have been experiencing during the last number of years. Since the global financial crisis (GFC), household debt has attracted considerable attention. Even if policy authorities have gradually introduced specific macroprudential interventions to reduce risks associated with increasing levels of household debt, borrowing by households is still growing worldwide, and it is now at very high levels in many Asian economies. Increasing household debt across economies heighthens possible threats to growth and global financial stability. Chinese Taipei, India, Malaysia, Mongolia, the Philippines, Thailand and Vietnam have also experienced a rapid growth in household debt since 2010, and therefore this research study focuses on understanding the causes and consequences of the surge of household debt in these selected SEACEN economies.

Increasing household debt is very often associated with the run-up in house prices. Therefore, part of this study focuses on the interdependence between asset prices, household debt and macroeconomic fluctuations.[1] The macro-financial linkages across the 7 SEACEN eonomies included in this study are analyzed and it is found that asset prices usually increase and peak before a GDP downturn (i.e., recession), while peaks in household debt-to-GDP ratio coincide with GDP downturns. This suggests that asset prices are key variables to predict a recession.[2] A probit model is also estimated to evaluate the predictors of a recession. Results show that asset prices and the loan-to-GDP ratio are good predictors of a recession. Equity prices increase the probability of a future recession, while interest rate spread, inflation and current account to GDP are not statistically significant. If I estimate the probability of recessions including downturns phases of asset prices, then the probability of recession increases by 13% (11%) and 17% (15%) at current (1-quarter ahead) recession, respectively. House price downturns are no longer good predictors for 4-quarter ahead recession. Increase in equity prices raises the probability of recession by about 90%. Downturns in loan-to-GDP are statistical insignificant in all three cases. These results suggest that asset prices are more vulnerable variables relative to loan-to-GDP ratio.

[1] Throughout the paper, I use the terms “household debt” and “loans” interchangeably.

[2] Similar results are found in Haavio, Mendicino, and Punzi (2014) for 21 OECD countries over the period 1960-2007.

In order to understand what causes the increase in household debt and house prices, I simulate a dynamic stochastic general equilibrium (DSGE) model for Malaysia. Results show that productivity and house preference shocks generate a contemporaneous increase in household debt and house prices. Also an increase in income class, i.e., larger share of top and middle income classes, boosts house prices and household debt. Increasing household debt is also driven by accommodative monetary policy and by a slowdown in the construction sector.

Finally, I run a Panel VAR for the 7 economies included in this study to support the findings from the DSGE model. Results show that, across these economies, house preference shock, productivity shocks and accommodating monetary policy all lead to increasing household debt and house price boom.

The rest is developed as follows. Section 2 describes the behavior of household debt in the SEACEN economies. Session 3 analyzes the macro-financial linkages in the 7 SEACEN economies. Session 4 delves into the development of a DSGE model for Malaysia to highlight the main macroeconomic and financial shocks driving household debt. Session 5 estimates the drivers of household debt with a Panel VAR for the 7 SEACEN economies. Session 6 estimates the probability of recessions though a probit analysis for the 7 SEACEN economies. Session 7 discusses policy implications and Session 8 concludes.

## 2. Household Debt in SEACEN Economies

The objective of this research project is to study the causes and consequences of the increase in household debt that many SEACEN economies have been experiencing during the last years. In particular, the study delves into the following economies:

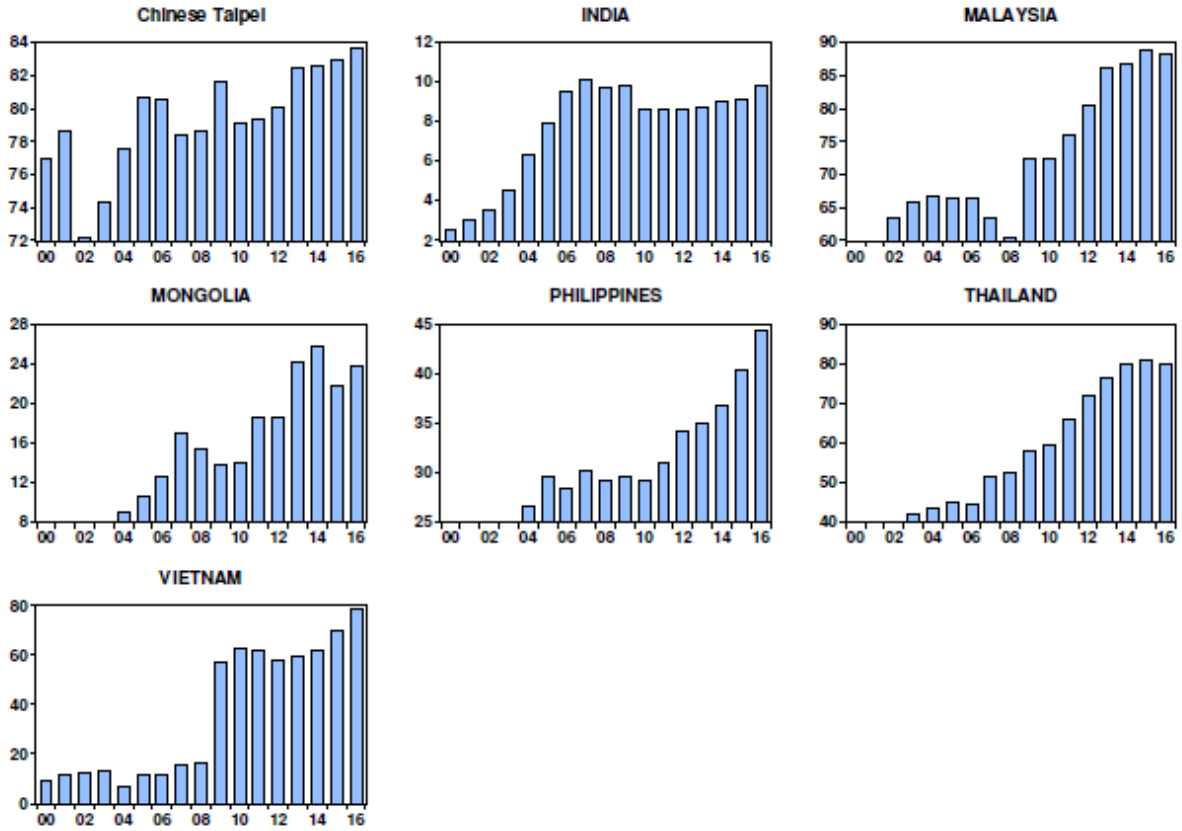
- Chinese Taipei
- India
- Malaysia
- Mongolia
- Philippines
- Thailand
- Vietnam

Figure 1 shows that the stock of household debt as percentage of GDP has increased in all economies under study.

The household debt-to-GDP ratio has increased from 77% and 3% in 2000 to 84% and 10% in 2016 in Chinese Taipei and India, respectively. The household debt-to-GDP ratio has increased from 9%, 35% and 9% in 2004 to 84%, 10% and 78% in 2016 in Mongolia, the Philippines and Vietnam, respectively. The household debt-to-GDP ratio has increased from

42% in 2003 to 80% and 10% in 2016 in Thailand while it has increased from 63% percent in 2002 to 80% and 88% in 2016 in Malaysia. The ratio for all economies, except India and Mongolia, reached extremely high levels in 2016, warning of potential financial vulnerability. Even though the ratio is not that high in India and Mongolia, nevertheless the speed of increase can also result in an alarming situation which need to be kept under control by policy makers.

**Figure 1: Household Debt-to-GDP Ratio in SEACEN Economies**




## 2.1 When Does the Debt become an Evil?

Lombardi, Mohanty, and Shim (2017) indicate that for a set of advanced economies and emerging market economies during the period 1990-2015, a 1% increase in the household debt-to-GDP ratio leads to lower long-run growth, and the impact is amplified when the household debt- to-GDP ratio exceeds 80%. While there is no threshold value for individual SEACEN economies, since the estimation includes Malaysia, Philippines and Thailand, we can take such values as possible warning indicators for the other economies analyzed in this study. Moreover, it can be generalized that when household debt-to-GDP growth exceed GDP growth, sustainability can be difficult to achieve. Table 1 shows that except for Chinese Taipei, India and Vietnam, all the other economies show a rapid household debt-to-GDP growth relative to their GDP growth. If the economy is not growing at the same pace as household

debt, then households may encounter hard times in repaying their outstanding debts in the future.

**Table 1: Household Debt-to-GDP**
**(Growth Rate 2010-2016)**

| | Household Debt-to-GDP | GDP |
|---|---|---|
| Chinese Taipei | 6% | 14% |
| India | 13% | 40% |
| Malaysia | 20% | 4% |
| Mongolia | 52% | 43% |
| Philippines | 42% | 35% |
| Thailand | 30% | 18% |
| Vietnam | 22% | 34% |

Meanwhile, GDP growth rates have not increased that much around the region (see Figure 2).

**Figure 2: GDP Growth Rate**
**(Y-o-Y)**

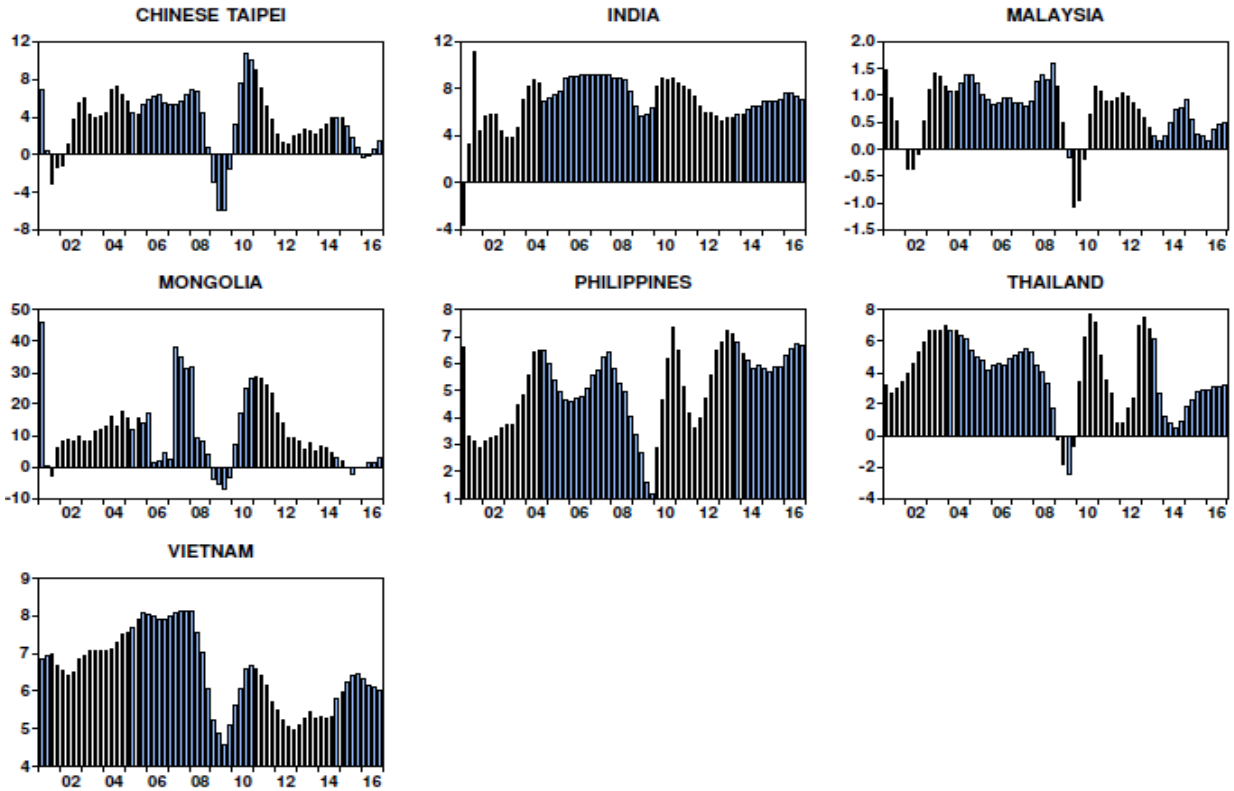
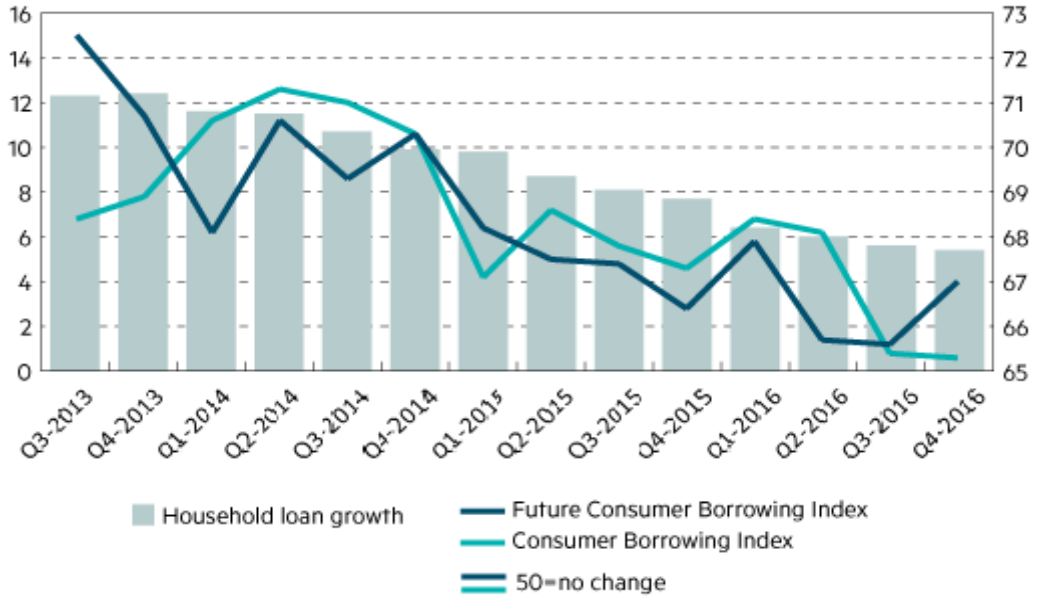
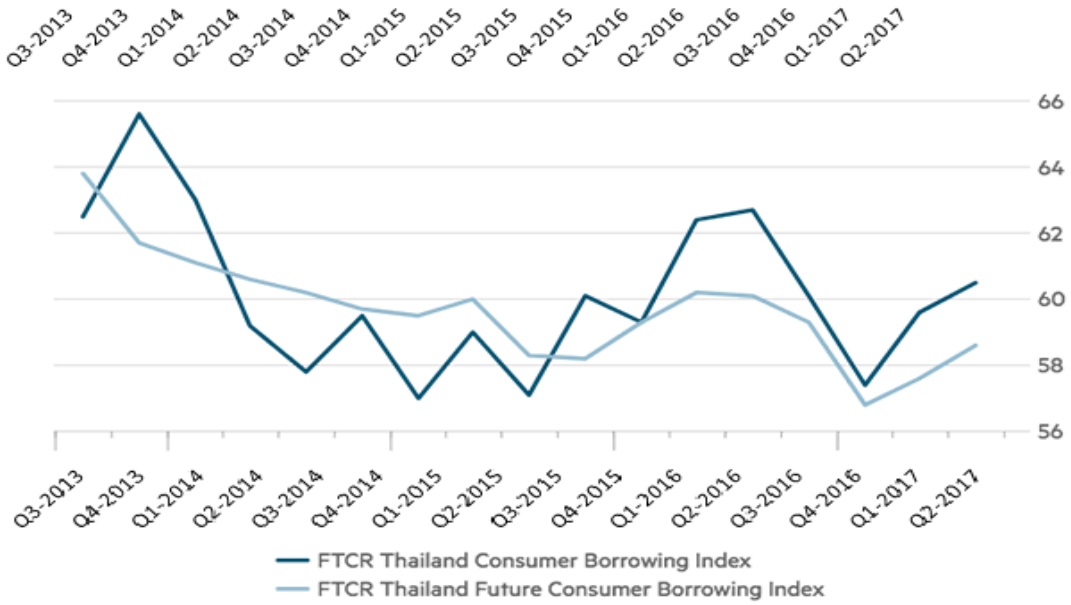


**Figure 3: Future Consumer Borrowing Index**

**Malaysia**




**Thailand**

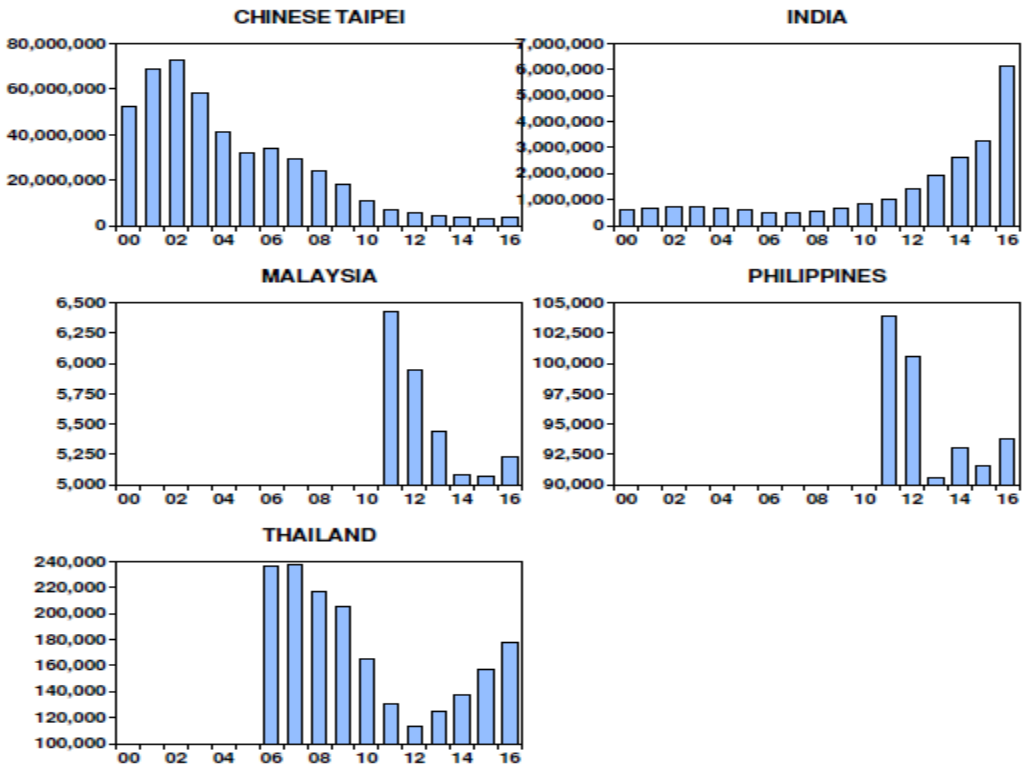



Note: Bar represent household debt growth (Y-o-Y) on the left side. FCBI is on the right side. FCBI indicates an increase if the index is above 50 or a decrease if it is below 50.

Some SEACEN economies do not show a slowdown in their level of borrowing. Indeed, it seems that there has been further acceleration since 2017. The Future Consumer Borrowing Index (FCBI) is an indicator based on survey responses on how consumer borrowing in the present month changed from the borrowing a year ago and how households expect their consumer borrowing to change in the next six months.[3] Figure 3 shows the FCBI for Malaysia (top panel) and Thailand (bottom panel).[4] While the FCBI index shows a decreasing trend for both Malaysia and Thailand, it appears that since 2017, the index has been increasing again, meaning that households expect expansionary changes in borrowing levels in the coming two quarters. Therefore, the survey confirms that for both Malaysia and Thailand, the household debt hangover is still an ongoing process.

Finally, even if many central banks in SEACEN economies have taken measures to lean against excess borrowing, non-performing loans have increased in all the economies, warning of a possible future default (see Figure 4).

**Figure 4: Non-Performing Loans**




Note: NPL expressed in local currency.

[3] The measure indicates an increase if the index is above 50 or a decrease if it is below 50.

[4] FCBI is not available for other SEACEN economies.

## 2.2 Household Debt and House Prices

Increasing household debt is very often associated with the run-up in house prices. First of all, house prices affect the economy through the wealth effect. The idea is that wealth effects from housing appreciation is able to boost household consumption. Indeed, an increase in house prices leads to more wealthy households, who will be more confident about spending and borrowing on credit cards, as they can always sell their houses in case of financial emergency. Houses are durable goods, which provide valuable services and serve as collateral for loans. Better access to credit reduces household consumption volatility, improves investment opportunities, eases the borrowing constraints on families and small businesses, and diversifies household and financial sector assets. A flexible financial sector and financial liberalization help global liquidity by augmenting funding to the banking sector and the whole economy. As a result, turnovers in housing markets have increased, the share of investment-oriented house purchases has risen, and novel mortgage products (such as interest-only loans, innovative forms of adjustable rate mortgages and the allowance for a limited amount of negative amortization) have proliferated in many advanced economies. These products enable many marginally qualified and highly leveraged borrowers to purchase homes at inflated prices.

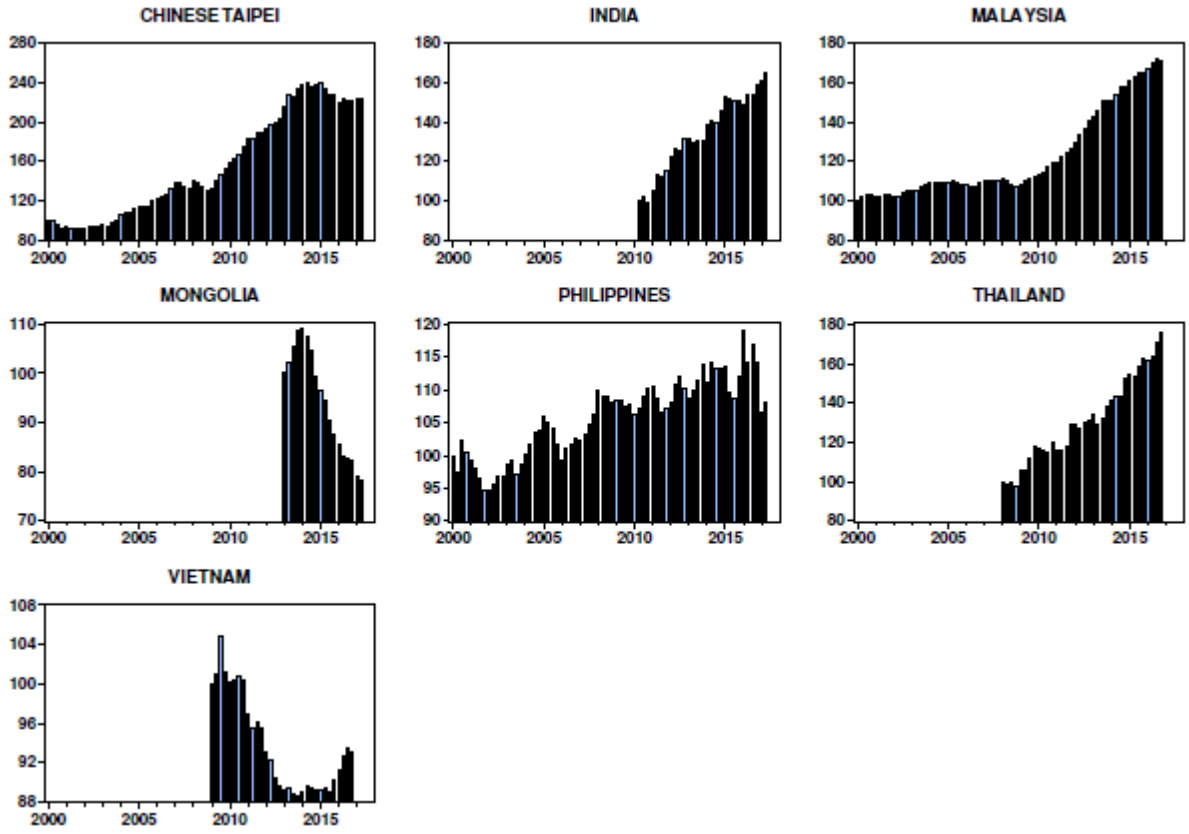
Housing price booms have been characterized, on average, by hump-shaped co-movement in GDP, consumption, investment, hours worked, real wages and housing investment. More precisely, these macroeconomic variables generally grow during the boom phase of housing prices and fall during the bust phase. Leamer (2015) reports that house prices and real residential investments peak several quarters before recessions, meaning that the housing market lead the business cycle. In particular, on average, the peak in house prices is anticipated by the peak in housing investment and followed by macroeconomic recessions. One possible interpretation is that the run-up in house prices and residential investments encourages household expenditure and household loans. Once the demand for housing slows down, house prices start declining, pushing towards an economic downturn. As a result, a decline in house prices and worsened economic conditions can cause credit conditions to also become tighter with further negative implications for housing and macroeconomic developments.

Figure 5 describes the latest trend in the housing market for our selected SEACEN economies. All economies show a strong run-up in house prices that many Asian economies have been experiencing since 2000. Mongolia is the exception with a decreasing trend since 2015. For Vietnam, Ho Chi Minh City houses prices have been dropping since the end of 2009 until the end of 2013, but a larger increase appear to occur since the 2016. As a result, these economies have a clear positive correlation between the house price index and household debt-to-GDP ratio.

## 3. Financial and Real Cycles in SEACEN Economies

This section focuses on macro-financial linkages to understand how financial cycles are related to business cycles for the 7 SEACEN economies. In particular, the question is whether economic recessions are usually followed by asset price and credit bursts. First, the peaks and troughs of real GDP and of the financial variables are identified using the Bry and Boschan (1971) algorithm. A downturn phase in a time series is a period between a peak and a trough, while an upturn is a period starting with a trough and ending with a peak. Second, the concordance index (CI) developed by Harding and Pagan (2002) is used to study the linkages between downturns in financial markets and the real economy. GDP, housing prices and lending activities are highly procyclical, but it is not clear which variables lag or lead the business cycle. The concordance index provides a measure of the fraction of time the two time series are in the same phase (expansion or downturn) of their respective cycles. In particular, CIs of real GDP with lags and leads of the financial variables are computed to test if the phases of the real economy are more related to the past or to the future phases of financial variables.

**Figure 5: Real House Price Index**




Note: Vietnamese house price index is represented by Ho Chi Minh City.

The findings are that the concordance of real GDP with the past phases of real house prices and real stock prices is somewhat higher than the concordance with the contemporaneous phases, while the index with the future phases of spread is lower than with the contemporaneous phases. These findings indicate that asset prices tend to lead real activity, while developments in credit and money markets typically lag developments in the real economy.

Traditional approaches identify the business cycle with phases of expansion and contraction in which time periods move from peak to trough. Harding and Pagan (2002) proposed the concordance index between macroeconomic variables to identify turning points, i.e., the average number of periods in which two variables move from a high point (peak) to a low point (trough) in the same phase of the cycle. The turning points define a binary variable $w_{z,t}$ as follows:

$$w_{z,t} = \begin{cases} 1, & if\ z\ is\ in\ expansion at\ time\ t \\ 0, & otherwise \end{cases}$$

where *z=(x,y)* and $w'_{z,t}$ is a vector containing the two variables for which we want to calculate the concordance index. One variable in $z$ is going to be the country's GDP, since we are interested in the synchronization of business and financial cycles.

The concordance index is a measure of the fraction of time the two variables $w_{x,t}$ and $w_{y,t}$ are in expansion or in downturn during the same phase, as follows:

$$C_{x,y} = \frac{1}{T}\sum_{t=1}^{T}[w_{x,t}w_{y,t} + (1-w_{x,t})(1-w_{y,t})]$$

If the concordance index takes values close to 1, then the two variables are always in the same phase (i.e., pro-cyclical), otherwise, for values close to 0 they are in opposite phases (i.e., countercyclical).

The sample includes India, Malaysia, Mongolia, Philippines, Chinese Taipei, Thailand and Vietnam over the period from 2000 until 2016, at quarterly frequency.[5] House and stock prices are indicators of asset prices; loans measure total lending activities to households and spread rates are calculated as the difference between 10-year government bonds and policy rates.

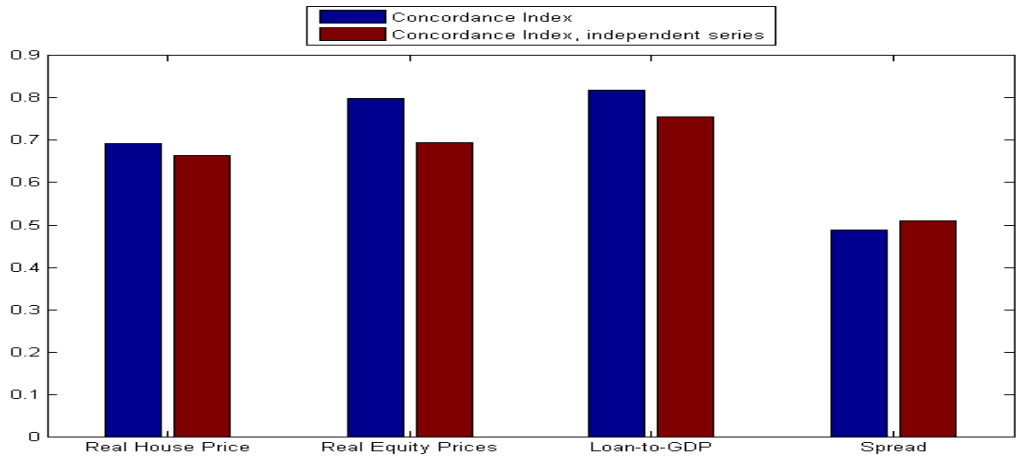
[5] For some economies, the series start later than 2000.

Relative to independent cycles, Figure 6 shows that for real house prices, real stock prices and the loan-to-GDP ratio, the value of the CI exceeds the value corresponding to independent cycles, meaning that financial variables are procyclical. On the other hand, interest rate spread are acyclical as the value of the CI is lower than the value corresponding to independent cycles.

In order to evaluate how phases of the real economy are related to past or future phases of financial variables, the concordance index is constructed taking into consideration leads and lags over the business cycle in order to evaluate if the current phase of the business cycle is related to previous or future financial cycles. Figure 7 computes the concordance index relative to GDP for real house prices, real stock prices, spread interest rate and loan-to-GDP. The vertical line at time 0 indicates the average of real GDP peaks. Therefore, periods between -10 and 0 indicate phases of GDP expansion, while periods between 0 and 10 indicate phases of contraction. Every interval indicates a change in quarter. Real house prices and real stock prices peak before time 0, meaning that developments in asset prices anticipate the developments in real variables. Past phases of asset prices and spread rates are higher than current or future phases, indicating that asset prices lead real activities. A different behavior is found for credit. The loan-to-GDP shows an higher concordance index exactly at the GDP peaks, meaning that this ratio moves with real activities.

During phases of expansion in GDP, the conditional probabilities that the financial variables are in an upturn phase only slightly differ from the unconditional probabilities (left panel of Figure 8). However, during economic downturns, real GDP and financial variables are more tightly tied together (See right panel of Figure 8).

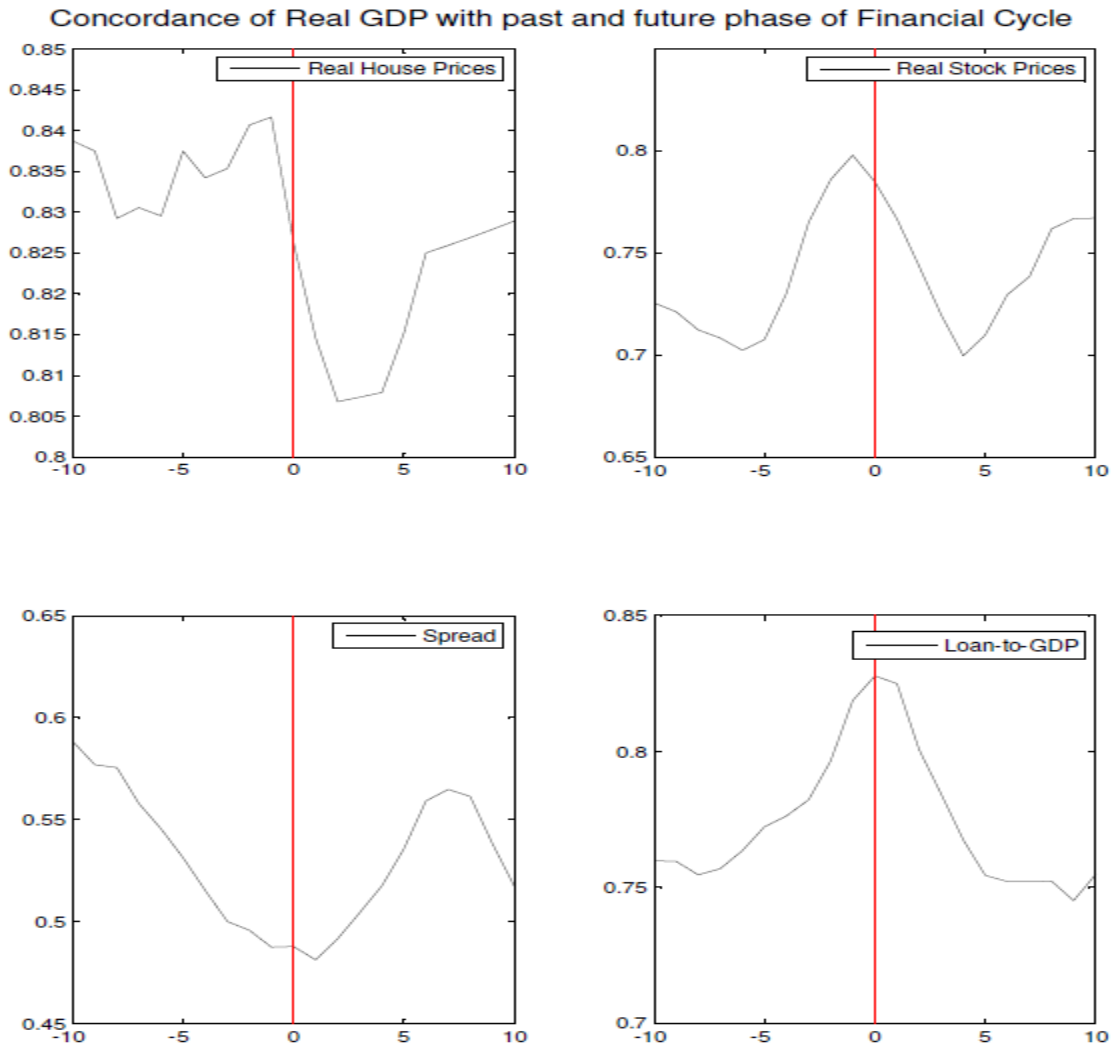
**Figure 6: Conditional Concordance Index**



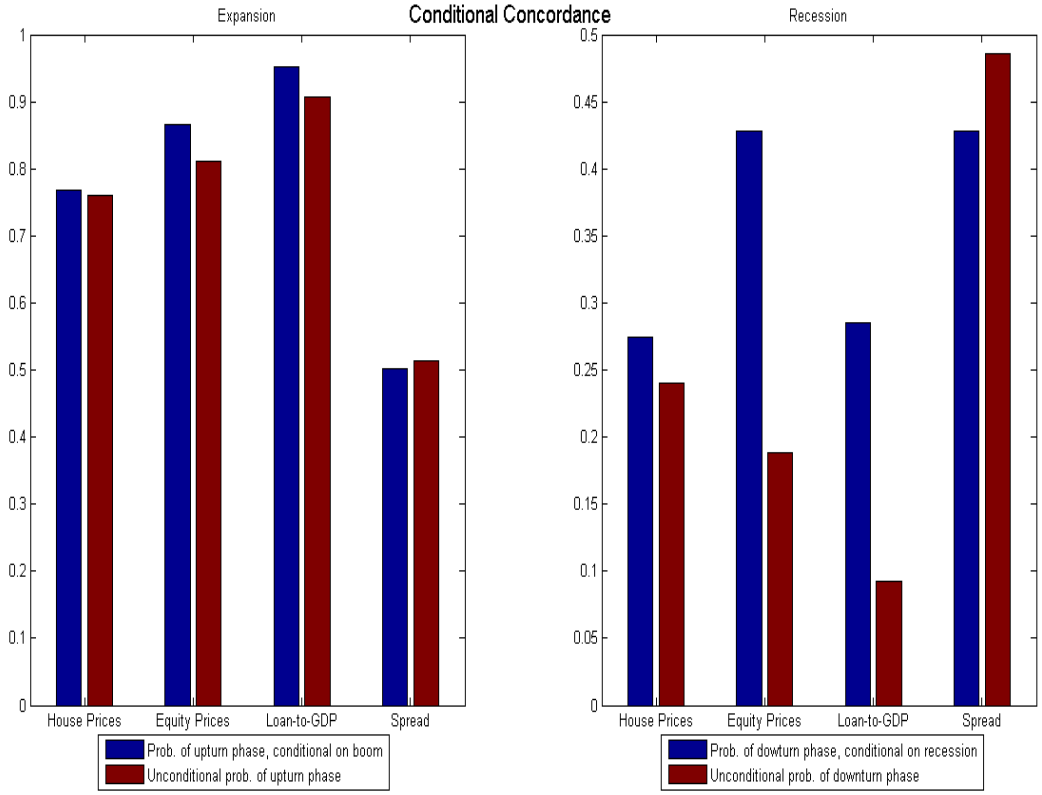

However, the conditional probability of real house and stock prices being in both upward and downward phases is still higher when we consider lags of this variables, with the highest conditional probability value reaching at one lag. Thus, an economy may experience a

recession when real asset prices fall. In contrast, the loan-to-GDP ratio shows the highest conditional probability when the real GDP downturns, and at the same point, spread shows the lowest conditional probability (see Figure 9).

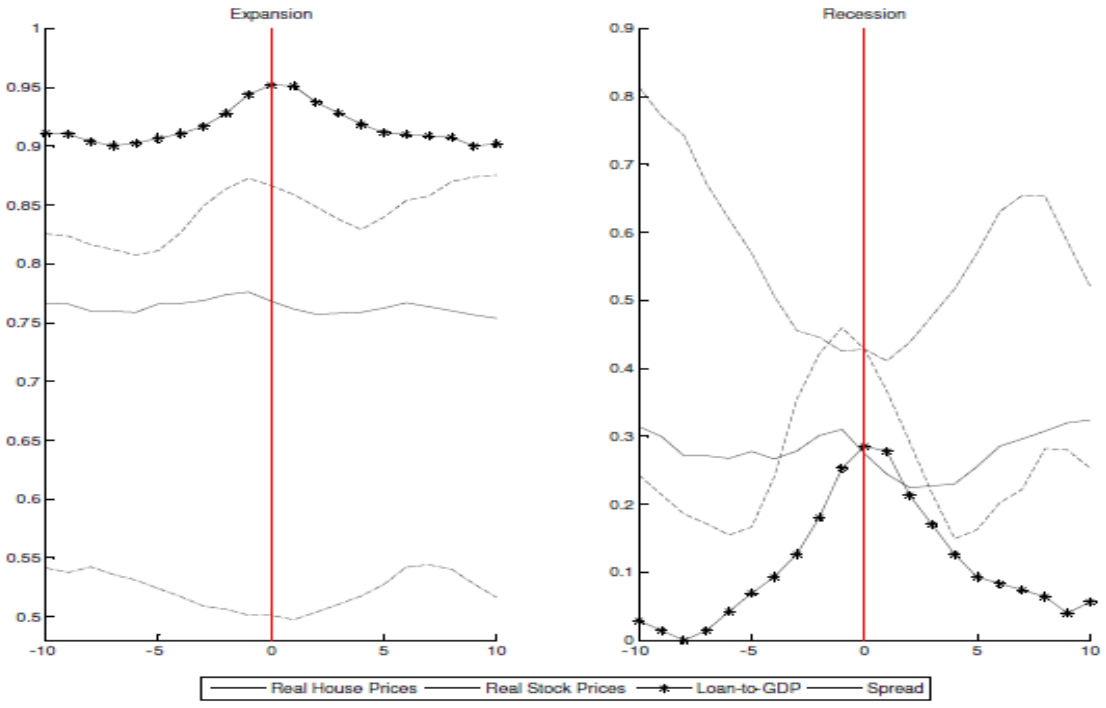
**Figure 7: Concordance Index**



## Figure 8: Conditional Concordance Index




## Figure 9: Conditional Probability



## 4. Case Study for Malaysian Economy

### 4.1 DSGE Model Applied to Malaysia

This section develops a two-country dynamic stochastic general equilibrium (DSGE) model with the housing market as in Mendicino and Punzi (2014). The model accounts for heterogeneous households which differ in terms of their time preferences. Each country is populated by two types of households that trade domestic loanable bonds: patient (lenders) and impatient (borrowers). Lenders have higher propensity to save, while borrowers dislike to save and they prefer to consume as much they can. In order to increase their consumption, borrowers collateralize the value of their homes, therefore they are financial constrained. This financial friction results in the familiar financial accelerator mechanism. Housing enters in the utility function and is treated as a durable good with its demand depending on both the service flow and asset value of housing units. The service flow is assumed to be proportional to the real value of the individual housing stock holding. The economy is also populated by perfectly competitive intermediate-goods-producing firms, retailers that operate in a monopolistically competitive market, capital and house producers, and a monetary authority that follows a standard Taylor-type interest rate rule. The model allows the domestic country to borrow from the foreign country.[6]

#### *4.1.1 Households*

Patient households are denoted with $1$ and impatient are denoted with $2$. Patient households have a higher propensity to save, i.e. $\beta_1 > \beta_2$. Households supply labour and derive utility from consumption, $c_{j,t}$, housing services, $h_{j,t}$, and hours worked, $L_{j,t}$,

$$\max E_0 \sum_{t=0}^{\infty} (\beta_j)^t \left[ \ln(c_{j,t}) + \gamma_{h,t} \grave{u} \ln h_{j,t} - \frac{v_L}{\eta} (L_{j,t})^{\eta} \right], \quad (1)$$

where $j = \{1,2\}$ denotes the two types of households and $\grave{u}$ is the housing weight in the utility. As common in the literature, housing services are assumed to be proportional to the stock of houses held by the household and $\gamma_{h,t}$ is a shock to the preference for housing services.[7]

**Lenders.** Patient households accumulate properties for housing purposes, $h_{1,t}$, trade domestic-currency loanable bonds, $b_{1,t}$, and foreign-currency bonds, $b_t^*$, and receive dividends from firms, $F_t$. They also invest in physical capital, $k_t$, that is then rented to the final-

[6] For simplicity, the model assumes the domestic and foreign economies are at equal size.

[7] See, for example Iacoviello (2005), Iacoviello and Neri (2010b) and Liu, Wang and Zha (2013).

goods-producing firms at the rate $R_t^k$. Thus, they maximize their expected utility subject to the following budget constraint:

$$\begin{aligned} c_{1,t} + q_{h,t}(h_{1,t} - (1-\delta_h)h_{1,t-1}) + q_{k,t}(k_t - (1-\delta_k)k_{t-1}) + b_{1,t} + s_t b_t^* = \ldots \\ = w_{1,t}L_{1,t} + R_t^k k_{t-1} + \frac{R_{t-1}b_{1,t-1}}{\pi_t} + s_t \frac{\varsigma_{t-1}R_{t-1}^* b_{t-1}^*}{\pi_t^*} + F_t, \end{aligned} \tag{2}$$

where $q_{h,t}$ is the price of housing, $q_{k,t}$ is the price of capital, $w_{1,t}$ are real wages, $\pi_t = P_t/P_{t-1}$ and $\pi_t^* = P_t^*/P_{t-1}^*$ are, respectively, the domestic and foreign gross inflation rate, and $s_t$ is the real exchange rate. The stock of housing and capital depreciate at rates $\delta_h$ and $\delta_k$, respectively. All the variables, except for the gross nominal interest rates on domestic and foreign bonds, $R_t$, and $R_t^*$, are expressed in real terms. The return on foreign debt depends on a country specific risk premium, $\varsigma_t$, that is required for the model to feature a stationary distribution.[8] This risk premium, $\varsigma_t$, is a positive convex function that depends on the ratio of net foreign assets to domestic output:

$$\varsigma_t = \exp\left[ \varphi\left( \frac{s_t b_t^*}{Y_t} \right) + \gamma_{\varsigma,t} \right], \tag{3}$$

where $\gamma_\varsigma$ represents a risk-premium shock.

**Borrowers.** Impatient households maximize their expected utility subject to the following budget constraint:

$$c_{2,t} + q_{h,t}(h_{2,t} - (1-\delta_h)h_{2,t-1}) = w_{2,t}L_{2,t} - \frac{R_{t-1}b_{2,t-1}}{\pi_t} + b_{2,t}, \tag{4}$$

and a borrowing constraint:

$$b_{2t} \le mE_t \frac{q_{h,t+1}\pi_{t+1}h_{2t}}{R_t}\gamma_{m,t}. \tag{5}$$

Borrowing is limited to a fraction of the value of the borrowers' housing stock, where $(1-m)$ is the cost that lenders pay when repossessing the asset in the case of default.

[8] See Schmitt-Grohe and Uribe (2003) for further details.

### *4.1.2 Firms and Price Setting*

**The Intermediate Sector.** There is a continuum of monopolistically competitive firms indexed by $i \in (0,1)$ that produce intermediate goods, $y(i)$, using the following technology:

$$y(i)_t = \gamma_{z,t}\left[\left(L(i)_{1,t}\right)^{\gamma}\left(L(i)_{2,t}\right)^{1-\gamma}\right]^{1-\alpha} k(i)_{t-1}^{\alpha}, \tag{6}$$

where $\gamma_{z,t}$ is an aggregate productivity shock, $k$ is rented capital, $L_1$ and $L_2$ is labor supplied by patient and impatient agents, respectively. As in Iacoviello (2005) and Iacoviello and Neri (2010), different labor types are complements.[9]

Price rigidities is introduced in the model following the New Keynesian literature. Thus, at time $t$, each intermediate firm revises its price with a probability $(1-\theta)$ as in Calvo (1983), leading to the following New Keynesian Phillips curve:

$$\log\left(\frac{P_t}{P_{t-1}}\right) = \beta_1\left[E_t \log\left(\frac{P_{t+1}}{P_t}\right)\right] + \varepsilon_{\pi} \log\left(\frac{X_t}{X}\right) \tag{7}$$

where $\varepsilon_{\pi} = \dfrac{(1-\theta)(1-\beta_1\theta)}{\theta}$ and $X_t$ represents the marginal cost of production. Intermediate firms are owned by the patient households.

**The Final-Goods-Producing Firms.** The final good, $Y_t$, is produced by perfectly competitive firms using $y_t(i)$ units of each type of intermediate good $i$ and a constant return to scale, a diminishing marginal product, and a constant elasticity of substitution technology:

$$Y_t \leq \left[\int_0^1 y_t(i)^{\frac{\xi-1}{\xi}} di\right]^{\frac{\xi}{\xi-1}}, \tag{8}$$

where $\xi > 1$ is the constant-elasticity-of-substitution parameter. The price of an intermediate good, $y_t(i)$, is denoted by $P_t(i)$ and is taken as given by the competitive final-good-producing firms. Solving for cost minimization yields a constant-price-elasticity demand function for each

[9] The primary motivation for this assumption is to obtain a closed-form solution for the steady-state of the model.

goods type $i$ which is homogeneous to degree one in the total final output, $y_t(i) = \left[\frac{P_t(i)}{P_t}\right]^{-\xi} y_t$ and the domestic price index $P_t = \left[\int_0^1 P_t(i)^{1-\xi} di\right]^{1/(1-\xi)}$.

### *4.1.3 Capital Producers*

Capital producers combine a fraction of the final goods purchased from retailers as investment goods, $I_{k,t}$, to combine it with the existing capital stock in order to produce new capital goods.[10] Capital production is subject to an adjustment cost specified as $\frac{\psi_k}{2}\left(\frac{I_{k,t}}{k_{t-1}} - 1\right)^2 I_{k,t-1}$, where $\psi_k$ governs the slope of the capital producers adjustment cost function. Capital producers choose the level of $I_{k,t}$ that maximizes their profits:

$$\max_{I_{k,t}} q_t^k I_{k,t} - \left( I_{k,t} + \frac{\psi_k}{2\delta_k}\left(\frac{I_{k,t}}{k_{t-1}} - \delta_k\right)^2 k_{t-1} \right). \tag{9}$$

From profit maximization, it is possible to derive the supply of capital:

$$q_t^k = \left[1 + \frac{\psi_k}{2\delta_k}\left(\frac{I_{k,t}}{I_{k,t-1}} - 1\right)\right], \tag{10}$$

where $q_t^k$ is the relative price of capital. In the absence of investment adjustment costs, $q_t^k$ ,is constant and equal to one.

The usual capital accumulation equation holds:

$$I_{k,t} = k_t - (1-\delta_k)k_{t-1}. \tag{11}$$

### *4.1.4 Housing Producers*

In the following, I introduce housing production which combines labor supplied by both agents, fixed capital and land in the production function, as in Iacoviello and Neri (2010).

[10] See, among others, Bernanke, Gertler and Gilchrist (1999), Christiano, Eichenbaum and Evans (2005) and Christensen and Dib (2008).

The production of new houses follows a CobbDouglas specification, such as:

$$IH_t = \gamma_{h,t} \left[ \left(L_{1,t}^H\right)^{\gamma} \left(L_{2,t}^H\right)^{1-\gamma} \right]^{1-\alpha_h-\alpha_L} k_{h,t-1}^{\alpha_h} l_{t-1}^{\alpha_L} \quad (12)$$

where $L_{1,t}^H$ and $L_{2,t}^H$ is labor supplied by the Savers and Borrowers in the housing sector, respectively. $k_h$ is capital used in the housing sector and *l* is land. Supply of land is fixed and equal to 1. Similar to Iacoviello and Neri (2010), land plays a role of housing adjustment cost.

The aggregate stock of housing, $h_t = h_{1,t} + h_{2,t}$, is accumulated according to:

$$I_{h,t} = h_t - (1-\delta_h) h_{t-1}. \quad (13)$$

### *4.1.5 Monetary Policy*

The policy rate is defined as a variable set by the Central Bank that responds to inflation, GDP gap and exchange rate.[11] Therefore, the monetary authority follows a simple interest-rate rule:

$$R_t = \left(\frac{\pi_t}{\pi}\right)^{\phi_\pi} \left(\frac{Y_t}{Y}\right)^{\phi_Y} \left(\frac{s_t}{s}\right)^{\phi_s} \varepsilon_{r,t} \quad (14)$$

$\varepsilon_{r,t}$ is an i.i.d. monetary policy shock.

### *4.1.6 Current Account Equation*

The trade balance equals:

$$TB_t = Y_t - C_t - q_{k,t} I_t^k - q_{h,t} I_t^h = -D_t^*, \quad (15)$$

and the current account is defined by the following equation:

$$CA_t = -TB_t + \frac{s(R_{t-1}^* - 1) b_{t-1}^*}{\pi_t^*} = s\left(b_t^* - \frac{b_{t-1}^*}{\pi_t^*}\right). \quad (16)$$

where $D_t^* = s\left(b_t^* - \frac{R_{t-1}^* b_{t-1}^*}{\pi_t^*}\right) - \frac{\varphi}{2}\left(b_t^* - b^*\right)^2$.

[11] This specification follows the rule set by Bank Negara Malaysia.

The last equation states that the current account is the sum of the service account, i.e., the interest required to service existing debt, and the trade account, which is the trade balance expressed as the difference between output, consumption and investments.[12]

#### *4.1.7 Rest of the World*

Finally, the domestic country borrows from the foreign country which is populated only by patient agents (denoted by $s$).

The foreign economy is assumed to be a saver economy that runs a current account surplus. For simplicity, there is only one representative household in the foreign economy. The foreign agent's expected utility is summarized by:

$$\max E_0 \sum_{t=0}^{\infty} \beta_s^t \gamma_{b,t} \left[ \ln(c_{s,t}) + ù \ln h_{s,t} - \frac{v_L}{\eta} \left( L_{s,t} \right)^{\eta} \right], \tag{17}$$

where $\beta_s^t = \beta_1^t$ and $\gamma_{b,t}$ is an exogenous shock to the foreign consumer's impatience.

All the rest of the model is defined identically to the domestic economy.

#### *4.1.8 Exogenous Factors*

Shocks to aggregate productivity, $\gamma_{z,t}$, house sector productivity, $\gamma_{h,t}$, house preferences, ù, $\gamma_{m,t}$, the risk premium, $\gamma_{\varsigma,t}$, and the income class, $\gamma_{b,t}$, follow an autoregressive process of order one:

$$\ln \gamma_t = \rho_\gamma \ln \gamma_{t-1} + \varepsilon_{\gamma,t}, \tag{18}$$

where *γ = {z, h, ù, ζ, b}*, $\rho_\gamma$ is the persistence parameter and $\varepsilon_{\gamma,t}$ is a i.i.d. white noise process with mean zero and variance $\sigma_\gamma^2$. Monetary policy shocks, $\varepsilon_{r,t}$, are instead i.i.d.

### 4.2 Calibration

The model is calibrated for Malaysia. The parameters are choosen such that the model matches the ratios in the data (see Table 2).

[12] 1A similar definition is found in Obstfeld and Rogoff (1995) and Ghironi (2006).

The discount factor of the lenders, $\beta_1$, is set equal to 0.9926, such that the average annual rate of return is about $2.98\%$.

The model assumes that the lenders own all the physical capital wealth, therefore lenders are assumed to represent the top 20 of the wealth distribution of households in the model economy. According to Khalid (2011), real estate assets represent 96% of total wealth and the top 20% of Malaysian households per capita owns 52% of the country's wealth, respectively.[13] Therefore, the discount factor of the borrowers, $\beta_2$, is set equal to 0.965 in order to match the two ratios for the borrowers: a share of income of about 51% and a share of housing wealth of about 48%.

The depreciation of the housing stock, $\delta_h$, is equal to 0.0089 in order to match a ratio of residential investment to GDP of 8.23%. The loan-to-value ratio, $m = 0.75$, and the housing weight in the utility, $\grave{u} = 0.20$, are jointly calibrated to match the ratio of household credit to GDP of 88.3%, as in the data.

The World Bank shows that the average Malaysian trade balance as a percent of GDP has been equal to 7.72 between 1960 and 2016.[14] Therefore, the following steady state relationship is used to calibrate the stock of foreign debt relative to GDP. $(b^*)$ aims to match the Malaysian trade deficit to GDP of 7.72% and a standard deviation of current account to GDP of 4% :

$$b^*(1-R^*) = -TB \tag{19}$$

The labor disutility parameter $\nu_L$ is a normalized one. The parameter $\eta$ is set to 2 such that the Frisch elasticity of labor supply equals one. The average net markup equals 10% and the Calvo parameter, $\theta$, is set to 0.67. Capital share in production, $\alpha$, is set equal to 0.30 and the depreciation of productive capital $\delta_k$ to 0.025. The adjustment cost parameters are set equal to 0.5.

[13] [?] studies the composition and inequality of wealth among the household per capita in Malaysia, using the 2007 Malaysia's Household Income Survey (HIS).

[14] See http://www.theglobaleconomy.com/Malaysia/tradebalance.

**Table 2: Targets**

| Ratio | Data | Model |
|---|---|---|
| Annual rate of return | 2.98% | 2.98% |
| Borrowers share housing wealth | 48% | 49% |
| Borrowers share of income | 51% | 55% |
| Residential investment/GDP | 8.8% | 7.94% |
| Household Credit to GDP | 88.3% | 87.4% |

### 4.3 Theoretical Impulse Responses

Figures 11-12 report impulse responses for the selected exogenous shocks. Productivity shocks in Malaysia lead to increasing GDP and residential investments. Indeed, the aggregate technology shock, $\gamma_{z,t}$, affects both sectors as the goods sector can produce some intermediated goods used in the construction sector, while a sector-specific shock $\gamma_{h,t}$ only affects the real estate market. Higher productivity generates lower inflation and interest rate increases. Lower prices boost demand of goods and households are willing to borrow in order to finance their present consumption. Moreover, GDP growth coupled with higher investments in the real sector lead to higher demand for housing, and as a result, house prices increase. Due to the collateral constraint, the increase in house prices lead to higher borrowing, even if the interest rate is initially higher (see Figure 10, solid line).

Income class shock and house preference shocks show similar dynamics. According to Table 3, the share of the top 10% of the income distribution in Malaysia has increased enormously: from 14.7% in 2002 to 45.1% in 2014. Income class shock represents an increase in the share of lenders (i.e., richest households in the model).

**Table 3: Percentage Distribution of Households by Income Class, Malaysia**

| Income Class | 1995 | 1997 | 1999 | 2002 | 2004 | 2007 | 2009 | 2012 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| 499 and below | 10.6 | 6.3 | 6 | 3.8 | 2.8 | 1.7 | 1.2 | 0.5 | 0.1 |
| 500 - 999 | 23.9 | 18.6 | 19 | 15.4 | 13.5 | 6.8 | 6.1 | 4.5 | 1.5 |
| 1,000 - 1,499 | 19.9 | 18.3 | 18.8 | 16.5 | 15.8 | 15.8 | 14.2 | 8.5 | 4.1 |
| 1,500 - 1,999 | 13.1 | 13.7 | 13.9 | 13.4 | 13.2 | 13.5 | 11.9 | 9.3 | 6 |
| 2,000 - 2,499 | 8.9 | 10.1 | 10.1 | 10.4 | 10.8 | 11.2 | 10.7 | 8.9 | 6.5 |
| 2,500 - 2,999 | 6.1 | 6.9 | 7.3 | 8.3 | 8.2 | 8.6 | 8.6 | 7.1 | 6.1 |
| 3,000 - 3,499 | 4.2 | 5.4 | 5.7 | 6.3 | 6.5 | 7.1 | 7.3 | 9.4 | 9.8 |
| 3,500 - 3,999 | 2.8 | 4 | 3.9 | 4.7 | 5.2 | 5.8 | 6.3 | 7.3 | 8 |
| 4,000 - 4,999 | 3.8 | 5.6 | 5.5 | 6.7 | 7.2 | 8.6 | 9.5 | 11.1 | 12.8 |
| 5000 and above | 6.7 | 11.1 | 9.8 | 14.7 | 16.8 | 20.8 | 24.2 | 33.6 | 45.1 |

The impulse response shows a clear preference for buying houses by this income class and house prices show a larger response to this shock. Similar to the case of productivity shock, higher house prices generate higher collateral value and thus, constrained households are able to borrow more. Booming housing prices lead to expectations of future higher prices, incentivizing construction companies to invest more in the real sector, with a clear spillover effect on the rest of the economy (see Figure 10, starred line). Finally, the house preference shock increases house prices with a positive impact on household debt and residential investments. In this case, GDP increases are less, relative to the other two shocks, ending up in a negative responses after 1 year (see Figure 10, dotted line).

**Figure 10: Impulse Responses**

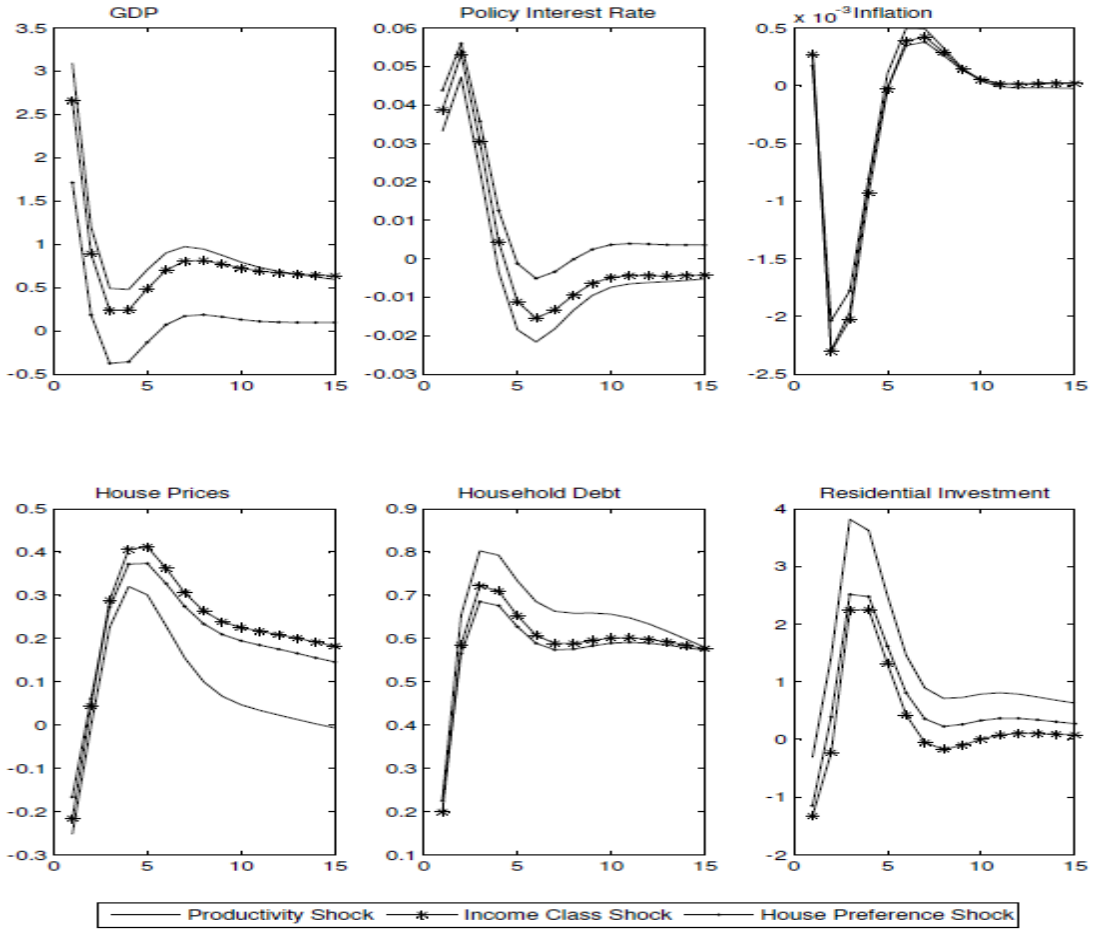



Figure 11 (solid line) reports impulse responses to a negative interest rate shock. Lower rates lead to cheaper cost of borrowing and therefore, affect positively the household debt, residential investment, house prices and GDP. Figure 11 (starred line) reports impulse responses to a negative productivity shock on the construction sector. This shock leads to a slowdown in the supply of dwellings, generating higher house prices because of lower supply. Higher house prices allow constrained household to borrow more to finance their consumption, leading to decreases in inflation and GDP increases. Finally, Figure 11 (dotted line) shows the impulse response for the only foreign shock present in the model: a negative risk premium. A lower risk premium increases the willingness of foreign investors to accumulate Malaysian assets, therefore increasing capital inflows and thus, a current account deficit.[15] The greater availability of foreign funds generates a greater availability of credit for domestic borrowers as well as an increase in the domestic consumption of both nondurable goods and housing. Due to the higher demand for housing, house prices rise which exacerbate the financial accelerator

[15] Even if Malaysia is running a current account surplus, since 2008 the current account shows a clear decrease till 2017.

effects linked to the existence of housing collateral. These findings are consistent with the findings of Bernanke (2005) , Sa and Wieladek (2011) and Mendicino and Punzi, (2014).

Table 4 reports the forecast error variance decomposition and shows the proportion of the unanticipated changes of a variable that can be attributed to innovations in the variable itself and to other variables in the system. House preference shocks and income class shocks explain about 36% and 35% of the variation of household debt, respectively. Productivity shocks explain about 26% of the debt fluctuations. These shocks are also important in explaining fluctuations in housing prices, but the main shock affecting house price variation in Malaysia is the slowdown in the construction sector.

**Figure 11: Impulse Responses**

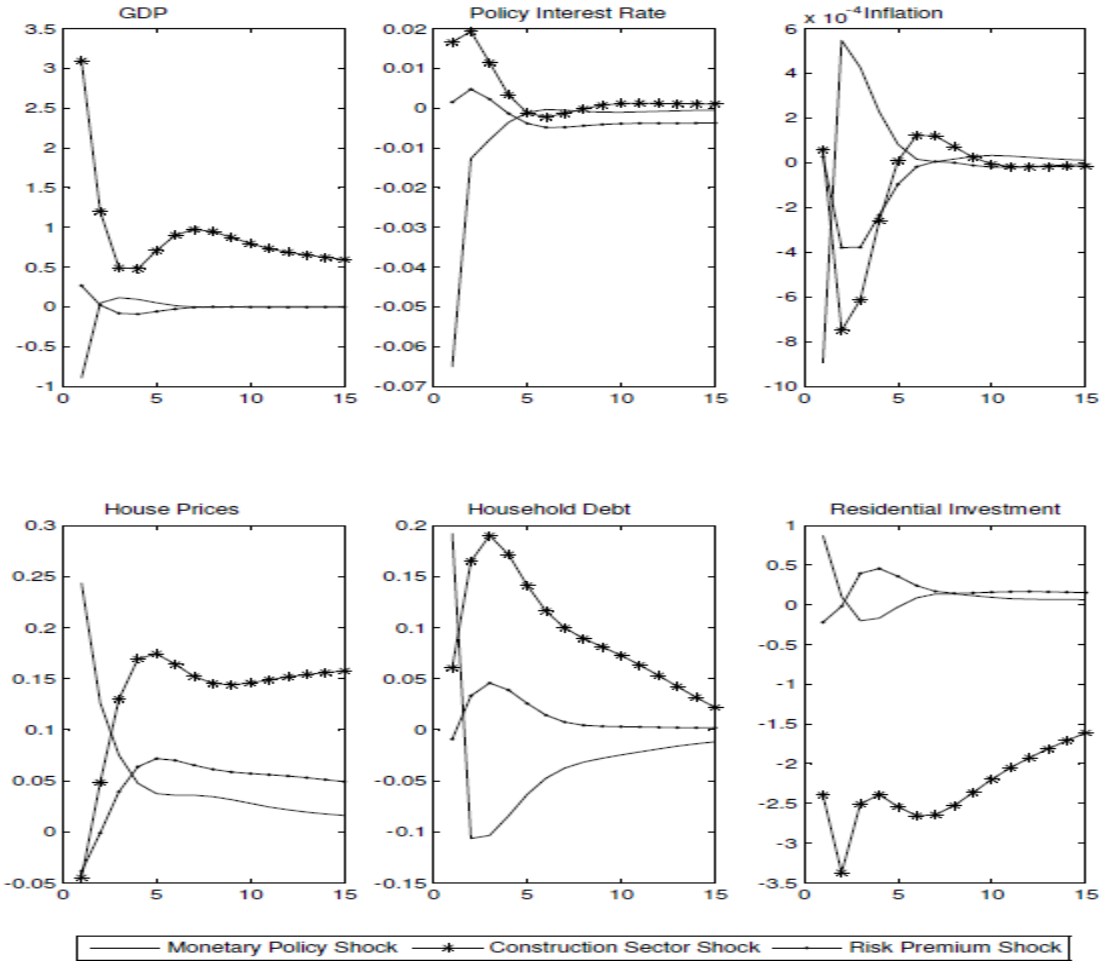


**Table 4: Variance Decomposition**

| Contribution of Shocks (%) | Productivity Shock | Income Class Shock | House Preference Shock | Monetary Policy Shock | Risk Premium Shock | Construction Sector Shock |
|---|---|---|---|---|---|---|
| GDP | 42.97 | 47.07 | 7.35 | 1.66 | 0.18 | 0.77 |
| Consumption | 20.47 | 59.13 | 17.82 | 0.26 | 0.26 | 2.06 |
| House Price | 10.52 | 29.88 | 21.29 | 1.89 | 1.96 | 34.45 |
| Household Debt | 26.02 | 35.41 | 36.03 | 0.19 | 0.08 | 2.26 |
| Residential Investment | 25.23 | 7.78 | 11.36 | 0.55 | 0.68 | 54.41 |

## 5. Panel VAR Applied to SEACEN Economies

In this section, I develop a Panel Vector Auto Regression (Panel VAR) model for the SEACEN economies under consideration in this project.[16] The sample period range from the first quarter 2000 until the first quarter 2016. The following system is estimated:

$$Y_{it} = AY_{it-1} + BX_{it-1} + u_i + e_{it}$$

where $Y_{it}$ is a *(kx1)* vector of dependent variables, $X_{it-1}$ is a $(1x1)$ vector of exogenous covariates, *A* is a *(kxk)*-dimensional matrix of the VAR coefficients on lagged domestic quantities and *B* is a regression coefficient to be estimated. $u_i$ and $e_{it}$ are *(kx1)* vectors of dependent variable-specific panel fixed-effects and idiosyncratic errors, respectively. For all $t > s$, $E(e_{it}) = 0$, $E(e_{it}e_{it}^{'}) = \Sigma$, and $E(e_{it}\, e_{it}') = 0$ for *t*<*s*.

I use the General Method of Moments (GMM) to estimate the Panel VAR, which regresses each endogenous variable on its own lag(s) as well as the lags of all other variables in the system. Following Love and Zicchino (2006), I apply forward mean differencing or orthogonal deviations (the Helmert procedure) to remove the fixed effects; all variables in the model are transformed in deviations from forward means (see Arellano and Bover (1995)).

To identify the shocks, the Cholesky's decomposition of the covariance matrix is adopted, which assumes a recursive exogeneity structure. Therefore, the first variable in the

[16] Mongolia is not included in the sample as the available data series are too short.

VAR is only affected contemporaneously by the shock to itself; the second variable in the VAR is affected contemporaneously by the shocks to the first variable and the shock to itself, and so on.

The variable included in the Panel VAR are: GDP, inflation, short-term interest rate, house prices, household debt, exchange rate and trade balance (% of GDP). All variables are expressed in real terms and their $log$, with the exception of the short-term interest rate and the trade balance which is expressed as a percentage of GDP. The model selection has included one lag.[17]

The ordering of economic activity, inflation and interest rates is standard in the monetary transmission literature. Den Haan and Sterk (2011) and Musso et al. (2011) order inflation before economic activity. However, ordering inflation after economic activity does not alter the results. Household debt and house prices are placed lower in the ordering. Assenmacher-Wesche and Gerlach (2010) argue that they should follow interest rates because monetary policy only reacts to asset price movements if these are prolonged, while asset prices react immediately to changes in monetary policy. Household debt is ordered after house prices because an increase in this variable makes more collateral available for mortgages, which eases the borrowing constraint of households (see Aoki et al., 2004 and Muellbauer and Murphy, 2008). Goodhart and Hofmann (2008) suggest that house prices should appear before financial variables because prices are probably stickier. Similarly, Musso et al. (2011) order house prices before credit because they interpret credit as a mortgage loan demand function. However, Assenmacher-Wesche and Gerlach (2010) order credit before housing prices, arguing that a shock to credit affects output and the price level with a lag, while house prices can react within one quarter to a shock. I order the exchange rate and the trade balance to GDP as the last variables, as it is assumed that the exchange rate respond to changes in monetary policy, thus attracting capital flows.

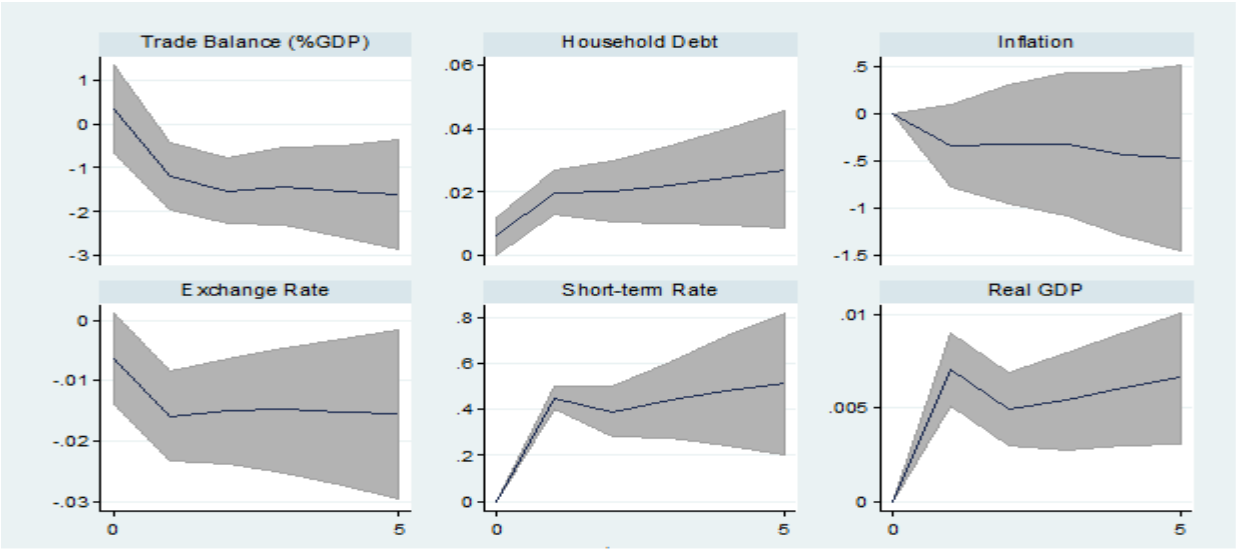
Figure 12 shows the impulses responses to a house preference shock. Real GDP, household debt and interest rate increase on impact, while trade balance runs a deficit and the exchange rate appreciates.

A positive productivity shock leads to increasing household debt, house price and interest rate, while the exchange rate appreciates and trade balance becomes negative (see Figure 13).

Finally an accommodating monetary policy also leads to a house price boom with consequential household debt increases. GDP drops initially but increases with some lag after 3 quarters. Similar to the other two shocks, the responses of trade balance and exchange rate are negative on impact (see Figure 14).

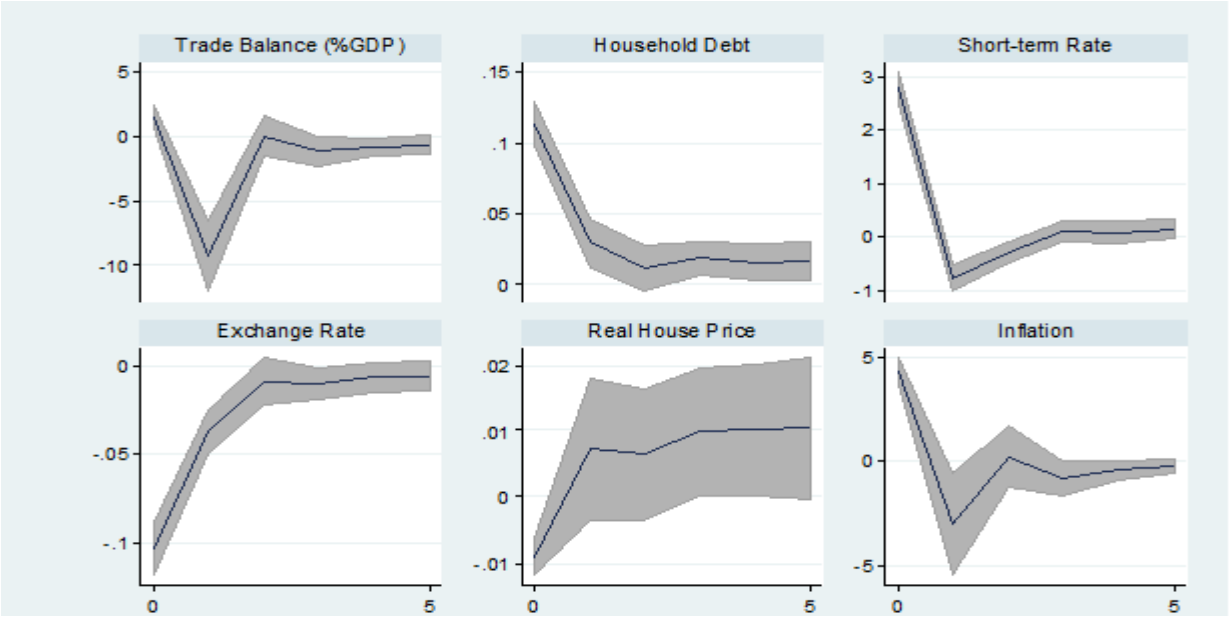
[17] The lag has been selected following Andrews and Lu (2001) by choosing the smallest BIC, AIC and QIC based on GMM estimation.

**Figure 12: Response to House Preference Shock**




Note: Grey area represents 95% confident interval.

**Figure 13: Response to a Productivity Shock**




Note: Grey area represents 95% confident interval.

**Figure 14: Response to a Negative Monetary Policy Shock**


Note: Grey area represents 95% confident interval.

Overall, the results from the empirical exercise are similar to the theoretical impulse responses found in the simulation of a DSGE model: household debt increase is associated with a housing price boom, which is driven by better economic performance, strong preference in investing in the real estate sector, and an accomodating monetary policy.

Table 5 reports the forecast error variance decomposition and shows the proportion of the unanticipated changes of a variable that can be attributed to innovations in the variable itself and to other variables in the system.

The monetary policy shocks explain about 20% of the variation of house prices and about 12% of the variation of the household debt over 10-steps ahead of the forecast error variance, while productivity shocks explain about 45% volatility of household debt. Increasing house prices also explain about 29% fluctuations of household debt over a longer time.

**Table 5: Variance Decomposition (Panel Data - Sample Size: 2000m1 -20016q4)**

| Response Variable and Forecast Horizon | Real GDP | Inflation Rate | Short-Term Rate | Real House Price | Household Debt | Exchange Rate | Trade Balance (%GDP) |
|---|---|---|---|---|---|---|---|
| **Real House Price** | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0.091765 | 0.525136 | 0.00911 | 0.37399 | 0 | 0 | 0 |
| 2 | 0.075012 | 0.261154 | 0.182548 | 0.393679 | 0.072228 | 0.002704 | 0.012675 |
| 3 | 0.066906 | 0.181216 | 0.225097 | 0.426291 | 0.088335 | 0.003514 | 0.008642 |
| 4 | 0.076678 | 0.136493 | 0.23228 | 0.448614 | 0.095093 | 0.004447 | 0.006394 |
| 5 | 0.082017 | 0.108045 | 0.229071 | 0.472575 | 0.097941 | 0.005325 | 0.005028 |
| 6 | 0.085279 | 0.087778 | 0.224693 | 0.492701 | 0.099302 | 0.006171 | 0.004077 |
| 7 | 0.087572 | 0.072584 | 0.221016 | 0.508417 | 0.10005 | 0.007002 | 0.003359 |
| 8 | 0.089116 | 0.06088 | 0.218198 | 0.520807 | 0.100384 | 0.007812 | 0.002803 |
| 9 | 0.09019 | 0.051677 | 0.216054 | 0.530704 | 0.10041 | 0.0086 | 0.002364 |
| 10 | 0.09092 | 0.044322 | 0.214397 | 0.538777 | 0.100202 | 0.00937 | 0.002012 |
| **Debt** | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0.703728 | 0.061108 | 0.113806 | 0.001953 | 0.119405 | 0 | 0 |
| 2 | 0.67116 | 0.058194 | 0.103614 | 0.021254 | 0.140293 | 0.001172 | 0.004312 |
| 3 | 0.648637 | 0.057082 | 0.100165 | 0.039341 | 0.146747 | 0.00366 | 0.004369 |
| 4 | 0.624874 | 0.053768 | 0.099686 | 0.058655 | 0.153565 | 0.005278 | 0.004175 |
| 5 | 0.598115 | 0.050672 | 0.101246 | 0.08038 | 0.159046 | 0.006594 | 0.003947 |
| 6 | 0.57005 | 0.047431 | 0.10442 | 0.103636 | 0.163315 | 0.007452 | 0.003696 |
| 7 | 0.541085 | 0.04412 | 0.108498 | 0.128424 | 0.166556 | 0.007878 | 0.003439 |
| 8 | 0.511644 | 0.040821 | 0.113118 | 0.154484 | 0.168804 | 0.007948 | 0.003182 |
| 9 | 0.48211 | 0.037567 | 0.118122 | 0.181403 | 0.170135 | 0.007736 | 0.002928 |
| 10 | 0.452835 | 0.034402 | 0.12338 | 0.208769 | 0.170615 | 0.007319 | 0.00268 |

## 6. Probit Analysis

A probit model is used to evaluate what affects economic recessions. I estimate a binary variable, $S_t = \{0,1\}$ as a proxy for the state of the economy, where the value of 1 indicates a GDP downturn and 0 otherwise. To be more specific, $S_t$ is derived from the turning points calculated in Section 4. Therefore, $S_t = w_{y,t}$.

Table 6 shows that a 10-percentage point increase in real house prices and loan-to-GDP relative to their trend, increases the probability of a recession in the current period by

about 3.5% and 3.1%, respectively. Equity prices, inflation and current account to GDP are not significant predictors of current recessions. See Table 6, Panel (a) - (b).

Table 6, Panel (c) to (f), explores the role of financial variables in predicting economic downturns 1 and 4-quarter ahead periods, $Prob(S_{t+i}=1), i=1,4$. Similar results hold as in Panel (a) and (b) with the exception of equity prices which become statistical significant and increase the probability of future recession by about 77% at 4-quarter ahead periods. Moreover, loans become more important in predicting 4-quarter ahead recessions. The predictive power over longer horizon is higher.

**Table 6: Probit Regression - GDP Recessions**

| | $Prob(S_t=1)$ | | $Prob(S_{t+1}=1)$ | | $Prob(S_{t+4}=1)$ | |
|---|---|---|---|---|---|---|
| | Panel (a) | Panel (b) | Panel (c) | Panel (d) | Panel (e) | Panel (f) |
| House Price | 0.035 *** | 0.034 *** | 0.038 *** | 0.035 *** | 0.035 ** | 0.032 ** |
| | (3.05 ) | (2.87) | (3.12) | (2.95) | (2.41) | (2.12) |
| Equity Price | 0.044 | -0.012 | 0.026 ** | 0.206 | 0.77 *** | 0.752 *** |
| | (0.34) | (-0.09) | (1.88) | (1.38) | (4.63) | (4.21) |
| Loan-to-GDP | 0.031 *** | 0.037 *** | 0.042 *** | 0.049*** | 0.047 *** | 0.050 *** |
| | (3.55) | (3.77) | (4.58) | (4.68) | (4.75) | (4.39) |
| Spread | | 0.000 | | 0.000 | | -0.000 |
| | | (0.57) | | (0.47) | | (-1.37) |
| Inflation | | -0.022 | | 0.051 | | 0.084 |
| | | (-0.59) | | (1.26) | | (1.90) |
| CA-to-GDP | | 0.005 | | 0.007 | | 0.012 |
| | | (0.67) | | (0.87) | | (1.24) |
| Pseudo $R^2$ | 0.0514 | 0.0621 | 0.0896 | 0.1067 | 0.1632 | 0.1825 |

Notes: ***, **, * denote significance at 1%, 5%, and 10%, respectively. Variables are measured as deviations from the HP filter.

Finally, the probability of recessions is estimated including downturn phases of financial variables, i.e., how would the probability of recession change if financial variables experience a bust after a boom phase. Table 7 shows that when house and equity prices experience a deep downturn, the probability of recession increases by 13% (11%) and 17% (15%) at current (1-quarter ahead) recession, respectively. House price downturns are no longer good

predictors for 4-quarter ahead recession. Increase in equity prices increases the probability of recession by about 90%. Downturns in loan-to-GDP are statistical insignificant in all three cases. The Pseudo $R^2$ improves substantially relative to Table 6.

**Table 7: Probit Regression - GDP Recessions**

| | $Prob(S_t = 1)$ | $Prob(S_{t+1} = 1)$ | $Prob(S_{t+4} = 1)$ |
|---|---|---|---|
| House Price | 0.0597 *** | 0.0613 *** | 0.0303 * |
| | (3.34) | (3.36) | (1.79) |
| House Price Downturns | 0.1301 *** | 0.1146 *** | 0.0430 |
| | (3.32) | (2.84) | (0.95) |
| Equity Price | 0.9139 *** | 0.9952 *** | 1.4301 *** |
| | (4.38) | (4.65) | (5.95) |
| Equity Price Downturns | 0.1702 *** | 0.1527 *** | 0.1481 *** |
| | (5.22) | (4.59) | (3.92) |
| Loan-to-GDP | 0.0305 *** | 0.0414 *** | 0.0519 *** |
| | (3.20) | (4.20) | (4.85) |
| Loan-to-GDP Dowturns | -1.2755 | -2.2252 | 0.8609 |
| | (-1.02) | (-1.57) | (0.67) |
| Pseudo $R^2$ | 0.1322 | 0.1508 | 0.2058 |

Notes: ***, **, * denote significance at 1%, 5%, and 10%, respectively. Variables are measured as deviations from the HP filter. Downturns are calculated as a decrease in a variable during its own recession.

## 7. Policy Implications

The previous sections have shown that house price peaks preceded by larger increases in household debt are associated with deeper recessions, weaker recoveries, and more pronounced household deleveraging. The fall in economic activity cannot be simply explained by a decline in house prices. Rather, it is a mix of falling house price and deleveraging of households. Indeed, recent theoretical models predict that household debt and deleveraging drive deep and prolonged slumps. In this context, macroeconomic policies are crucial to avoid excessive contractions in economic activity during phases of household deleveraging. While household debt can be beneficial in the short-term, economic growth and financial stability can suffer in the medium- and long-term. Even in countries with *low* stock levels of household debt,

a rapid expansion in credit may lead to an increasing fraction of highly leveraged households that may be vulnerable to shocks. The trade-off between benefits in short-term and cost of financial instability in the medium-term can be attenuated by a combination of good policies, institutions and regulations. For example in 1990, Scandinavian economies proposed fiscal transfers to unemployed households to sustain household incomes and improve their ability to repay their outstanding loans. If mortgages contracts are written with variable interest rates, an easing monetary policy can help reduce mortgage payments and prevent household defaults. Also strong support for the banking sector can reduce the risk of household balance sheet distress affecting banks' willingness to supply credit. It is also important to strengthen the protection of consumer finance. For example, policymakers can develop an efficient system for credit registries to improve the welfare of households vulnerable to overborrowing, such as transparency of financial contracts, financial education, prohibition of predatory lending, and regulation of certain financial innovation products. Shiller (2014) and Mian and Sufi (2015) suggest mortgage contracts to increase risk sharing between mortgage lenders and borrowers. Such contracts automatically write down the principal when the local property value falls below a specified threshold. In this way, lenders are better able to evaluate the local house price before extending credit and reduce the debt overhang problem of households when house prices fall.

The most common policies implemented since the global financial crisis are macroprudential measures, with the main goal of avoiding excess household leverage. Demand-side measures, such as limits on the debt-service-to-income ratio and loan-to-value ratio, seem highly effective. Supply-side measures targeted at loans, such as limits on bank credit growth, loan contract restrictions, and loan loss provisions, are equally effective. However, most of previous literature and most of the macroprudential measures that have been implemented by policymakers have targeted all borrowers or all types of loans. For example, lower loan-to-value ratio for all borrowers or higher capital requirements for all banks. Punzi and Rabitsch (2017) suggest targeting only risky borrowers in the design of an efficient macrorpudential policy. In particular, Punzi and Rabitsch (2017) consider the implications of macroprudential policies with the aim to lean against the excess in household debt by constraining the ability of the banking system to extend credit to only the highest leveraged households. They find that if macroprudential authorities target only higher leveraged borrowers, then a rule that countercyclically responds only to the growth of household debt-to-GDP for only this particular group, improves welfare relative to a macroprudential tool that targets all borrowers.

Thus, it may be advisable for policymakers to consider the LTV ratio distribution and tailor their policy towards highly leveraged agents in an economy.

## 8. Conclusion

This study aims to understand the causes and consequences of the surge of household debt in Chinese Taipei, India, Malaysia, Mongolia, the Philippines, Thailand and Vietnam.

Since 2010, these economies have experienced a rapid growth in household debt, stressing the need for intervention from policy makers. From the global financial crisis, we have learnt that increasing household debt can lead to possible threats to growth and global financial stability. As we learn from history, SEACEN economies do not want to repeat the experience of 2007.

Similar to many advanced economies, increased household debt-to-GDP in SEACEN economies is associated with the run-up in house prices. Analyzing Malaysia through the lens of a DGSE model and a cross-country Panel VAR, it is found that good economic performance, strong preference in investing in the real estate sector, and accomodating monetary policy are the main drivers of co-movements between household debt and house prices. Moreover, asset prices tend to peak before loan-to-GDP and GDP downturns, meaning that asset prices are good predictors of recessions. Indeed, changes in asset prices increase the probability of GDP downturns, and a burst in asset prices amplifies the change of curent and future recessions. Therefore, monitoring the housing market is essential to prevent further increase in household debt-to-GDP.

In order to avoid this, many SEACEN economies have been implementing measures to slow down the increase in household debt and house prices. While macroprudential measures have been used extensively, these tools have had marginal impact in leaning against excess credit and housing boom. This is due mainly to strong capital inflows and lower interest rates, which makes macroprudential tools less effective.

Therefore, it is important to balance the short-term benefits with the long-term costs of increasing household debt, and adopt a combination of good policies, institutions, and regulations, as only macroprudential tools are not enough.

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