



## THE NEW KEYNESIAN PHILLIPS CURVE IN THAILAND THROUGH TWO FINANCIAL CRISES



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### ABSTRACT

*This paper examines the New Keynesian Phillips curve (NKPC) in Thailand in the two decades from 1993 to 2014 marked by the two large crises of 1997 and 2008. This analysis is significant because expectations and economic growth in Thailand may have been influenced by incidents including coups and natural disasters. The findings are summarized as follows. First, the empirical analysis shows that the NKPC in Thailand is relatively forward-looking compared with that shown in previous studies involving developed countries. Second, the NKPC in Thailand did not exist before the 1997 crisis, probably because of the bubble economy. Third, the NKPC is clearly observable after 2009, partly because of improved economic conditions.*

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### Contribution/ Originality

This paper contributes to the first empirical study to survey the NKPC in Thailand marked by the two large crises of 1997 and 2009. The result is important to show the NKPC is relatively forward-looking compared with previous studies.

### 1. INTRODUCTION

After the 1997 crisis, Thailand made efforts to prevent another financial crisis. First, new governance systems were instituted such as an inflation target and the new company law. Second, economic resilience was strengthened by the trade surplus and increased international reserves. Third, many economic indices were introduced, such as quarterly GDP statistics. As a result, Thailand's economic performance improved significantly, and the effect of the 2008 crisis was relatively minor compared with that of 1997.

The Phillips curve is a fundamental macroeconomic concept related to the aggregate supply curve; therefore, it is important to estimate it in considering the effect of financial policy. Gali and Gertler (1999) is one of the original empirical studies investigating the NKPC in developed regions such as the U.S. and the Euro zone, and Gali *et al.* (2001) and Gali *et al.* (2005) expand on this research. Recent empirical studies are summarized by Tsuruga and Muto (2008) and the method of estimation is summarized in Rummel (2012). Regarding the NKPC in Thailand,

Bhanthumnavin (2002) estimated it for 1993-2000 and showed that it was not observable in Thailand before the 1997 crisis and that the estimation result is heavily backward looking. However, this estimation is now out-of-date and has three problems. First, new data has become available. At that time, the CPI was the only inflation index, as the quarterly GDP deflator was only introduced in 1999 in Thailand. Second, a new method of estimation has prevailed. At that time, two-stage least squares (2SLS) regression analysis was the most widespread method, while now the general method of moments (GMM) has become most common. Third, Thailand has experienced further incidents such as several coups in 2006 and 2013, civil war in 2010, and a large flood in 2011. After that, Khemangkorn *et al.* (2008) estimated the NKPC in Thailand and found it as relatively backward looking. Recently, Manopimoke (2014) investigated the NKPC in Thailand among other countries, but not focusing on Thailand specifically.

This paper aims to examine the estimation of the NKPC in Thailand during the period of the third quarter of 1993 (1993Q3) to the third quarter of 2014 (2014Q3) by focusing on the two financial crises, in 1997 and 2008, in the estimation process. The estimation period is divided into five: from 1993Q3 to 2014Q3 (equation (1)), from 1993Q3 to 1997Q2 (equation (2)), from 2009Q2 to 2014Q3 (equation (3)), from 2000Q1 to 2014Q3 (equation (4)), and from 2000Q1 to 2014Q3 (equation (5)).

## 2. EMPIRICAL ANALYSIS OF THE NKPC IN THAILAND

This section focuses on the empirical analysis of the forward-looking and hybrid variants of the NKPC in Thailand. First, we describe the methodology, data, and the unit root test. Then, we show the results and discussion.

### 2.1. Methodology<sup>1</sup>

The estimation equation of the NKPC is the relationship between inflation and the GDP gap (shown as equation 1). Because this formula depends on inflation expectations, it is called the forward-looking variant of the NKPC.

$$\pi_t = \beta E_t \pi_{t+1} + \theta(y_t - y_t^n) \quad (1)$$

Where  $\pi_t$  is the inflation rate,  $y_t$  is nominal GDP (logarithm), and  $y_t^n$  is natural GDP (logarithm) for the period  $t$ .

Because inflation depends on the past (sticky prices), prior studies introduced another version of the NKPC, the hybrid variant (shown as equation (2)).

$$\pi_t = \beta E_t \pi_{t+1} + \gamma \pi_{t-1} + \theta(y_t - y_t^n) \quad (2)$$

Another version of the NKPC uses the real marginal cost. However, while it is more correct from the theoretical point of view, we do not have relevant quarterly data for Thailand. Using annual data does not provide enough data points to yield stable results.

If we let  $E_t(\pi_{t+1}) = \pi_{t+1}$  by using ordinary least squares (OLS), the estimator is not consistent. Hence, we adopt GMM. When estimating  $E_t \pi_{t+1}$ , let  $\varepsilon_{t+1} = (E_t \pi_{t+1} - \pi_{t+1})\beta$ . Then, equations (1) and (2) become equations (3) and (4), respectively.

$$\pi_t = \beta \pi_{t+1} + \delta(y_t - y_t^n) + \varepsilon_{t+1} \quad (3)$$

$$\pi_t = \beta \pi_{t+1} + \kappa \pi_{t-1} + \delta(y_t - y_t^n) + \varepsilon_{t+1} \quad (4)$$

Seeing that the information set in the period  $t$  is  $\mathbb{P}_t$ ,  $\mathbb{P}_t$  and  $\varepsilon_{t+1}$  will not be correlated. Hence, the condition  $E(\varepsilon_{t+1} \mathbb{P}_t) = 0$  will exclude the problem of estimating GMM. The instrument set includes two lags in the GDP gap and four lags in inflation (consistent with Gali *et al.* (2005)).

<sup>1</sup> Tsuruga and Muto (2008) summarized the methodology in detail.

The method of estimating natural GDP presents a further problem, as this indicator represents the level of GDP at which inflation does not occur. In this estimation, we apply the Hodrick-Prescott (HP) filter to natural GDP in the same manner as [Tsuruga and Muto \(2008\)](#).

## 2.2. Data

The data are published by the National Economic and Social Development Board (NESDB) of the Government of Thailand. Since the base for 2008 national accounts has been published since 1993, our period of estimation is also from 1993 to 2014. We use the inflation rate as the GDP deflator, as CPI is not provided on a quarterly basis and is not seasonally adjusted, and recent research moreover prefers to use inflation as the GDP deflator. Thailand experienced two financial crises in 1997 and 2008. Therefore, the estimation period is divided into five: from 1993Q3 to 2014Q3 (equation ①), from 1993Q3 to 1997Q2 (equation ②), from 2009Q2 to 2014Q3 (equation ③), from 2000Q1 to 2014Q3 (equation ④), and from 2000Q1 to 2014Q3 (equation ⑤).

## 2.3. Unit Root Test

Before estimating, we check the stationarity of the data by using the augmented Dicky-Fuller test (ADF test) and the Phillips-Perron test (PP test) because this estimation is expected to be relatively short-term. The two tests are carried out at the 1% significant level and are judged at the 5% significant level.

From the results in Table 1, the following three points can be observed. First, the unit root exists in the period between 1993 and 1997 (pre-1997 period). During this time, Thailand was in a bubble economy and trending upward, phenomena which both exhibit random walk. Second, during the periods between 2000 and 2008 and between 2009 and 2014, the GDP deflator does not have a unit root. This is partly because, at equal capacity, prices of most electronic equipment such as computers were falling. The GDP deflator is defined as deflation in such case. Third, the unit root does not exist through the 1997 crisis or 2008 crisis such as in the first row (from 1993Q3 to 2014Q3) or fifth row (from 2000Q1 to 2014Q3). These points are consistent with the trend in figure 1 because the trend is downward during the crisis period. From these results, we observe stationarity except during the pre-1997 crisis period.

## 2.4. Estimation Results

Results of the estimation of the NKPC in Thailand are shown in Table 2. The first three points below describe period characteristics. The fourth and fifth points highlight overall features of the results.

First, upon observing the second equation from 1993Q3 to 1997Q2, it seems that the NKPC does not exist. In both variants, forward-looking and hybrid, inflation as an explanatory variable is insignificant at the 5% level. In addition, the sign condition is not satisfied. [Bhanthumnavin \(2002\)](#) also indicated that the NKPC did not exist in Thailand for 1993-1997 (pre-1997 crisis). Second, looking at the third equation from 2009Q2 to 2014Q3, the NKPC appears to exist, in particular in its forward-looking version. Except for past inflation, variables are significant at the 1% level and the sign condition is satisfied (positive). Third, regarding the fourth equation from 2000Q1 to 2008Q2, it is difficult to judge because the sign condition is not satisfied for either variant. The same observation can be made concerning the fifth equation, from 2000Q1 to 2014Q3. Fourth, we obtain a better estimation with the forward-looking variant than with the hybrid variant. This is particularly visible in the first equation (from 1993Q3 to 2014Q3) and the third equation (from 2009Q2 to 2014Q3). Fifth, the GDP gap coefficient is large compared to that observed in developed countries in previous research such as [Gali et al. \(2005\)](#). In contrast, the coefficient of expected inflation is smaller than that observed in developed countries. These results show that the small country assumption is adequate.

### 3. CONCLUDING REMARKS

In this paper, the NKPC in Thailand is estimated. The implications of the estimated results are described in the following three points.

Firstly, the empirical analysis shows that the NKPC in Thailand is forward-looking compared with former studies involving developed countries. This result also differs from [Bhanthumnavin \(2002\)](#) and [Khemangkorn \*et al.\* \(2008\)](#). One of the reasons for this is that the inflation rate in Thailand derives from global oil prices. Another reason is that the index of the inflation is different.

Next, from 1993 to 1997, during the Thai bubble economy period, it is highly probable that the NKPC did not exist. This result is consistent with [Bhanthumnavin \(2002\)](#). One explanatory hypothesis is that the Thai economy did not meet with the assumptions of the model, sticky prices and incomplete competition. Because capital inflows were very large, given the fixed exchange rate during this period in Thailand, domestic companies may have had difficulties changing prices due to overseas pressure at that time.

Lastly, it appears easier to state that the NKPC in Thailand has effectively been observable after 2009, in the post-crisis era. Although major incidents occurred in Thailand in this period, e.g., the domestic turmoil in 2010, the large flood in 2011, and the coup d'état in 2014, stable economic growth and mild inflation have both persisted regardless. This is partly because companies in Thailand may have the power to manage prices as long as global oil prices drive inflation in Thailand.

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**Table-1.** Result of the Unit Root Test

① from 1993Q3 to 2014Q3

	ADF		PP		ADF		PP	
	intercept	intercept&trend	intercept	intercept&trend	intercept	intercept&trend	intercept	intercept&trend
I(0)	-8.093***	-8.119***	-8.087***	-8.094***	-3.942***	-3.951**	-3.971***	-3.978**
I(1)	-	-	-	-	-	-10.262***	-	-11.686***

② from 1993Q3 to 1997Q2

	GDP deflator				GDP gap			
	ADF		PP		ADF		PP	
	intercept	intercept&trend	intercept	intercept&trend	intercept	intercept&trend	intercept	intercept&trend
I(0)	-3.102**	-3.906**	-3.102**	-3.035	-1.438	-2.686	-1.464	-1.814
I(1)	5.494***	-5.378***	-5.495***	-5.548***	-4.601***	-4.614**	-3.352**	-3.899**

③ from 2009Q2 to 2014Q3

	GDP deflator				GDP gap			
	ADF		PP		ADF		PP	
	intercept	intercept&trend	intercept	intercept&trend	intercept	intercept&trend	intercept	intercept&trend
I(0)	-	-4.467**	-4.645***	-8.560***	-3.517**	-3.260	-3.516**	-3.260
I(1)	4.479***	-4.865***	-	-	-5.954***	-6.082***	-6.076***	-6.608***

④ from 2000Q1 to 2014Q3

	GDP deflator				GDP gap			
	ADF		PP		ADF		PP	
	intercept	intercept&trend	intercept	intercept&trend	intercept	intercept&trend	intercept	intercept&trend
I(0)	-6.537***	-6.849***	-6.512***	-6.849***	-1.434	-1.434	-1.434	-4.314***
I(1)	-	-	-	-	-7.825***	-7.736***	-15.255***	-

⑤ from 2000Q1 to 2014Q3

	GDP deflator				GDP gap			
	ADF		PP		ADF		PP	
	intercept	intercept&trend	intercept	intercept&trend	intercept	intercept&trend	intercept	intercept&trend
I(0)	8.249***	-8.214***	-8.297***	-8.267***	4.019***	-4.000**	4.098***	-4.091**
I(1)	-	-	-	-	-	-8.738***	-	-12.010***

The asterisks represent significance at the 10 percent (\*), 5 percent (\*\*), and 1 percent (\*\*\*) confidence levels.

Source: Calculated by author, using the data of NESDB "National Account".

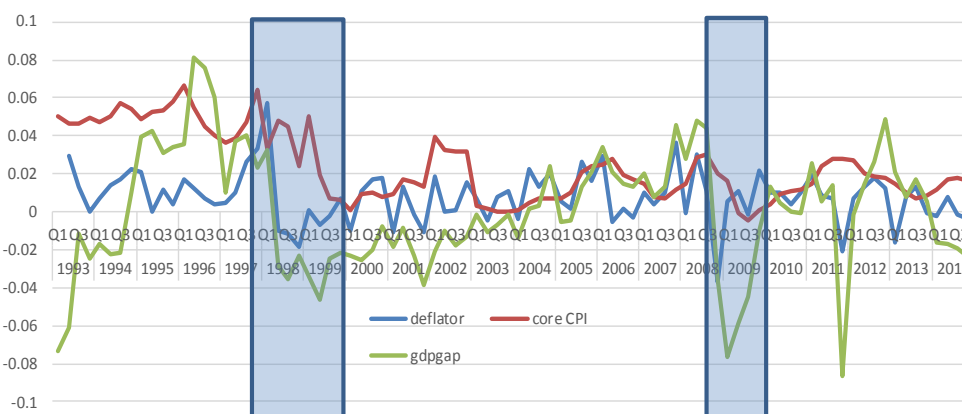


Figure-1. Trends of the GDP deflator, Core CPI, and GDP gap

Source: NESDB "National Account" and Ministry of Commerce "Consumer Price Index".

Table-2. Estimation results

Forward-Looking NKPC

	From	To	const.	$\beta$	$\theta$
①	1993Q3	2014Q3	-0.001(-0.383)	1.178(3.613)***	0.253(3.954)***
②	1993Q3	1997Q2	0.022(4.996)***	-0.307(-1.542)	-0.190(-2.413)***
③	2009Q2	2014Q3	0.006(4.944)***	0.276(3.437)***	0.304(12.345)***
④	2000Q1	2008Q2	0.0164(4.759)***	-0.904(-3.046)***	0.399(8.912)***
⑤	2000Q1	2014Q3	0.005(1.412)	0.500(1.274)	0.409(5.086)***

Hybrid NKPC

	From	To	const.	$\beta$	$\gamma$	$\theta$
①	1993Q3	2014Q3	0.001(0.313)	1.069(3.168)***	-0.144(-1.666)*	0.323(4.062)***
②	1993Q3	1997Q2	0.019(4.884)***	-0.351(-1.544)	0.276(1.849)*	-0.198(-2.273)**
③	2009Q2	2014Q4	0.006(3.118)***	0.319(2.839)***	-0.087(-0.998)	0.361(7.130)***
④	2000Q1	2008Q2	0.0179(5.760)***	-0.595(-2.447)**	-0.446(-3.531)***	0.515(8.402)***
⑤	2000Q1	2014Q3	0.010(3.007)***	0.170(0.564)	-0.415(-3.692)***	0.516(6.922)***

t-statistics in parentheses

The asterisks represent significance at the 10 percent (\*), 5 percent (\*\*), and 1 percent (\*\*\*) confidence levels.

**Source:** Calculated by author, using the data of NESDB "National Account".

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