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# BANK OF THAILAND DISCUSSION PAPER

ราคาสินทรัพย์และการส่งผ่านนโยบายการเงินของไทย

โดย

อมรา ศรีพยัคฆ์ และ สุกพินน์ วงศ์สินศิริกุล

มกราคม 2550

E-Mail Address: [amaras@bot.or.th](mailto:amaras@bot.or.th) and [sukpinnv@bot.or.th](mailto:sukpinnv@bot.or.th)

ข้อคิดเห็นที่ปรากฏอยู่ในเอกสารวิจัยนี้เป็นความเห็นส่วนตัวของผู้เขียนโดยเฉพาะ  
ซึ่งไม่จำเป็นต้องสอดคล้องกับนโยบายของธนาคารแห่งประเทศไทย

# **Asset prices and Monetary Policy Transmission in Thailand**

**Amara Sriphayak and Sukpinnarat Vongsinsirikul**  
**Bank of Thailand**  
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# **Asset prices and Monetary Policy Transmission in Thailand**

## **1. Introduction**

Asset price inflation has occurred in a low consumer price inflation environment in several economies. These experiences have given rise to a debate over the role of asset prices in monetary policy for at least a decade. Most central banks agree that asset prices are too volatile to be an additional target, but should be used as indicators to aid in the forecasting process. Many central banks using the inflation-targeting framework have kept a close track of asset price movements, especially those in the real estate sector. The motivation for this was based on the possibility that rising asset prices would increase wealth and confidence and thereby stimulate consumption and investment, resulting in increased inflation. Thailand's economic crisis in 1997 was partly attributed to the authorities' inability to control asset price inflation in the preceding period. Accelerating real estate prices at the time were not reflected in the consumer price index. Under the inflation-targeting framework, the Bank of Thailand thus decided to closely monitor and assess the pass-through effects from asset prices to inflation.

As stated in the quarterly *Inflation Report*, the role of monetary policy during an economic up-cycle includes not only taking care of inflationary pressure, but also monitoring indicators of potential financial imbalances. On many occasions since the recent property price acceleration, the press releases following Monetary Policy Committee (MPC) meetings have expressed the particular concerns of the MPC about the imbalances in the real estate sector. Since mid 2004, the Thai policy rate (RP 14 days) has been continuously raised so as to keep core inflation within the target range and the inflation expectation in check as price pressures increase. In light of the linkage between the policy rate and the minimum loan rate (MLR), and their links to all floating mortgage rates, real-estate demand was thus kept under control.

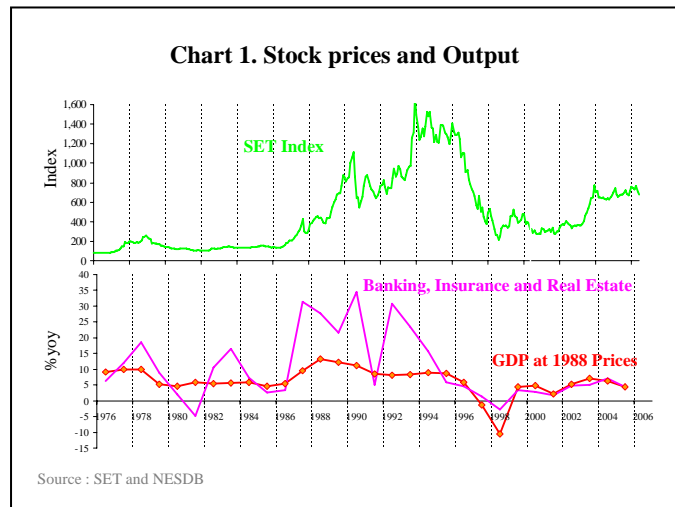
The purpose of this paper is to explore asset prices in Thailand in relation to monetary policy transmission, covering the complete loop of transmission from monetary policy to asset prices, from asset prices to the real economy and financial stability, and the subsequent implications on monetary policy. The paper is organized into 6 parts. This introduction is followed by Section 2, which presents an overview of the stock and housing markets in Thailand. Section 3 then provides a review of recent analytical studies on asset prices that have been carried out at the Bank of Thailand. Section 4 explores the impact of monetary policy via the asset price channel, which affects consumption and output in the real economy. Section 5 then includes some discussion on how the impacts of asset price changes on the real economy and financial stability would affect monetary policy implementation. Finally, section 6 concludes the paper.

## **2. The Thai stock and housing markets**

### **Pre-crisis overview**

Asset prices in Thailand have, since the early 1970s, encountered several boom and bust cycles. The largest boom of the cycles, which brought about a crisis in 1997, began in the late 1980s and continued into the early 1990s. The boom of the economy, along with large amounts of direct foreign capital inflows and low interest rates, stimulated rapid price increases in the Thai stock market. With the booming stock market, a significant portion of income from capital gains was channeled toward property acquisition. Meanwhile, fostered by attractive market prospects, financial institutions lent aggressively to the real estate sector, and such behavior increased liquidity in the sector and hence contributed to great financial performance of real estate companies. High profitability growth, in turn, reinforced the general optimism in

both the capital market and the real estate sector. Thus, prices in the stock and real estate markets moved closely together.



Throughout the 1990s, the real estate sector continued to grow. A source of funding came from inflow of funds via the Bangkok International Banking Facilities, which were initiated in 1992. This gave opportunities to domestic financial institutions to borrow foreign loans at low rates and to then lend the money to local housing developers. By the end of 1996, outstanding property loans reached 863 billion baht compared to 135 billion baht in 1989, increasing to around 19 percent of GDP. This growing real estate market

faced a temporary slow down in 1990 with the effect of the Gulf War, but on average the Thai housing market had expanded along with the growing economy at around 9.5 percent each year during 1987 through 1996. Increases in demand for property, as a result of great confidence in the economy together with easy lending practices, led to rises in property prices.

Although the housing market did initially help facilitate economic growth in Thailand, its downfall also affected other sectors of the economy. As construction costs were so high, developers could not lower prices, despite the excess supply. By 1997, the real estate market came to a sudden freeze. Supply exceeded demand in almost all areas of the property market and many building projects were left incomplete.

**Table 1: Relevant statistics of the real estate sector**

	1989	1991	1996	1997	1998	2001	2002	2003	2005
Investment in the construction sector/GDP (%)	13.8	16.1	11.9	6.2	3.5	3.2	3.6	4.1	4.6
Loans to real estate sector/total loans (%)	12.0	17.9	17.8	15.5	17.6	13.9	14.2	15.5	16.7
- Residential loans	3.5	11.0	8.9	7.4	7.5	8.3	8.7	10.0	11.2
- Loans to property developers	8.5	6.9	8.9	8.1	10.1	5.7	5.5	5.6	5.4
Commercial bank loans to real estate sector (% of GDP)	7.3	12.9	18.7	19.8	20.1	11.7	12.0	12.4	13.0

The real estate sector's performance obviously has implications on economic stability, through linkages with financial stability and household wealth—with the latter helping to determine aggregate consumption and investment. Overinvestment in the real estate sector brought about considerable non-performing loans that threatened the soundness of the commercial banking system and its ability to extend credits in the subsequent years. As shown in table 2, non-performing loans (NPLs) in the real estate and real estate related sectors still represented a higher proportion of total credits to the sectors than those of other sectors, which was a legacy from the burst of the property sector bubble following the 1997 crisis.

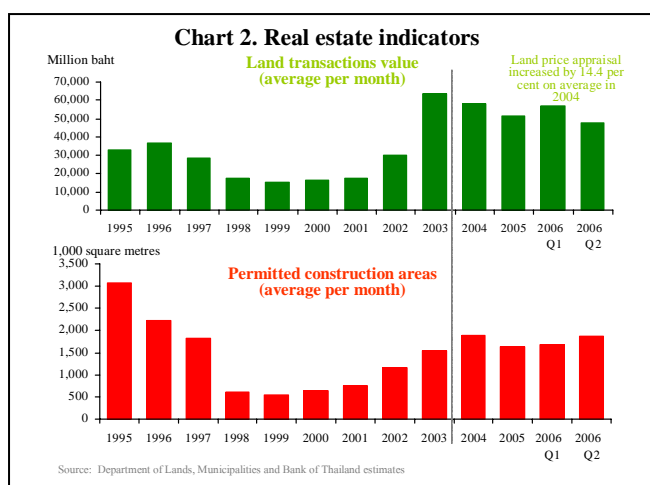
**Table 2: NPLs in selected business sectors  
(% of total loans to each sector)**

Sector	2001	2002	2003	2004	2005
Agriculture, Fishing and Forestry	19.3	23.4	17.3	14.8	11.9
Mining and Quarrying	18.8	19.5	19.4	16.4	15.8
Manufacturing	6.8	15.9	15.7	12.6	9.8
Construction	21.9	31.5	26.6	26.2	19.7
Real Estate Business	19.3	27.8	18.1	18.7	13.0
Public Utilities	3.1	6.9	6.8	5.7	2.3
Personal Consumptions	19.0	19.4	13.5	9.7	6.1
<b>Total NPLs</b>	<b>10.5</b>	<b>15.7</b>	<b>12.7</b>	<b>10.8</b>	<b>8.2</b>

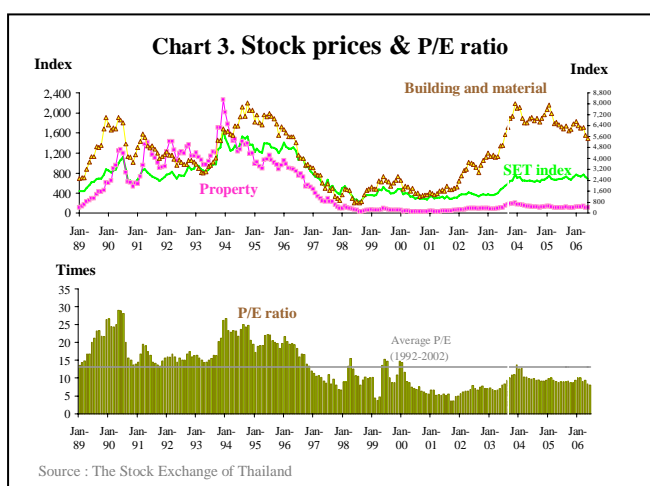
**Post-crisis behavior of asset prices**

Thailand’s real estate market remained sluggish after the economic crisis in 1997. The problem of non-performing loans impaired credit extension by the financial sector. Since the beginning of 2001, however, the government has introduced measures to stimulate the demand for real estate. These measures include personal income tax deduction for real estate buyers, reductions in transfer fees for real estate, tax exemption for residential real estate, and housing loan schemes for members of the Government Pension Fund. Together with the low interest

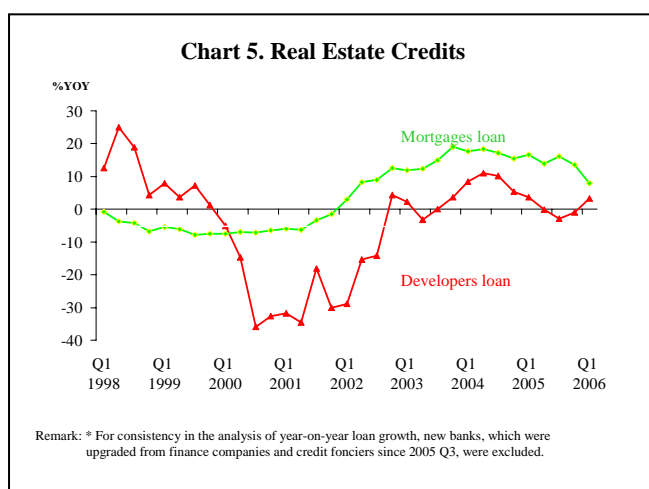
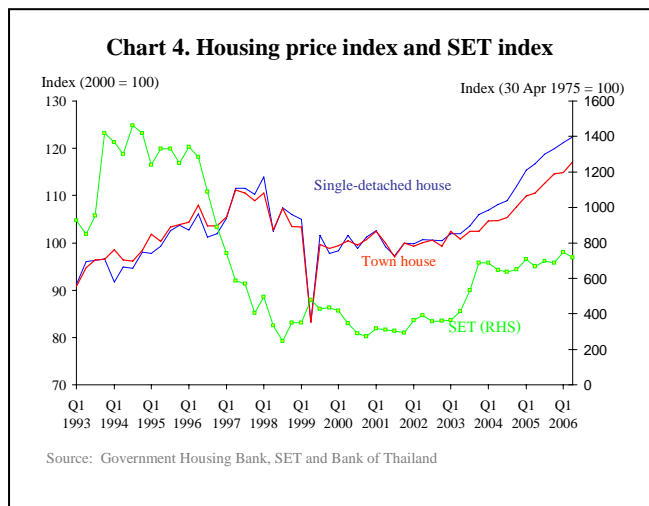
rate environment, these measures have helped revive the real estate market somewhat, and transaction volumes have shown a rising trend, especially in Bangkok and its vicinities. Stock market indices of the construction and property sectors have also edged up since the second half of 2001.



After a successful economic recovery particularly in the year 2003, during which the stock market gained 116 percent (the biggest gain among Asian stock markets—far greater than 73 percent for India, 65 percent for Pakistan, and around 30 percent for Hong Kong and Singapore), the Thai stock market leveled off in 2004. This slowdown was attributable in part to avian flu, unrest in the southern provinces, oil price volatility, and the tsunami disaster. Since the beginning of January 2005, however, the stock market has rallied, with capital inflows from foreign investors in anticipation of the renminbi appreciation. Nevertheless, there is no sign of overheating in the asset markets that could affect economic stability. The P/E ratio toward the end of



the first half of 2006 stayed at around 8 percent. The low P/E relative to Thailand’s historical average and to those for other foreign markets —16 percent for Malaysia and Singapore and 18 percent for the Philippines— suggests that there is potential growth in the stock market.



Although prices in the stock and real estate markets were intertwined as shown in Chart 4, the real estate market grew faster than the stock market throughout 2004, benefiting from the low interest rate environment and homeowners' greater access to bank loans, together with some government stimulus measures related to property transfer tax reductions. However, growth in property prices does not necessarily indicate an overheated market. Intense competition among entrepreneurs has limited the rise in sale prices and helped keep pressure off the property market. In 2005, overall real estate activities slowed down from the previous year in line with slowing demand, mainly as a result of higher oil prices, rising interest rates and removals of government stimulus measures, along with the imposition of new prudential measure related to the property sector. With more conservative commercial bank credit extensions to housing development projects, commercial banks' outstanding loans to real estate developers decelerated in growth terms from 6.4 percent in 2004 to only 0.4 percent in 2005. Nevertheless, during the second half of 2006, real estate

activities should improve as inflation was expected to moderate.

High economic growth in Thailand has contributed to expansion in the real estate sector and the stock market, and to concerns over future financial imbalances. Though the Bank of Thailand has no asset price target, asset price information is used to detect fragilities in the economy. If an asset price hike reflects overall demand pressure, monetary policy may be tightened along with a stepping up of prudential measures to safeguard macroeconomic stability as well as financial institutions' stability. In some cases, however, if the use of monetary policy is likely to be too broad to address the problem, even though it pertains to macroeconomic stability, the Bank of Thailand may opt to use prudential measures, instead of tightening monetary policy. As was the case in December 2003, the Bank of Thailand took preventive anti-speculation measures and played its part in promoting good corporate governance by stipulating that financial institutions: (1) Lower the post-construction loan-to-value ratio to 70 percent for residential property with the transaction price exceeding 10 million baht; (2) Extend credit to property developers only when the projects are legal; and (3) Report to the Bank of Thailand on new real estate loans made over 100 million baht on a quarterly basis.

### **3. Literature review**

Being aware of the important role played by asset markets in the economy and the conduct of monetary policy, the Bank of Thailand has paid attention to analytical work in this area. The study by Disyatat and Vongsinsirikul (2002)<sup>1</sup> found that, during the period of 1993-2001, the interest rate channel played the dominant role in transmission in Thailand and accounted for almost half of the transmission to the real sector. This study compared the relative importance of each channel; however, the bank lending channel<sup>2</sup>, the exchange rate channel and the asset price channel each contributed to the pass-through of monetary policy by around 17 percent, while the interest rate channel accounted for the rest which represents almost half of the total transmission to the real economy<sup>3</sup>.

The asset price channel in this study covered only equity prices. The relatively small importance of the asset price channel through equity prices follows from the fact that firms' reliance on equity financing has not been very significant compared with bank loans and debt instruments, while stock holdings also make up only a small fraction of the household sector's wealth. Thus, at the macro level, both private investment and private consumption respond not very significantly to changes in equity prices. However, given continued developments in the capital market in Thailand, monetary policy transmission through equity prices is expected to strengthen in the future.

Asset price imbalances have generally been observed to lead to economic instability, which monetary policy should aim to prevent. Can monetary policy actually preempt or mitigate such impacts? A study by Ahuja, Mallikamas, and Poonpatpibool (2003) found regularities in the movement of asset prices (see the stylized facts of asset prices in appendix A) and real sectors and employed several methods to identify an asset bubble in Thailand. First, this study compared the implied risk premiums for any given P/E ratios, derived from Gordon's formula, with assumptions of GDP growth and current interest rate as proxies for the future earnings growth and the future interest rate. Based on the intuition that if there is no reason to believe that the risk premium should be any different today from what it used to be, on average, and they turn out to differ, then it is argued that an asset price bubble may be at play. Equity price is overvalued when the imputed risk premium in that period is below its historical benchmark. It was found that equity price is somewhat overvalued in 1989 and 1993. As for 2002, it is clear from these measurements that equity price is undervalued compared with historical averages using the average risk premium during 1980-2002.

Second, using the noise-to-signal ratio approach, they calibrated for thresholds appropriate for crisis signaling in the case of the crisis of 1997. They found that the thresholds for credit-to-GDP, the real exchange rate and the real SET (Stock Exchange of Thailand) index are 4, 5, and 13 percent, respectively, above each of its trend. The three composite indices all signal potential danger in 1995.

Traditional means, namely the price-to-earning ratio and Gordon's formula have been tested to identify past episodes of asset price bubbles in Thailand. An indirect approach,

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<sup>1</sup> This study uses VAR analysis on quarterly 1993-2001 data of policy rate, GDP and proxy variables for each channel. In measuring a channel impact of an interest rate impulse, one can compare the impact of the case with the particular channel closed (by exogenizing that representative channel variable) to the one of the case with that channel opened (by endogenizing that representative channel variable). The difference will represent the impact of the channel of interest

<sup>2</sup> Note that the effectiveness via the bank lending channel has declined after the crisis due to the weakened banking sector which was greatly hit by the crisis.

<sup>3</sup> The impact of interest rate channel found in this study could be overstated because this methodology did not consider the expectation channel.

analyzing the symptoms of bubbles or “financial imbalances” as early warning indicators, is found to be consistent with the traditional stylized facts.

Together with facts found in Ahuja et al. (Appendix A) about the pro-cyclicality of asset price cycles with private credits and the one of private credits with real sectors, private credits, as an early warning indicator, indicates that a link between asset price movements and real economy exists via the financial sector involving banking, corporate and households, who are key players in the financial sectors. Therefore, an asset price imbalance may pose a risk of financial imbalance on the banking, corporate, and household sectors and, equivalently, on to the real economy.

The upswing in demand for housing and property lending in 2004 raised some concerns about the possibility of an asset price bubble. Moreover, another important question is whether there is a role for monetary policy. Two studies attempted to address those concerns. First, a study by Nakornthab, Karnchanasai, and Piamchol (2004) examined the link between the property market and the banking sector and assessed the risk of asset price acceleration during 2004 on the banking sector. Second, a paper by Moenjajak, Imudom, and Vimolchalao (2004) explored the causes of financial instability in more general terms and the role for monetary policy under inflation targeting.

In Nakornthab et al.’s work, the risk to the banking sector from the connection between the property and banking sectors was analyzed. In the period up to 1996, loans from banks and finance companies were the major source of pre-financing in the real estate market, averaging around 87%. Since 1997 the structure of pre-financing has changed greatly because most of the finance companies went bust. Banks now capture more than a 60% share, and the capital markets capture another 30%. Although bank loans cover a greater share of total pre-financing, in absolute amount, they have been much less than before. The capital markets now play an important role in the pre-financing of large property developers. Nevertheless, commercial banks still have the prominent role in financing the real estate market. For post-financing of property, due to limited access to other sources of financing, most (about 90%) homebuyers borrow from financial institutions. Consumers generally borrow 70-80% of the home value with the remainder from their own pockets.

From the structures of pre- and post-financing, loans from commercial banks are the most important source of funds in the property sector. Therefore, they are important in determining both supply and demand of the property market and hence property prices. Loose bank credit policies and low interest rates not only generate real demand for property, but also stimulate speculative demand and excessive supply. These drive up property prices and may lead to a speculative bubble. Hence, the acceleration in bank credit to the property sector needs to be watched closely.

Banks’ exposures to the property sector, besides banks’ property-related loans, include collateralized properties used in the calculation of loan provisions and foreclosed properties that banks possess. From 2003 annual reports, the total property-sector exposures of Thai banks amounted to nearly 50 percent of the total combined asset base. The largest exposure was the collateral used in the calculation of required provisions, which accounts for more than two-third of banks’ total exposures. And most of the properties foreclosed were previously collateral of loans that had turned sour, which represented about 2.5 percent of Thai banks’ total assets in 2004. Having such sizeable non-income generating and highly illiquid assets, which are sensitive to property price volatility, on balance sheets will entail high costs and great risk for Thai banks as property prices change.

With such high exposure of Thai banks to property prices, if there is a drastic fall in property prices, it would have a great impact on banks’ balance sheets in terms of their expenses from five sources: an increase in required loan-loss provisions, a loss of interest income, an increase in NPL resource costs, losses on impairment of properties foreclosed, and



losses from bank-owned Asset Management Companies. After a stress test of a 30 percent drop in property prices, Nakornthap et al. found that Thai commercial banks as a group have enough capital to absorb the losses induced by a severe price stress. Banks felt the need to have capital high enough to act as a cushion for hypothetical capital loss due to the remaining high non-performing assets foreclosed after the crisis. Had there not been substantial amount of provisions that banks currently have in excess of the BOT regulation, the story would have turned out differently.

Property prices can affect the economy in various ways. Given that banks' exposure to the property market is quite significant and bank loans remain the most important source of funding for both households and firms in Thailand, developments in property prices have important implications on the behaviors of banks, corporate, and households in loan markets as well as their demand for property, and, as a result, on bank soundness, credit growth, and private consumption and investment.

Moenjak et al. studied the link of asset price imbalance to financial imbalance in the corporate and household sectors via the balance sheet effect, which relates directly to the bank lending channel, and the wealth effect. Because of asymmetric information between banks and borrowers, banks require collateral in order to reduce loan risk. For the banking sector in Thailand, which practices collateral based lending, the value of collaterals, mostly properties and real estates, or the value of the asset side on a borrower's balance sheet determine the associated loan amount. Since about 80% of collateral are properties, any property price fluctuations will reflect on the fluctuation of collateral value and consequently affect lending behavior.

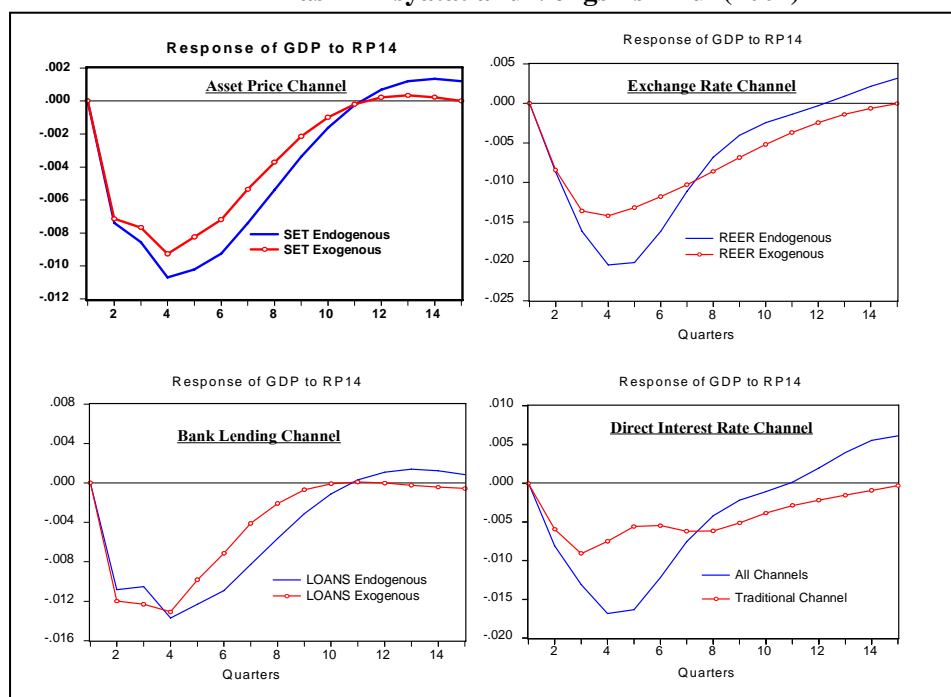
In the up-cycle of asset prices, higher asset prices increase firms' and households' net worth and collateral value could improve their access to funds and lead to excessive borrowing which facilitates further asset price speculation. As happened during the pre-crisis period, real estate prices rose and, consequently, the net worth of collateral increased and encouraged greater borrowing. Moreover, increases in perceived lifetime wealth of household and corporations holding properties have the wealth effect causing aggregate demand to increase. At the same time, rising property prices increase the net worth of banks and allow banks to be able to extend more loans. With increased lending, this will stimulate more demand feeding back to economic activities and asset prices. In the down-cycle of asset prices, loan contraction due to the balance sheet channel will propagate an economic downturn. Moreover, if a broad drop of asset prices is substantial to the point that, as a result, falling value of collateral does not cover existing loans or the value of equity falls much short of debt, then financial positions of the corporate as well as the household sectors would be off-balanced and the probability of borrowers reneging would rise. If the impact is across the board in the corporate and household sectors, the problem will become systemic and the banking sector would be affected. Making such a bearish environment even worse, the wealth channel reinforces the economic downturn because declining wealth as a result of an asset price fall causes aggregate demand to shrink.

This linkage shows that property prices and bank lending, as well as the economy as a whole, have cycles that move together as confirmed by the facts found in Ahuja et al. that asset price normally fluctuates with private credit, with equity leading it by 1-2 years and real private credit and output are highly correlated, with the former lagging the latter slightly by about 0-1 year. Therefore, asset price imbalance could cause financial imbalance and propagate the imbalance onto the real economy via the balance sheet channel.

#### 4. Effects of asset prices on the transmission mechanism of monetary policy

According to Disyatat and Vongsinsirikul's results, a monetary tightening (corresponding to a rise in the policy rate of one standard deviation or around 200 basis points) results in an immediate but small fall in equity prices of approximately 4 percent that lasts about six quarters. Moreover, for the period of 1993-2001, this asset price channel is significant, though playing a minor role relative to the interest rate channel. In this paper, two additional methodologies were used to examine the asset price channel and how it changes over time. Firstly, an analysis was made using the Bank of Thailand's Macroeconometric Model (BOTMM)<sup>4</sup>, and secondly, a cross-correlation analysis was performed.

**Chart 6. Monetary policy transmission using VAR approach as in Disyatat and Vongsinsirikul (2002)**



#### 4.1 Analysis using BOTMM

##### Financial and physical wealth effects

Firstly, we use the BOTMM to separately examine the links from the policy interest rate to asset prices and from the asset prices to the real sector, the consumption and the GDP.

Given the real estate sector's importance to the Thai economy, physical wealth in the form of real estate<sup>5</sup> can affect private consumption, and therefore has been added into the durable consumption equation of the BOTMM since October 2005. The model uses townhouse prices with land as a proxy in order to incorporate the impact of physical (property) wealth, in addition to financial (equity) wealth, on private consumption. Meanwhile, the behavioral equation of townhouse prices with land was explained by the difference between the minimum lending rate and inflation expectation in the previous period and its own one-period lag. Therefore, transmission of a monetary policy change having an impact on property prices and

<sup>4</sup> The BOTMM is the ECM (Error Correction Model) approached system of equations covering 4 sectors, namely real, government, external, and monetary, as well as prices. It is officially used as the economic forecasting model at the Bank of Thailand.

<sup>5</sup> The equity price channel has been incorporated into the BOTMM since the beginning use of the model in 2000, but the house price channel has recently been incorporated into the BOTMM since October 2005.

on consumption via the property wealth effect, together is considered the property price channel. These equations from the BOTMMJul06, which was estimated over the sample period of 1993Q1-2006Q1, are shown in Appendix B.

From the BOTMM, a simulation of an increase in the policy rate leads to falls in physical (property) wealth, as proxied by property price, and financial (equity) wealth, as proxied by equity holdings. More specifically, financial wealth (equity holdings) drops by a 1.03 percent deviation from baseline in a year after a positive 10-percent policy rate impulse compared to physical wealth (property prices), which drop by a 0.64 percent deviation from baseline. That is, equity wealth is much more responsive to a change in interest rate than are property wealth.

Comparing the property and equity wealth effects, simulations of 10-percent increases in the house price index and equity holdings are performed separately. A rise in house prices does not have much accumulated impact on durable consumption and output for they deviated by only 0.3 and 0.04 percent from baseline in a year, respectively, compared to 2.85 and 0.25 percent responses of those two to a rise in equity prices. One of the reasons for a smaller impact of interest rate changes via the property price channel compared to the equity price channel is that the data we use to represent property prices in the model, the price index of townhouse with land, may not be a good representative, although it is the most optimal in terms of statistical best fit and significance out of all property price data available at the time<sup>6</sup>. This price index of townhouse with land is composed from the housing loan data of the Government Housing Bank, which accounts for 30 per cent of the total housing loans in the country and covers mostly the medium-to-low-income home-buyers in Bangkok and the vicinities. Therefore, the wealth effect may not be significant among this group of medium-to-low-income home-buyers as they may be constrained from refinancing or leveraging on their wealth increase. From these simulations (results shown in boxes in Appendix B)<sup>7</sup>, note that although the total impact of the property wealth effect is smaller than that of equity wealth affect, consumption and output respond more strongly and immediately to property price change, but then the impacts of property price change fade out much more quickly too. The findings here will help in understanding the property and real estate price channels and their significances in the Thai monetary policy transmission as detailed next.

### **Asset price channels**

In addition, we also use the BOTMM to examine the relative importance of monetary policy transmission channels. The analysis using the BOTMM follows the same concept, in finding each channel's transmission impact, as that used in the aforementioned VAR approach (Chart 6), by making a comparison of the GDP responses to an innovation in policy rate<sup>8</sup> between the model with all transmission channels and the model with the channel of interest blocked off. The difference would be the impact of the channel of interest. The assets of focus explored in the BOTMMJan03 are equities, and a change in equity holdings would determine a consumption movement, which reflects the equity wealth effect. The channel, for which a

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<sup>6</sup> New data series of property price and its related indices will be composed from housing loans of greater coverage such as loans by commercial banks in other provinces. These series are under the development by the Bank of Thailand and the completion is expected by the end of 2006.

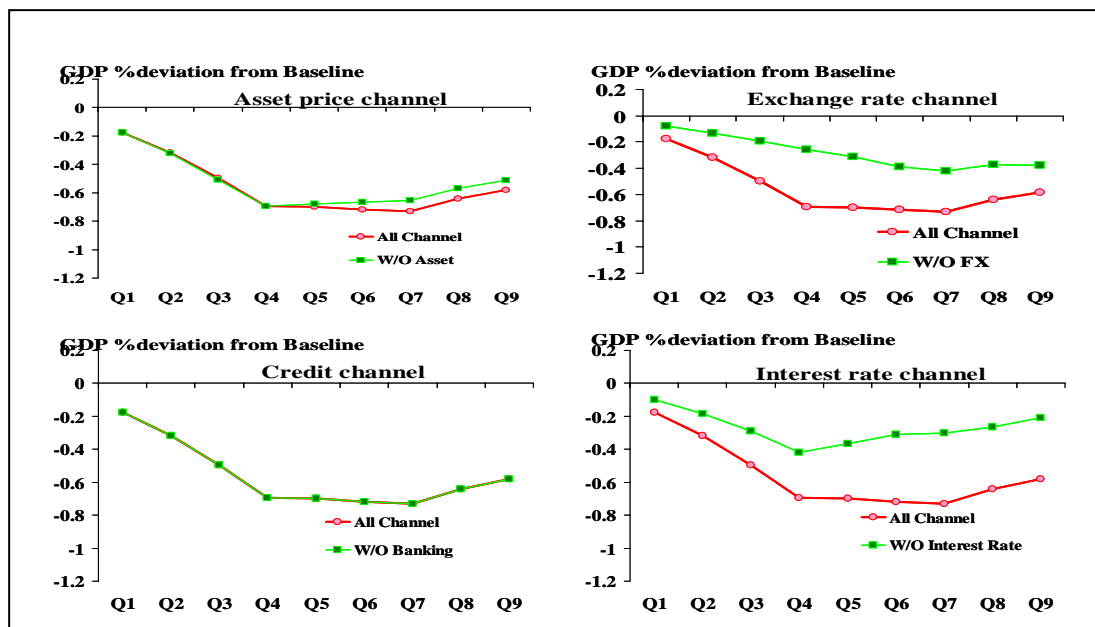
<sup>7</sup> Appendix B provides the model equations related to wealth, property prices and equity holdings in consumption equations. It also shows the results of model simulations in 3 cases: 10-percent shock of policy interest rate, 10-percent shock of equity holdings, and 10-percent shock of index of townhouse with land.

<sup>8</sup> The analysis explores the monetary policy transmission of a permanent shock of one standard deviation of policy rate (approximately 1.75 percent) on the BOTMM.

policy rate change has an impact on equity holdings and therefore on consumption, is considered the asset price channel in this model. Results from the VAR analysis of Disyatat and Vongsinsirikul above are confirmed by the analysis using the BOTMMJan03<sup>9</sup> as shown in Chart 7<sup>10</sup>. For a similar sample period of 1994Q1 to 2002Q3, the asset price channel<sup>11</sup> did not have a major role in monetary policy transmission compared to the interest rate and the foreign exchange channels as shown in Chart 7.

As the sample extended to 2006Q1, Chart 8 shows that the asset price channel in the BOTMMJul06<sup>12</sup> becomes more prominent because the transmission of monetary policy as a whole has regained its effectiveness in recent years. However, the relative importance of the asset price channel to other channels remains more or less the same. Given the limited size of the second-hand housing market, this channel is likely to remain of smaller importance compared with other channels.

**Chart 7. Channels of monetary policy transmission using BOTMM Jan 03 of 1994Q1-2002Q3 sample period**



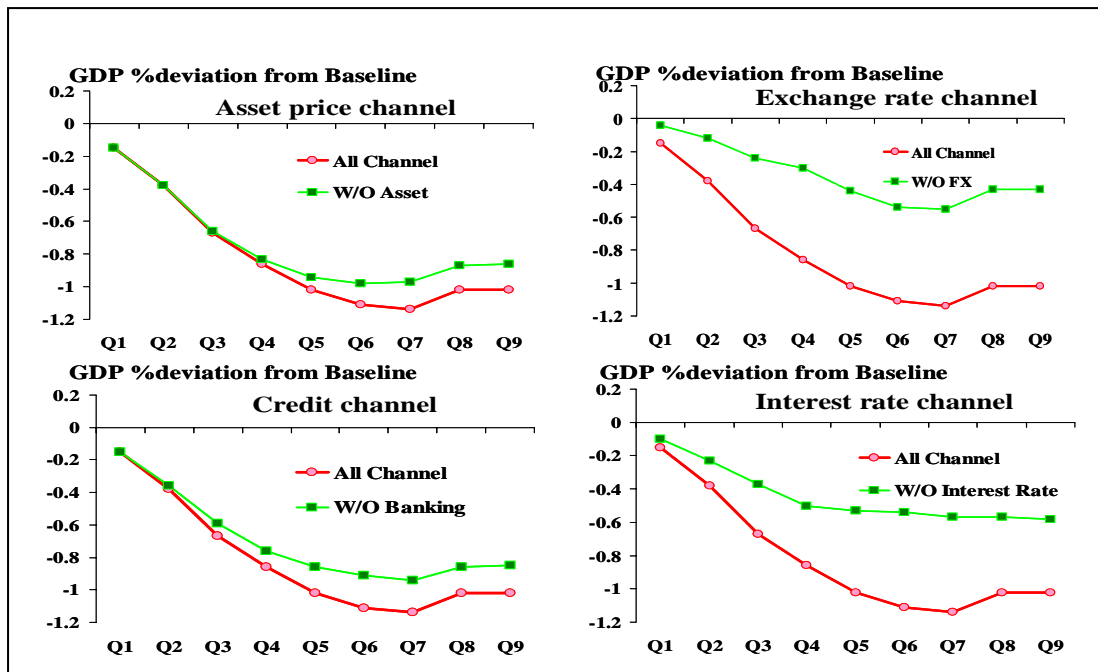
<sup>9</sup> The BOTMMJan03 is the estimated model using data from 1994Q1 to 2002Q3.

<sup>10</sup> The impact of interest rate channel found in this study could be overstated because this methodology did not consider the expectation channel.

<sup>11</sup> Here, in the BOTMMJan03, assets mean equity holdings including stocks and bonds incorporated to represent financial wealth. Property prices, proxied by price index of townhouse with land to represent physical or property wealth, were not incorporated into the BOTMM until October 2005.

<sup>12</sup> The BOTMMJul06 is the estimated model using data from 1994Q1 to 2006Q1.

**Chart 8. Channels of monetary policy transmission using BOTMM Jul 06 of 1994Q1-2006Q1 sample period**



From the aforementioned model (as of July 2006), a change in equity prices has a greater impact on consumption than the one of a change in property prices. Moreover, the sensitivity of asset prices to interest rates differ as stated earlier in this section where a simulation of a 10-percent policy rate rise on the BOTMM showed that equity prices are more sensitive than house prices to interest rate changes. Therefore, the transmission via equity prices in this model is more effective than the one via house prices. This finding may contradict the conventional view that property wealth should have a greater influence on consumption than equity wealth since the monetary gain from a property price increase is more permanent than the one from an equity price increase and hence property prices should be more sensitive to interest rate changes than equity prices.

A possible explanation could be linked to the determinants of asset prices according to Gordon's formula. The present value of an asset depends on the future stream of earnings from that asset and future interest rates, as discounted factors of that stream of earnings. The interest rate as a discounted factor will have the same impact on both equity and property prices. But the future stream of earnings generated by equity depends on the investors' view of economic prospects which also varies with interest rate. Compared to future earnings of equity, the ones of property depend less on interest rates and hence are less sensitive to interest rates since most house or home purchases are for necessity rather than for speculation given the house price samples among medium income earners. Therefore, equity prices, determined by future discount factors and future earnings, both of which depend on interest rates, are more sensitive to interest rates than property prices.

## 4.2 Cross-correlation analysis

Offering complementary findings to the previous analysis, correlation analysis can provide implicated relationships between variables related to the asset price channel for each sub-sample period, which would not be possible in the BOTMM analysis due to minimal sample size requirement for regression analysis. This method may partially explain the lagged measurement of transmission which is derived from the BOTMM analysis. The results (Table 3) confirm the findings about the equity price channel found via the BOTMM analysis, namely that a change in equity wealth has more or less the same influence on consumption before and after the crisis (0.56, 0.46, and 0.55 for the sub-sample periods of 1993Q1-1997Q4, 1999Q1-2002Q4, and 2002Q1-2005Q4, respectively). As for a change in policy or interest rate, the correlations of these with a change in equity value in all three sub-sample periods are all negative, with approximately the same values: -0.41, -0.63, and -0.35 for the period of 1993Q1-1997Q4, 1999Q1-2002Q4, and 2002Q1-2005Q4, respectively. The results confirm the finding about the equity price channel using the BOTMM analysis, that the equity price channel has more or less the same effectiveness across all periods.

With respect to property prices, the correlation between changes in price index of townhouse with land, and changes in consumption during 2002Q1-2006Q1, are, although small, much greater than the pre- and post-crisis periods (0.34, 0.19, and 0.02, respectively). However, when looking at the whole-sample period (1993Q1-2006Q1), the impact of the wealth effect during the 2002Q1-2006Q1 period is diluted by the larger sample coverage, which includes the 1999-2002 period of weak link between property price changes and consumption changes after the crisis (see Table 4). Moreover, the unusually low interest rate environment during 1999-2002 boosted the demand for property and therefore drove up house prices. During that time, a small rise in interest rates could not undermine the strong demand for properties due to the unusual low interest rate environment. Therefore, the unusually low and positive correlation between changes in interest rates and changes in townhouse price index suggests that house prices rise with interest rate during 1999-2002. These two correlations, together, imply that the property wealth effect on consumption has recently been effective, but the pass-through of interest rate to property prices is overwhelmed by a major rise in demand for housing as a result of the low interest rate environment and sociological and demographical changes in recent years<sup>13</sup>. As a result, monetary policy transmission via the property price channel is still not working in the usual way and has not been signified in the BOTMM analysis.

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<sup>13</sup> In Thailand, the trend of family structural change, from extended to nuclear family households, has continued widely during the past decade. Moreover, during an unusually low interest rate environment and low property prices, many workers who have houses in the suburb started to find second home by buying apartments in Bangkok for the convenience in commuting to work.

**Table 3: Pairwise cross-correlation among the first differences of policy rate, securities value, and real durable consumption**

Period		d(rp) and dlog(bmcap)*		d(mlr) and dlog(bmcap)		dlog(bmcap) and dlog(cpr1)	
		Leading**	Contemporaneous	Leading	Contemporaneous	Leading	Contemporaneous
Whole Sample							
93Q1-97Q4	Pre-crisis	<b>-0.41</b>		0.04	<b>0.36</b>		<b>0.56</b>
93Q1-02Q4	Post-crisis	<b>-0.55</b>			<b>-0.34</b>		<b>0.4</b>
93Q1-06Q1	Present	<b>-0.51</b>			<b>-0.32</b>		<b>0.39</b>
Sub Sample							
93Q1-97Q4	Pre-crisis	<b>-0.41</b>		0.04	<b>0.36</b>		<b>0.56</b>
99Q1-02Q4	Post-crisis		-0.63		<b>-0.53</b>	<b>0.46</b>	
02Q1-06Q1	Present		-0.35	-0.49	<b>-0.36</b>	<b>0.55</b>	

\* d(a) is first difference of a, dlog(a) is first difference of log(a), rp =14-day repurchase rate or policy rate,

mlr = minimum loan rate, bmcap = securities value representing equity value, cpr1 = private durable-goods consumption

\*\* Leading of correlation between A and B represents the correlation of A one quarter ahead and B.

**Table 4: Pairwise cross-correlation among the first differences of policy rate, price index of townhouse with land, and real durable consumption**

Period		d(rp),dlog(plandth)*		d(mlr),dlog(plandth)		dlog(plandth),dlog(cpr1)	
		Leading**	Contemporaneous	Leading	Contemporaneous	Leading	Contemporaneous
Whole Sample							
93Q1-97Q4	Pre-crisis	<b>-0.27</b>	-0.16	0	<b>-0.35</b>	0.19	<b>0.19</b>
93Q1-02Q4	Post-crisis	<b>-0.04</b>	0.1	0.21	0.17		<b>0.13</b>
93Q1-06Q1	Present	<b>-0.03</b>	0.1	0.21	0.16		<b>0.14</b>
Sub Sample							
93Q1-97Q4	Pre-crisis	<b>-0.27</b>	-0.16	0	<b>-0.35</b>	0.19	<b>0.19</b>
99Q1-02Q4	Post-crisis	0.05	0.4	0.37	0.29	-0.17	<b>0.02</b>
02Q1-06Q1	Present	0	0.2	0.31	0.16	-0.58	<b>0.34</b>

\*plandth = price index of townhouse with land representing property prices

\*\* Leading of correlation between A and B represents the correlation between A one quarter ahead and B.

In the case of the correlation between equity holdings and interest rates, a negative correlation is found, which is particularly strong during 1999-2002 when the interest rate was very low. The implication is that, after the crisis, equity wealth may be more sensitive to interest rate movements, while their influence on consumption remains the same. Therefore, the equity price channel becomes more effective after the crisis. On the other hand, house prices are not sensitive to the low interest rate environment, but have a greater wealth effect on consumption in the recent years, compared to the pre-crisis period. Hence, monetary policy transmission via the house price channel seems to be less effective. However, house prices

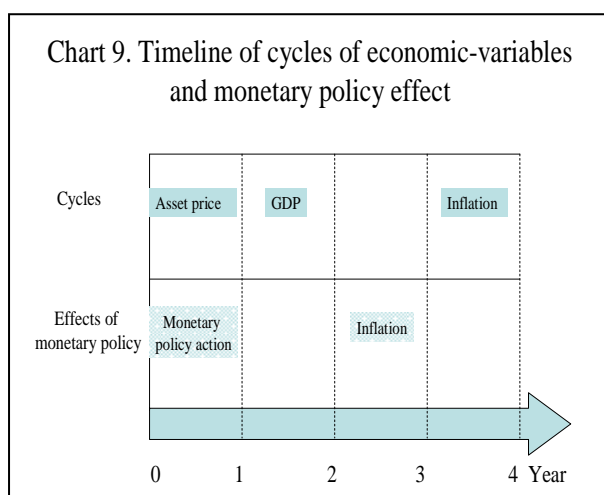
have a greater impact on consumption than ever before. Therefore, the cross correlation analysis suggests that monetary policy pass-through via the equity price channel is more effective than via the house price channel.

In conclusion, the asset price channel is significant, although not as prominent as some other channels, especially the interest rate channel. Among the assets in the BOTMM, the equity price channel is shown to be more effective than the house price channel. Despite a recently more effective property price effect, measurements of the pass-through based on regression models of whole-sample historical data could cause a time lag in the measurements and, especially when the economy has gone under a major structural change after the crisis, it can mislead and undermine the actual impact of the asset price channel in the present (2002-2006) compared to the one 4 years ago of post crisis period (1999-2002).

### **5. Monetary policy and financial stability: the inflation targeting case**

Since financial instability could undermine price stability and long-term output growth, which are the main objectives of monetary policy, it is necessary for the MPC to consider financial stability as one of its goals. However, it is very difficult to define financial stability precisely enough for actual use and hence to put it into the policy function.

Another reason for not adding a financial stability term into the policy function is the



unsynchronization of asset price imbalance and inflation. From the findings of a cross correlation analysis by Ahuja et al. (Appendix A) and Moenjok et al., condominium and real equity prices are found to lead core inflation by at least 3 years (Chart 9). Given that the price stability is the overriding objective of monetary policy, had the asset price imbalances not synchronized with the movement of inflation, monetary policy would address its first objective. As a normal practice, inflation and output are projected forward to a two-year horizon, since that is about the time it takes monetary policy to affect future

inflation and the real economy. If an imbalance buildup occurs within this two-year horizon, but is not expected to significantly affect inflation or output within the horizon, under the normal setting, there is no ground for the central bank to hike the policy rate to suppress the imbalance buildup. The results suggested that monetary policy under inflation targeting that focus on 8 quarter-ahead inflation might not be able to address timely the risk of asset price imbalance buildups.

Therefore, it is probably more practical to incorporate financial stability issues into monetary policy formulation via a longer time horizon, as well as a more comprehensive balance of risks in inflation consideration. As the risk on inflation posed by imbalance may not be reflected in the 8-quarter outlook, the MPC deemed a close monitoring of any financial imbalance development in the economy. In doing so, several methods are employed. It is necessary to rely not only on early warning indicators but, more importantly, financial surveillance indicators (FSI) and macroeconomic stress testing.

In a study by Ahuja et al., thresholds were found for credit-to-GDP, real exchange rate and real SET index, and also composite indices, which can signal the potential danger of asset price imbalances. However, the thresholds of these indicators were based on ex-ante short-



period data to reflect past imbalances, which may not necessarily repeat themselves. Therefore, it is necessary to have more comprehensive indicators.

By looking at the whole set of corporate and household sector FSIs, which can be considered as leading indicators of future shocks to financial stability, monetary authorities will get a picture of possible risks that may affect inflation beyond the projection period, and indicate a need for policy action. With such a framework, monetary policy decisions can be made for a longer period, and a more comprehensive risk assessment made. By systematically incorporating FSIs into the monetary framework, monetary policy decisions will be based on inflation, while financial stability considerations will automatically be taken into account if they are perceived to affect medium-term inflation. Although the analysis to date has been much constrained owing to data limitation, the compilation of FSIs on the financial sector as well as the corporate and household sectors shall continue.

By linking corporate, household, and financial sector FSI variables to the macroeconometric model, the monetary authority can assess risks to future inflation more comprehensively. This link can incorporate risks of imbalances on household and corporate sectors and their interactions with other parts of the economy, and risks posed to inflation can be assessed. Given the importance of the link between FSIs and the macroeconometric model, the Bank of Thailand has developed two new tools to help in the assessment of financial stability. These are the corporate sector model and the household sector model. The corporate sector model is constructed from quarterly data of companies listed in the Stock Exchange of Thailand, covering profit and loss and balance sheets. Specifically, data on sales, costs of goods sold, profits, along with assets, liabilities, equities, and interest burden are included. The household sector model focuses on the variables that reflect debt-servicing ability, and use data on household interest expenses, as well as household interest gearing (interest payment to income ratio).

This link allows us to perform stress testing which may suggest how plausible macroeconomic scenarios might affect household and corporate sector balance sheets. With stress testing, a more comprehensive assessment of risks that financial imbalances might pose to inflation can be quantified, explicitly for the 8 quarter-ahead horizon, and implicitly beyond that horizon. Taking into account such risks should lessen the probability that financial instability will cause medium term inflation that breaches the target.

## **6. Conclusion**

As experienced in Thailand, asset price imbalances lead to financial imbalances in the banking, corporate and household sectors. Therefore, they naturally lead to economic and price instability in the real sector. Especially during the major financial crisis in 1997, a combination of imbalances involving the intertwining banking and property sectors, together with the fixed exchange rate policy and links to asset markets as a whole, led to major disruption and subsequent structural change in the Thai economy. Several studies at the BOT demonstrate that assets and the banking and real sectors are strongly linked, as Thailand's is a bank-based economy with collateral-based lending practices. As asset price imbalances may naturally lead to financial imbalances and affect prices and economic stability, monetary policy is required to take these risks into consideration.

Monetary policy implementation using policy rate as a tool is explored to assess the relative importance of each channel, especially the asset price channel. The asset price channel is significant although not as prominent as some other channels, especially the interest rate channel. Among the assets in the BOTMM, the equity price channel is shown to be more effective than the property price channel. Despite the recently more effective property price effect, measurements of the pass-through based on regression models of whole-sample

historical data could cause a lag in the measurement and, especially when the economy has undergone a major structural change after the crisis, can mislead and undermine the actual impact of the asset price channel in the present compared to 4 years ago. Nevertheless, implementing monetary policy by using policy rate will affect sectors other than the equity and property sectors. As a result, if interest rate is required as a tool to respond to asset price imbalances, a more thorough analysis of the impact of monetary policy must be done to ensure optimal outcome.

For Thailand, the most appropriate modification of monetary policy to address asset price imbalances is to consider FSIs and their links to the BOT's Macroeconometric Model. Use of these tools allows a more comprehensive assessment of financial imbalances and their risks posed on the real economy and inflation in the medium term beyond the current 8-quarter projection horizon.

## **Appendix A**

The stylized facts about asset prices in Thailand found by Ashvin et al. (2003) are as follows.

1. Increases in asset price are gradual and decreases abrupt.
2. Only one-fourth of equity (and 40 percent of housing) booms are followed by a bust.
3. An equity bust involves a price decline of roughly 45 percent within 10 quarters, on average, and a housing bust 30 percent within 4 years.
4. Equity prices typically fluctuate with the business cycle and GDP components, leading them by a bout 1 year. A housing bust coincides roughly with a GDP bust, with deeper output decline. Peaks in equity prices tend to lead those in commercial and real estate prices by 1-2 years.
5. Equity price is the most volatile, followed by commercial and residential property in that order. Equity prices fluctuate roughly 9 times more than real GDP does, in percentage terms.
6. Asset prices normally fluctuate with private credit, with equity leading it by 1-2 years.
7. Both CPI and core CPI fluctuate in opposite direction with equity price; both lag real equity price by roughly 3 years.
8. A bank-based economy such as Thailand's is more affected by a housing bust. A capital market-based system is more affected by an equity bust.
9. Real private credit is pro-cyclical with real equity price, with real equity price leading it by 1-2 years. And real private credit and output are highly correlated, with the former lagging the latter slightly by about 0-1 year.

## **Appendix B**

### **Private durable goods consumption at 1988 constant prices**

$$\ln(\text{CPR1sa}) = 0.809 \cdot \ln(\text{GDPRsa}(-1) \cdot (1 - \text{RH}(-1))) +$$

(5.19)

$$0.131 \cdot \ln(\text{WEALTHsa} \cdot 100 / \text{COREsa}) + 0.204 \cdot \ln(\text{PLANDTHsa})$$

(1.89)

(2.70)

$$- 0.231 \cdot \text{ecmCPR1}(-1)$$

(-3.76)

Adjusted R-Squared = 0.57, S.E. of regression = 0.0221, LM(2) = 0.36 (0.70)

$$\text{ecmCPR1} = \ln(\text{CPR1sa}) - (0.296 \cdot \ln(\text{GDPRsa} \cdot (1 - \text{RH})) - 0.012 \cdot (\text{MLR} - \text{CINFEX}) + 0.339 \cdot \ln(\text{WEALTHsa} \cdot 100 / \text{COREsa}))$$

### **Financial asset value**

$$\text{WEALTH} = \text{M2A} + \text{BMCAP}$$

### **Housing Price Index**

$$\ln(\text{PLANDTHsa}) = 2.134 - 0.019 \cdot (\text{MLR}(-1) - \text{CINFEX}(-1)) +$$

(2.74) (-3.22)

$$0.587 \cdot \ln(\text{PLANDTHsa}(-1))$$

(3.84)

Adjusted R-Squared = 0.93 S.E. of regression = 0.0133 LM(2) : 1.77 (0.20)

### **Securities value**

$$\ln(\text{BMCAP}) = 0.001 \cdot (\text{CAPITAL\$} \cdot \text{FX}) + 1.524 \cdot \ln(\text{GDPRsa}) - 0.052 \cdot (\text{MLR} -$$

(4.64) (1.91) (-1.96)

$$\text{FEDFUND}) - 0.345 \cdot \text{ecmBMCAP}(-1)$$

(-2.77)

Adjusted R-Squared = 0.33, S.E. of regression = 0.1083, LM(2) = 0.35 (0.71)

$$\text{ecmBMCAP} = \ln(\text{BMCAP}) - (0.002 \cdot (\text{CAPITAL\$} \cdot \text{FX}) + 1.363 \cdot \ln(\text{GDPRsa}) - 0.082 \cdot \text{MLR})$$

where CINFEX - Inflation expectations

CPR1 - Private durable goods consumption at 1988 constant prices (billion baht)

GDPR - Gross domestic product at 1988 constant prices (billion baht)

M2A - Money supply (M2 + finance companies' promissory notes) (billion baht)

MLR - Minimum lending rate (percent per annum)

PLANDTH - Townhouse (including land) price index (1991 = 100)

WEALTH - Asset value (M2A and securities value) (billion baht)

RH - Personal income tax rate (percent)

BMCAP - Securities value (billion baht)

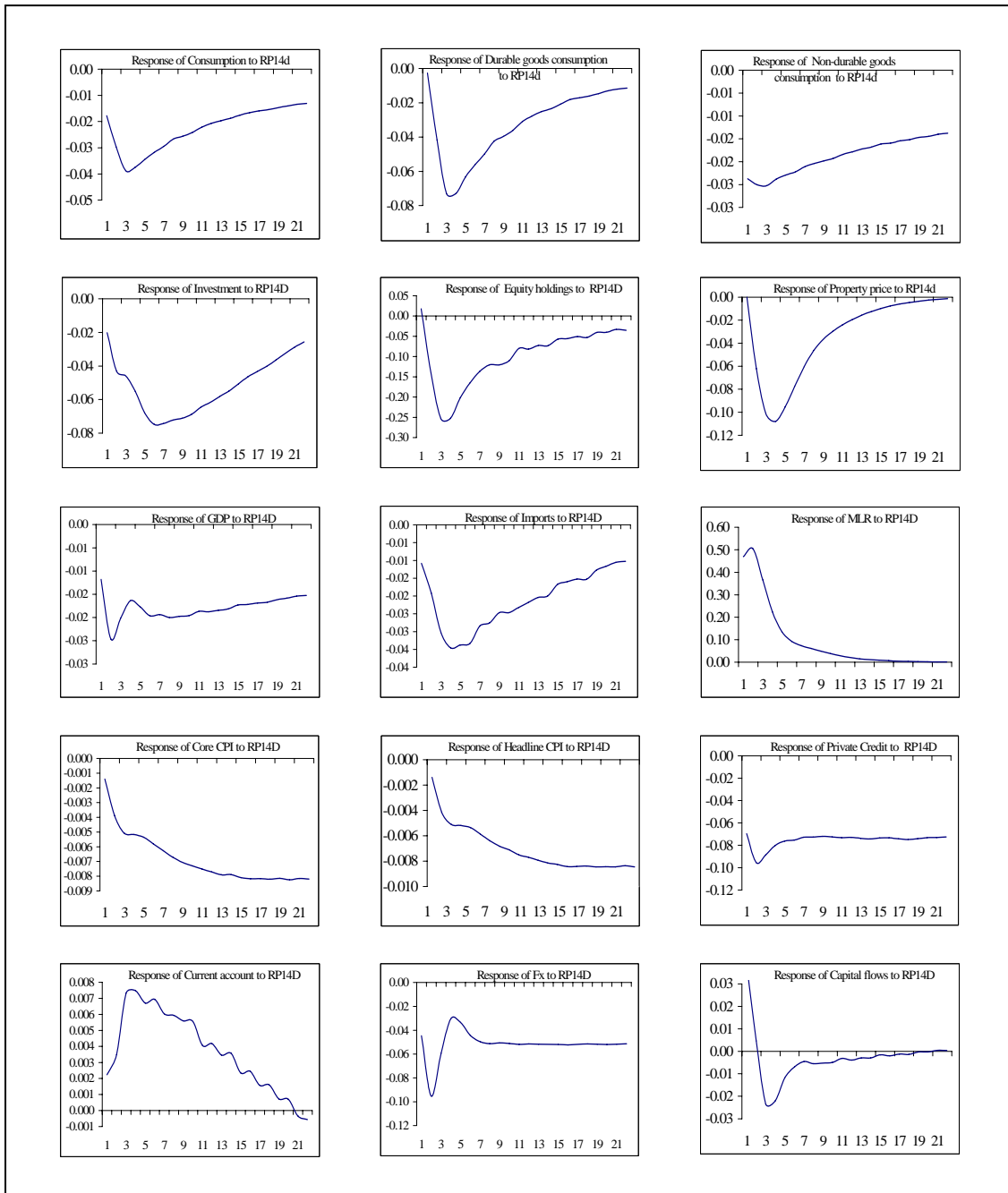
RD3M - Three-month deposit rate (percent per annum)

CAPITAL\$ - Capital and financial account (billion US dollars)

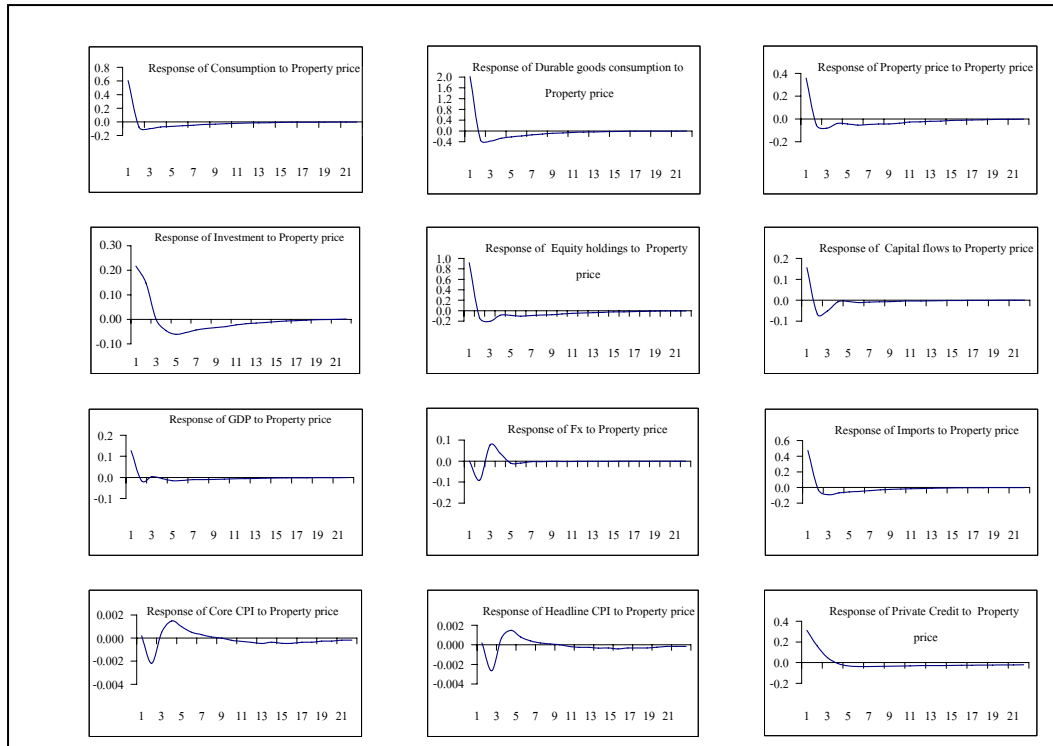
FX - Exchange rate (baht/US dollar)

FEDFUND - Federal funds rate (percent per annum)

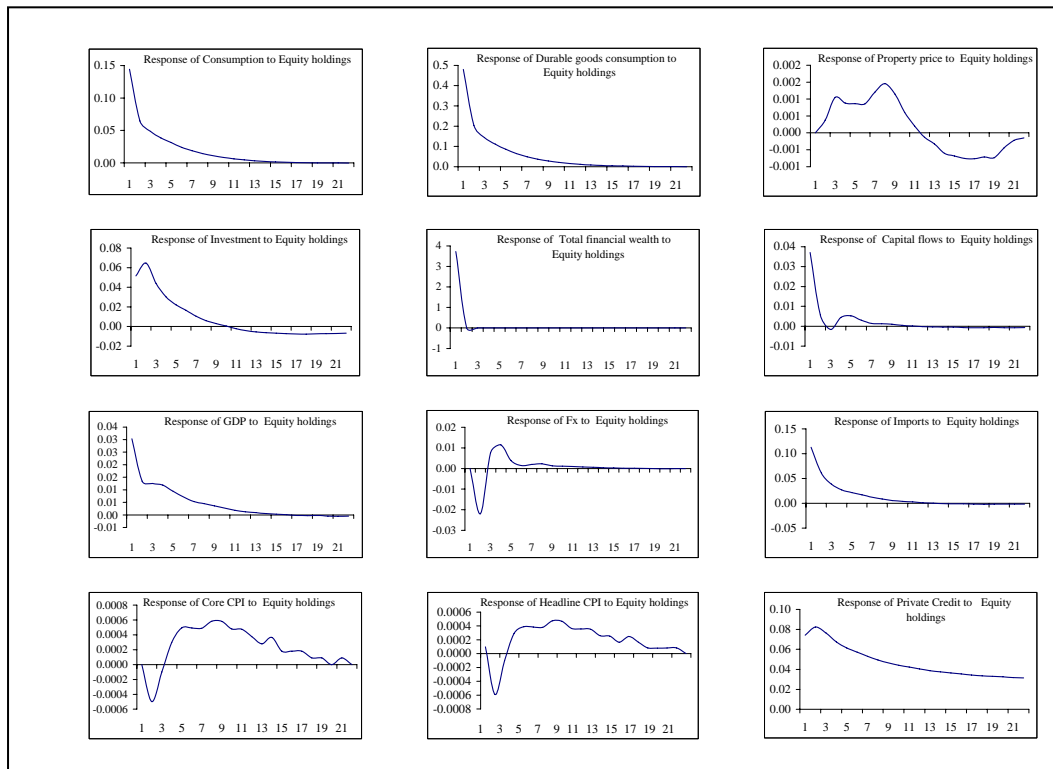
## Summary Model : 10% Shock to Policy Rate (RP14d)



## Summary Model : 10% Shock to Property Price



## Summary Model : 10% Shock to Equity Holdings



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