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Exchange Rate Pass-through and Inflation in Thailand

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Abstract

This paper examines the extent to which exchange rate changes affect domestic prices, using the experience of Thailand from January, 2000 to August, 2011. The standard Engle-Granger two-step estimation is applied. Our main finding is that, inevitably, a change in exchange rate will affect inflation incompletely. One per cent of currency depreciation causes an increase in price level of 0.02 per cent in the short run. Its effect is larger in the long run: 0.4. The low degree of pass-through especially in the short-run is due to government reaction to curb the adverse effect of an inflation threat on cost of living. The limited side effect of exchange rate changes on price stability as found in this paper could be used as input in managing exchange rate policy in Thailand.

Keywords: Pass-through, Foreign Exchange Policy, Macroeconomic Stability

1. Introduction

As postulated by purchasing power parity (PPP) theory, goods in any parts of the world should have the same price when converted to a common currency. This implies that any change of exchange rate with an expected effect on price competitiveness would be cancelled

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out by price adjustment. In reality, the presence of PPP lacks empirical support, at least in the short- or medium-term (Dornbusch, 1987; Hopper and Mann, 1989; Bai and Perrson, 1998; Mishkin, 2008; Barhoumi and Jouini, 2008; Chai-anant et al., 2008)[2]. In other words, changes in the exchange rate can affect international price competitiveness to a certain extent, which is known as incomplete exchange rate pass-through.

The extent to which exchange rate changes affect domestic prices is highly policy relevant in the context of the managed floating exchange rate. This is popularly pursued in developing countries. Governments in these countries express reluctance to allow their currency freely to be determined by market forces. This is especially true when the exchange rate appreciates when as international price competitiveness deteriorates (Razafimahefa, 2012).

Its policy relevance increases in the slow economic recoveries in the USA and Europe as well as Japan's attempt to emerge from a decade-long deflation trap. Measures introduced to overcome current economic problems in these developed countries could put pressure to appreciate on currency in developing countries and East Asian ones in particular.

Against this backdrop, we examine the exchange rate pass-through, using Thailand as a case study. Thailand is chosen due to her outstanding performance in price stability during the post-war period (Kohpaiboon, 2006). During the 1997/98 crisis, when currency depreciated by nearly 60 per cent, inflation remained at a one-digit figure. Since 2000, inflation has been around 2.70 per cent, moving within a narrow range (Figure 1). A recent rapid currency appreciation led to hot debate between the Bank of Thailand and exporters. Better understanding of the degree of exchange rate pass-through would be helpful. Lessons from a small-and-open economy with export-oriented growth strategy should be learnt for Thailand and other nearby countries.

This paper is outlined as follows: Section 2 presents a literature review on exchange rate pass-through. Section 3 provides a brief look at inflation in Thailand from 2000, followed

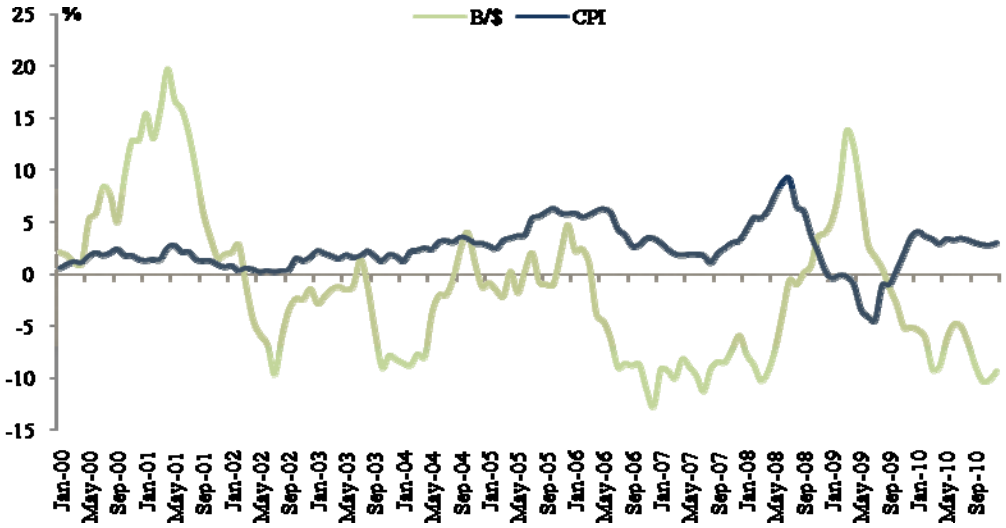
[2] This is due to many reasons such as price rigidities, government intervention heterogeneity in goods and services, presence of trade barriers and transportation cost.

by the empirical model used in this paper (Section 4). Conclusions and policy implications are in the final section.

Figure 1

Changes in monthly Consumer Price Index and Exchange Rate

(year-over-year)



Source: Bank of Thailand and Bureau of Trade and Economic Indices

2. Literature Review

This section discusses previous studies on exchange rate pass-through. So far, many tools have been used to study this economic phenomenon. Dornbusch (1987) was based on micro foundation/industrial organization combined with purchasing power parity to explain the relationship between exchange rate and inflation. Its key finding suggested that price levels adjust slowly in accordance with changes in exchange rate. Hopper and Mann (1989) investigated the impact of the exchange rate in 1980s on the import prices, especially industrial goods. The mark-up model was carried out, in which the price of goods and services in a

country is determined by the price of the last unit of imported intermediate inputs. The study discovered that 50 to 60 percent of pass-through determines import prices.

Mishkin (2008) analyzed recent research on exchange rate pass-through and presented microeconomic evidence. It imposed simulation of SIGMA model, described by Erceg, Guerrieri and Gust (2006) with some adjustments allowing for incomplete pass-through. As the paper indicated, sizable depreciation of nominal the exchange rate created a small change in price levels in industrialized countries and these effects declined over the past decades. Weak pass-through of the exchange rate to import prices was realized. However, exchange rate volatility can still affect inflation and economic activity. Monetary authorities must consider and manage exchange rate pass-through.

Barhoumi and Jouini (2008) used the Taylor proposition to examine pass-through for developing countries, structural breaks and cointegration tests by Bai and Perrson (1998), and Gregory and Hansen (1996) to examine coefficients of pass-through. Quarterly data from 1980 to 2003 were applied. An imperfect competitive market structure was assumed, concentrating on the micro-foundation of firm pricing. Exchange rate pass-through was seen as an equilibrium profit-maximizing strategy for firms. They found that there was a decline in pass-through between exchange rate and import price. This can be explained by a shift of monetary policy regime by many Central Banks in developing countries.

In macro perspectives, Dwyer, Kent and Pease (1993) employed the error correction model and found that in the short run, there was a little magnitude from exchange rate to inflation by import price channel. Nonetheless, it took two months in the long-run to affect inflation. Wickremasinghe and Silvapulle (2004) explored Japanese imported goods. The cointegration and asymmetric model was tested to find the degree of pass-through. It was around 0.674 to 1.202 in the paper. Campa and Goldberg (2002) empirically studied 19 countries in the Organization for Economic Cooperation and Development (OECD). Panel data was employed. An incomplete pass-through was observed.

Korthonen and Wachtel (2005) started their study with the Commonwealth of Independent States (CIS), independent from the Soviet Union. Vector Autoregression was carried out with impulse function and variance decomposition. It was discovered that the degree

of pass-through and magnitude of volatility of exchange rate to inflation are related. Kiptui, Ndolo, and Kaminchia (2005) used Kenya as a case study. They first used the cointegration test by Johansen and a first stage pass-through was found by the error correction model. Impulse response was imposed for the second stage.

Chai-anant, et al. (2008) examined the impact of the exchange rate as a transmission mechanism to mitigate inflationary pressure caused by monetary policy under inflation targeting. They constructed a small structure model of the economy. The model postulated a relationship among macroeconomic variables within a simple and tractable framework. An element of dynamic stochastic general equilibrium with rational expectation was also added to examine the role of exchange rate. In that model, the degree of pass-through was calculated, revealing that it was incomplete through the import price channel.

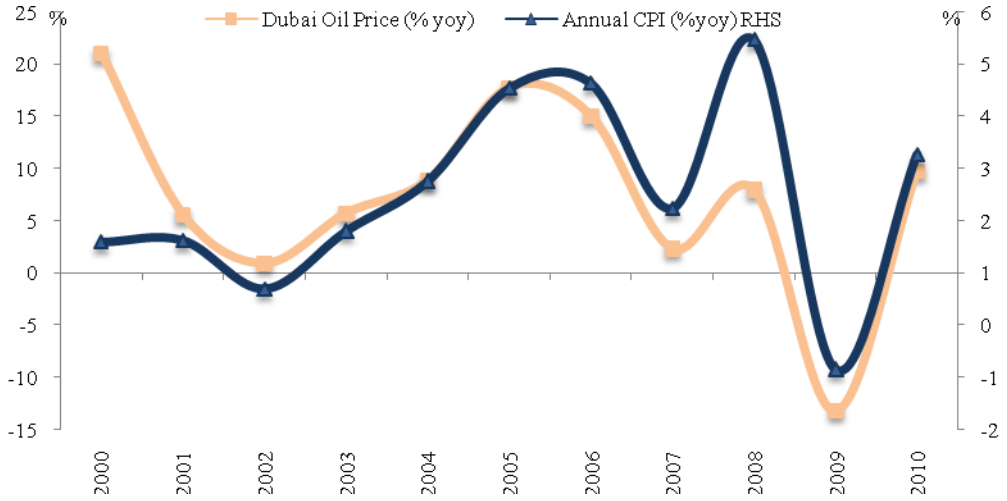
Sekine (2006) studied the time-varying impact of exchange rate fluctuations on domestic prices and categorized pass-through in two stages from exchange rate to prices of imported goods and services for the first stage and from changes in import prices to consumer prices for the second. The study found that both stages of pass-through declined over time. Overall, incomplete pass-through was the trend for all countries.

3. Inflation in Thailand

Thailand is an oil-dependent country so the price of oil must offer clues about changes in overall price levels. In 2000, world crude oil prices increased as OPEC reduced production. As a result, public transportation costs rose. Bus fare between Bangkok and provinces increased and motorcycle taxi and passenger ferry fares increased. Still, inflation was moderate in 2000, offset by a decline in food and beverage prices. Later, the changes in the consumer price index moved in the same direction as oil prices from 2002 to 2008. The crisis in the USA also decelerated speculation in oil prices in 2009 and price levels in Thailand are in line with the change in oil price. There is a general positive correlation between prices of oil and domestic inflation in Thailand (figure 2).

Figure 2

Change in annual CPI and Dubai Oil Price (year-over-year)

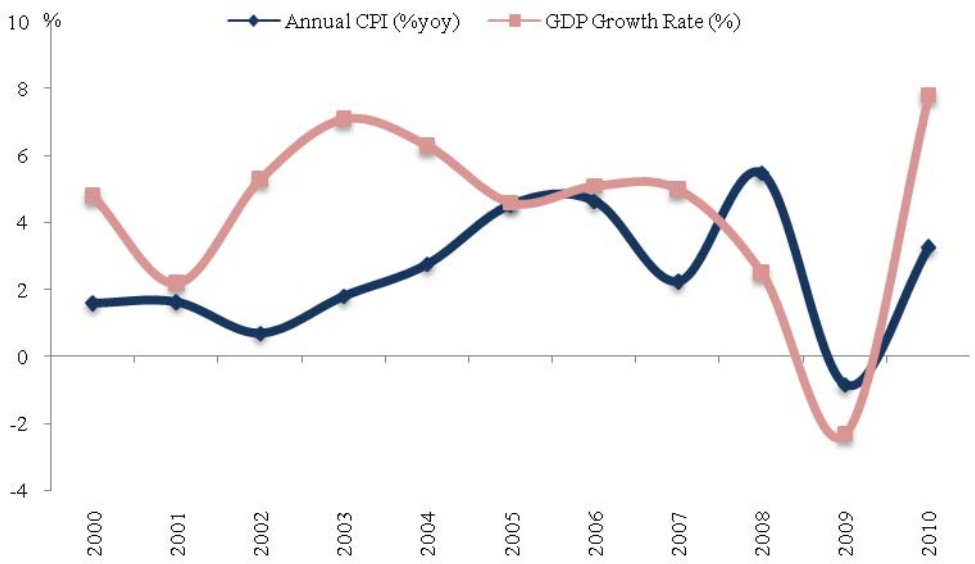


Source: Bureau of Trade and Economic Indices and Bank of Thailand

Relating inflation to economic growth, the Thai economy has just recovered from the 1997 recession. A small decline in GDP growth rate in 2001 was due to the dot-com bubble in the USA. Inflation was modest, at around 2 percent for some years (figure 3) before it accelerated around 2005 as a consequence of the heating-up economy. A global financial crisis hindered economic prosperity for the Thai economy as Thai growth strategy depended heavily on international trade. This drove down both inflation and GDP growth in 2008 and 2009. 2010 marked another resilient year, as the economy rebounded from an economic slump. Inflation moves in the same direction when the economy expands. Macroeconomic stabilities of Thailand have always relied on external economic conditions.

Figure 3

Change in annual CPI and GDP (year-over-year)



Source: Bureau of Trade and Economic Indices and Bank of Thailand

Figure 4 illustrates the relationship between inflation and change in the exchange rate. In PPP theory, a rise in price level must accompany currency depreciation so that PPP holds. This means positive change in the value of the Thai Baht with respect to the US dollar (depreciation) during inflationary pressure periods. Yet the Thai baht appreciated and inflation remained stable from 2002 to 2007. This might be a result of other factors than the change in exchange rate, such as capital inflows during the decade. The sequent appreciation of baht accompanied a rise in inflation in 2008, which contradicted the PPP principle. In 2009, the depreciation of the baht showed a negative relationship with the change in CPI as effects from the crisis in the USA occurred, lessening inflationary pressure in Thailand.

In 2010, the baht appreciated and inflation started to rise. This change in the relationship of exchange rate and inflation might derive from the fragility of the dollar and the implementation of unconventional monetary policies in developed countries, putting pressure on the Thai baht to appreciate, along with inflation hikes as a consequence of policy packages by the Royal Thai Government to counter global economic recession and costs of living threats.

Judging the statistics, exchange rate pass-through will be incomplete since the law of one price and purchasing power parity do not work but more rigorous proof will be offered.

Figure 4

Change in annual CPI and Exchange Rate (year-over-year)

Source: Bureau of Trade and Economic Indices and Bank of Thailand

While the Bank of Thailand is at the center of price stability as leader of monetary policy[3], there is also ad hoc intervention by the government on any threat to price stability and cost of living. Such intervention is often observed as a response to oil price hikes worldwide. This happens through subsidies on oil consumption. After oil prices climb to certain level, domestic oil price is frozen. The difference between actual and subsidized prices is financed by Ministry of Energy. In addition, prices of basic consumer goods such as cooking oil, medicine, milk, rice, detergents, toothpaste, and fertilizer are monitored, although the effectiveness of this measure remains debatable. The Department of Internal Trade Affair at the Ministry of

[3] Thailand's monetary policy regime is flexible inflation targeting, implemented since May, 2000. From May, 2000 to Dec, 2008, core inflation was set to be met between 0.0 – 3.5 per cent.

Commerce is in charge of monitoring price movement of these goods to alleviate the burden on producers and consumers.

In recent years, as part of cushion measures against the adverse effect from the global financial crisis starting in 2008, the Thai government introduced measures such as a reduction in excise charges for gasohol and diesel, suspension of price adjustments for cooking gas for household use, reduction of water charges, and reduction of electricity charges. Commuters on non-air-conditioned buses in Bangkok avail themselves of free services. All third-class train services in every route nationwide will not charge passengers. All these affect cost of living and inflation. After such measures ended, the next cabinet arrived and extended five measures of these that maintained price levels in Thailand for some months.

4. Empirical Model and Econometric procedures

The empirical model in this paper is based on Purchasing Power Parity (PPP) theory. Domestic price is a product of exchange rate and the price. In addition, two explanatory variables are introduced: manufacturing production index (MPI) and oil price. The latter measures any supply shock on the cost of production as well as reflecting the fact that Thailand is oil-dependent, so there is co-movement between inflation and oil prices. The former is introduced to proxy economic activities within an economy. Domestic prices tend to be inflated when production expands. The empirical model is summarized in equation 1 below:

$$P_t = \beta_0 + \beta_1 e_t + \beta_2 mpi_t + \beta_3 oil_t + \beta_4 PM_t \qquad (1)$$

where P_t = consumer price index,

oil_t = index of retail price of ULG 95 (BKK),

PM_t = the import price in term of dollar,

mpi_t = the manufacturing production index,

e_t = the exchange rate in the form of baht/dollar,

The consumer price index will be set as a representative for domestic price. A retail price of ULG95 is a proxy for the domestic oil price. Manufacturing Production Index (MPI)

represents economic activity within an economy since the industrial sector comprises major part of Thai economy. Import prices in dollars will be a proxy to the cost of imported raw materials. All variables are in natural logarithm form, collected monthly.

Data from January, 2000 to August, 2011 will be used. During this time, the Thai economy stabilized after the financial slump in 1997. The main source of data will be the Bank of Thailand for the nominal exchange rate. The Office of National Economic and Social Development Board (NESDB) will be another source of information as well as the Bureau of Trade and Economic Indices at the Ministry of Commerce.

As a standard practice in time series analysis, time series property is examined to guard against spurious regression. Table 1 reports augmented Dickey-Fuller (DF) unit root tests for all variables. Results from Table 1 indicate that we cannot reject all null hypotheses. All variables are first-difference stationary at the conventional level of statistical significance (5 per cent or better).

A simple cure to overcome the presence of first-difference stationary is to estimate the relationship using differenced series rather than absolute levels (Nelson and Plosser, 1982; Mills, 1990). Nonetheless, a difference in series might cause important aspects of potential relationships between these variables to be lost (Granger, 1987). In this study, a two-step Engle-Granger co-integration technique is employed. As an extension of Granger and Newbold (1974), Engle and Granger (1987) proposed the concept of co-integration. While the individual economic series may be non-stationary, a vector of variables, combined with well-established theoretical support, may be co-integrated (generating a stationary residual) and interpreted as an equilibrium (long-run) relationship.

In practice, Engle and Granger propose a constructive two-stage approach to modeling economic relationships involving non-stationary variables, provided the variables are integrated of the same order. The first stage involves modeling the long-run or co-integrating the relationship. The short-run dynamic relationship among variables is estimated at the second

stage modeled with an error correction model. The short-run disequilibrium relationship between them can be represented by an ECM. [4]

Equation (1) above represents the equilibrium (long-run) relationship, whereas its corresponding error correction model is expressed in Equation 2. The lagged ECM, ΔECM_{t-1}, indicates the speed of adjustment or short-run disequilibrium in the long-run relationship.

$$\Delta P_t = \alpha_0 + \alpha_1 (ECM_{t-1}) + \sum_{t=1}^{p} \gamma_{1t} \Delta oil_{t-t} + \sum_{t=1}^{p} \gamma_{2t} \Delta PM_{t-t}$$

$$+ \sum_{t=1}^{p} \gamma_{3t} \Delta mpi_{t-t} + \sum_{t=1}^{p} \gamma_{4t} \Delta e_{t-t} \qquad (2)$$

where $ECM_t = P_t - \beta_0 - \beta_1 e_t - \beta_2 mpi_t - \beta_3 oil_t - \beta_4 PM_t$

Table 1

Dickey-Fuller Test for Unit Roots

Variables	t-statistics for I(0)	t-statistics for I(1)
CPI	0.24	-11.30*
Oil	-0.40	-8.90*
Imported Price	0.57	-6.68*
MPI	-0.19	-6.02*
Exchange Rate (B/$)	-0.18	-7.77*

Note: 1. an augmented Dickey-Fuller test is performed. Optimal lags for the test are selected by the Schwarz Information Criterion (SIC).

2. * indicates that the null hypothesis of non-stationary I (1) are accepted for all variables at a five per cent level of significance

[4] The discussion of econometric procedure is drawn from appendix 2 of Athukorala (2002).

5. Results

Our main results are presented in Table 2. ADF Unit root test results re-confirm that equation 1 generates stationary residuals, suggesting that its estimation can be interpreted as a long-run relationship, while its corresponding ECM model indicates short-run dynamics. A long-run equilibrium equation indicates that a change in exchange rate will, on average, result in a 0.047 change in inflation. An increase in oil prices will also lead to a 0.06 rise in the consumer price index. The incremental change in the manufacturing production index will contribute to an additional 0.071 percent increase in price level. Lastly, an 0.36 increase in inflation is a consequence of one change in import prices. This result shows that there is incomplete pass-through from exchange rate to inflation, at only 4.7 per cent and this also confirms the pattern of change in CPI and exchange rate.

Table 2

Short- and Long-Run Determinants of Price Level

Variables (Price level = dependent variable)	Cointegration Model	Error Correction Model
Intercept	2.0962*	0.0010*
Exchange Rate	0.0470*	0.0160
Oil Price	0.0595*	0.0027*
MPI	0.0708*	0.0642
Import Price	0.3596*	0.1775*
ECM		0.1406*
R-squared	0.9878	0.5552

Note: numbers in the table are the coefficients and * indicates the rejection of null hypothesis at 0.05 level of significance.

When short-run dynamics are involved, the coefficient of adjustment is -0.1406. This implies that the deviation from long-run equilibrium is adjusted by 14.06 per cent each period or

month. The increase in price level since 2000 is associated with a change in exchange rate. Depreciation and appreciation of Thai baht will impact inflation in Thailand. Jitpokkasame (2007) applied quarterly data from 1995 to 2005, finding that there is 18 per cent of pass-through from the exchange rate to inflation while Chai-anant et al., (2008) found that there is 13 of pass-through for the Thai economy, when monthly data was employed. This study reveals 0.047 of incomplete pass-through from exchange rate to inflation. Therefore, an incomplete degree of pass-through has been confirmed by studies.

The low level of pass-through is attributable to responses from government authorities to counter the threat on cost of living. Price administrations from the Ministry of Commerce, inflation-targeting monetary policy, oil price subsidies and certain schemes during the crisis years explain the lower price level and degree of pass-through because such restrictions prevent normal price adjustments. Domestic and world price competition, which result in rigidity in price level, are another factor. In addition, the use of import price in terms of dollars as a dependent variable in the employed model might underestimate the degree of pass-through.

With less transmission between exchange rate and inflation, currency flexibility will be realized, since the change in exchange rate will not be passing through the domestic price level in any significant way. This leaves more room for the Central Bank to stabilize the inflation and real activities (Mishkin, 2008).

Nevertheless, the Bank of Thailand still must keep an eye on both currency management and inflation. The volatility of exchange must be carefully inspected so that imported prices do not fluctuate. Firms importing raw materials will benefit and can be assured about international transactions. This helps reduce fluctuation in production cost as well as product prices in the market.

6. Conclusion

The baht has been volatile and shown an appreciating trend since 2000. As the Thai economy demonstrated resilience in its long-term growth, other reasons account for the

appreciation of the Thai baht. One is the devaluation of the American dollar caused by subprime crisis and policies initiated by the Federal Reserve to tackle turbulence.

Exchange rate volatility will affect changes in price level. This paper confirms that a change in the exchange rate inevitably affects inflation. To verify this phenomenon, the model in this paper used retail oil price as an explanatory variable for external supply shocks to changes in the Consumer Price Index. Imported prices in dollars are representative for domestic costs. The manufacturing production index indicates the supply and demand conditions of the Thai economy. The law of one price and purchasing power parity theory state that the exchange rate and inflation correspond, and there should be exchange rate pass-through in the economy.

The study finds that there is a 0.0470 degree of pass-through from exchange rate to inflation in the long-run. If the baht appreciates or depreciates by one per cent, the price level will be adjusted by 0.1406 in the opposite direction in the short-run, so that it can correct errors for all variables and achieve long-run equilibrium.

This incomplete pass-through may derive from several government policies. Inflation-targeting monetary policy might restrain the increase in inflation. Government price administration for necessary goods and services from the Ministry of Commerce also holds a rise in price levels. A government subsidy in energy also helps firms and households in costs of production and living. Some measures to counter the global financial crisis also lower living expenses. Macroeconomic stability is manageable, although the external macroeconomic conditions channel adverse effects through changes in price level from exchange rate fluctuations.

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