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Analysing inflation dynamics in the Philippines using the new Keynesian Phillips curve

Faith Christian Q. Cacnio
Bangko Sentral ng Pilipinas

This study analyses short-run inflation dynamics in the Philippines using the new Keynesian Phillips curve (NKPC) framework. The NKPC highlights the inclusion of micro-based behavioral models for economic agents (i.e., households and firms) in deriving the relationship between inflation and economic activity. A key finding of this paper is the declining sensitivity of inflation to changes in the real variables of the economy. Various reasons have been cited to explain this phenomenon, which is often referred to in the literature as the flattening of the Phillips curve. For the Philippines, the adoption of inflation targeting and increased trade openness contributed to the flattening of the Phillips curve.

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1. Introduction

Short-run inflation dynamics is one of the key issues in macroeconomics, model design, and monetary policy formulation [Olafsson 2006]. It is traditionally studied under the framework of the Phillips curve. The Phillips curve started as a simple statistical relationship between money-wage growth and unemployment. Since then, its basic premise has been modified and revised as developments occurred in both theoretical and empirical fronts. From a straightforward empirical relationship between wage inflation and unemployment, the Phillips curve has evolved into a structural macroeconomic model.

Recent literature on the Phillips curve highlights the inclusion of micro-based behavioral models for economic agents (e.g., households and firms) in deriving the relationship between inflation and economic activity. This framework is referred to as the new Keynesian Phillips curve (NKPC). The NKPC is part of the synthesis between the Keynesian approach, in which demand plays a key role in an environment of sticky prices and wages, and the real business cycle models, in which supply-side factors drive changes in real activity [Ribon 2004]. It is now used as the main approach to wage and price modeling and in analysing the linkages between inflation and real activity. Its central assumptions include price setting based on monopolistic competition, use of marginal cost instead of the output gap or unemployment as measure of real activity, and a forward-looking factor to inflation expectations. Many of the studies on the NKPC dealt with empirically establishing the assumptions of the model. While some tried to look into the econometric issues related to the estimation of the NKPC, others tried to extend the original formulation by using alternative production functions (i.e., other than the assumed Cobb-Douglas) and by taking into consideration the role of open-economy aspects in the inflation process [Ribon 2004].

The objective of this paper is to analyse inflation dynamics in the Philippines using insights from the new Keynesian framework. The main contribution of this study is the derivation and estimation of a NKPC for the Philippine economy using quarterly data between 1988 and 2009. The paper is organized as follows: the next section discusses the theoretical and basic framework of a reduced-form Phillips curve; the third section shows the derivation of the NKPC; the fourth section presents estimates of the NKPC for the Philippines; the fifth section determines whether the Phillips curve for the Philippines exhibits the phenomenon of "flattening"; the sixth section extends the model to include open-economy aspects (i.e., trade openness); the seventh section looks into the policy implications of the observations generated in the study; and the last part of the paper concludes.

2. Estimates of a reduced-form Phillips curve for the Philippines

For the Philippines, studies conducted on the relationship between the inflationary process and real activity, often measured as the unemployment rate, focused on testing and validating the short-run trade-off. Bagsic [2004], using Philippine quarterly data, obtained robust results that confirmed the inflation-unemployment trade-off. Dumlao [2005] arrived at the same conclusion using a modified Phillips curve (MPhilC). By contrast, Dua [2006] observed that a trade-off between inflation and unemployment does not exist in the Philippines once globalization factors (e.g., exchange rate, import price, and oil prices) are incorporated in the traditional specification of the Phillips curve.

Reduced-form estimates of the Phillips curve, like those in Roberts [2006] and Kuttner and Robinson [2008], often have the following specification

$$\pi_t = \alpha + \beta(L)\pi_{t-1} + \gamma y_{t-1} + \delta z_t + \varepsilon_t \qquad (1)$$

where π_t is quarterly inflation, L is the lag operator, y_t is an estimate of the output gap, and z_t represents exogenous factors that affect inflation.[1] The lags of inflation are at times taken as proxies for inflation expectations, but in general they are meant to capture the observed persistence in inflation.[2]

The coefficient γ is allowed to vary over time to capture the behavior of the Phillips curve during the study period, 1988–2009. One way of doing this is by estimating equation 1 over a six-year rolling window. The six-year rolling window was chosen to coincide with the adoption of the Bangko Sentral ng Pilipinas (BSP) of a modified monetary targeting policy in 1995 and the eventual shift to inflation targeting as a framework for monetary policy in 2002. The regression includes a lag of inflation, the second lag of the output gap, and a lag of the wage index.[3]

In Figure 1, the coefficient of the output gap displayed sharp reductions in three periods—in the first part of the 1990s, in 1997, and in 2007. The early 1990s saw the onset of a power crisis that lasted for almost two years. This resulted in declining economic growth and double-digit inflation. Exacerbating the country's economic woes were natural calamities like the 1990 Luzon earthquake and the eruption of Mount Pinatubo in 1991, which caused massive destruction of properties and livelihood. From a less than 1 percent growth, the country began to recover in 1993. Inflation was likewise brought down to single-digit levels. Positive developments in the country's economy were, however, interrupted in 1997 when the East Asia region was swept by a severe financial crisis, which resulted in massive capital outflows. Although the Philippines did not suffer in the same magnitude as the other countries (e.g., Korea, Thailand), it still reeled from the viciousness of the crisis. This is reflected in the negative output gap coefficient between the second quarter of 1997 and the first quarter

[1] I likewise tried using the unemployment gap in the reduced-form equation. Many of the resulting estimates were, however, statistically insignificant and had the wrong sign. I generated the same results even when I tried to control for possible data incompatibility due to the change in the National Statistics Office's (NSO) definition of unemployment. The new unemployment definition was adopted starting April 2005 per NSCB Resolution No. 15 dated 20 October 2004.

[2] The coefficients on the lags of inflation are often restricted to sum to 1 (with the constant restricted to be 0). This is to ensure that, in the long run, the Phillips curve is vertical (i.e., the "accelerationist" model of inflation). Kuttner and Robinson [2008] noted that these restrictions imply that inflation is an integrated process, which is improbable when the central bank's reaction function satisfies the Taylor principle, or that nominal interest rate is moved more than one-for-one in response to expected inflation. Moreover, these restrictions ignore the cross-section constraints that would exist in fully specified models [Sargent 1971].

[3] The output gap was estimated using a modified Hodrick-Prescott filter (with a smoothing coefficient of 1600). The HP filter was adjusted to lessen the endpoint problem often associated with this filter (see Maravall and Kaiser [1999] for a more detailed discussion on this matter). The non-agriculture wage index for the Philippines was constructed using regional, non-agriculture minimum wages. Initially, the change in the prices of oil (*zt*) was included in the regression but was eventually excluded because it was not significant in many of the sample periods. Blanchard and Gali [2005] noted that in estimating a reduced-form Phillips curve, the effects of the changes in factors such as oil prices or the level of technology are already reflected through their effects on the estimated natural output.

of 1998. This period saw rising inflation and high unemployment rate.[4] Starting in the second quarter of 2006, the coefficient of the output gap followed a downward trend. In 2007, the country's economy expanded at an impressive rate of 7.3 percent, markedly higher than the 5.4 percent growth in 2006. The high economic growth did not result in inflationary pressures as the prices of major food items stayed relatively stable given favorable supply conditions and the sustained growth in agriculture. Moreover, the peso remained firm, tempering the impact on domestic prices of rising global commodity prices during the latter part of the year [BSP 2013]. An uptick of the coefficient was observed in the last quarter of 2008.

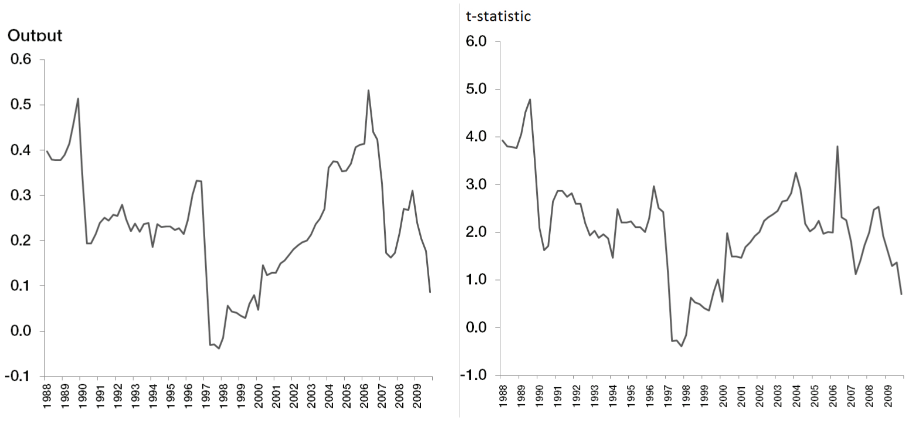

FIGURE 1. Output gap coefficient
Six-year rolling regression

Another way of examining changes in the output gap coefficient is by the use of the Kalman filter. Here, the process is specified so that the output gap follows a random walk. The main advantage of the Kalman filter is that it provides two-sided estimates, or that it uses all the information in the entire sample at all points of time.

From Figure 2, it can be seen that the decline in the coefficient of the output gap occurred at an earlier date—2002 (compared to 2006 for the rolling regression exercise)—and stayed relatively stable. This coincided with the BSP's adoption of inflation-targeting as its framework for monetary policy. One important implication emerging from this result is that inflation targeting provided a good anchor for inflation expectations, which has helped tame inflation.

[4] The Phillips curve implies a positive relationship between inflation and output gap. However, some studies have documented a negative relationship between inflation and output gap [Ozbek and Ozlale 2004]. These authors argue that in economies experiencing highly volatile output and rapidly changing macroeconomic dynamics, the traditional view of a positive inflation-output gap relationship may not necessarily hold.

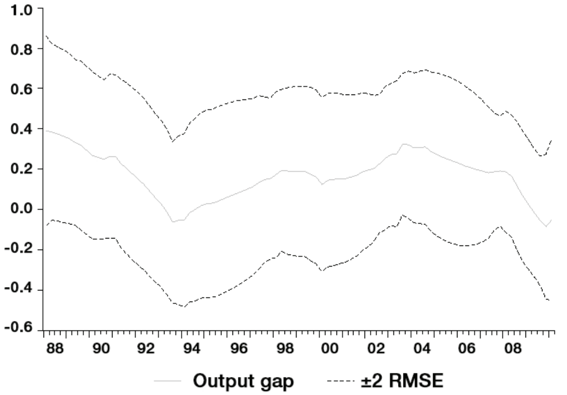

FIGURE 2. Output gap coefficient estimates (+/- two standard error band)

3. Derivation of the Phillips Curve in the new Keynesian model

Lucas [1976] criticized the use of reduced-form models, like those used above, in drawing policy conclusions. He argued that since the parameters of these models are not structural—not policy-invariant—they would be affected by changes in the policies implemented in the economy. It would then be difficult to tell whether the results generated from reduced-form models represent changes in the fundamental relationship of the variables being observed or if they capture the effects of policy changes in the other sectors of the economy. To address this issue, Lucas suggests the modeling of "deep parameters" that govern individuals (e.g., preferences). A more structural view of the inflation process is examined in this section using insights from the new Keynesian approach. The theoretical framework used closely follows that of Gali and Gertler [2000]; Gali, Gertler, and Lopez-Salido [2001]; Sbordone [2002]; and Blanchard and Gali [2005].

The behavior of inflation is solved under the new Keynesian framework by introducing the assumption of price staggering à la Calvo. In doing so, the new Keynesian Phillips curve is derived.

3.1. The baseline model

The new Phillips curve was built on two key developments in inflation dynamic modeling: first, the works of Friedman [1968], Phelps [1967], Sargent [1971], and Lucas [1972, 1976] paving the way for the explicit modeling of expectations and putting emphasis on forward-looking behavior in the inflation process; and second, the introduction of implicit price and wage optimization problems within a monopolistic environment [Dixit and Stiglitz 1977] and staggered price and wage setting (Fischer [1977]; Taylor [1980]; and Calvo [1983]).

The typical starting point for the new Phillips curve is the assumption that monopolistically competitive firms set prices optimally subject to a constraint on the frequency of price adjustments. This is in a way akin to the staggered contracts model of Taylor [1980]. Its main difference is that the pricing decision is derived explicitly from a monopolistic competitor's profit maximization problem subject to the constraint of time-dependent price adjustment [Gali and Gertler 2000]. Aggregating the optimal price-setting behavior of individual firms results in a short-run relationship between inflation and a measure of real activity.

Aggregation can be very tedious with deterministic time-dependent pricing rules at the micro level. To simplify the aggregation problem, a pricing assumption due to Calvo [1983] is commonly employed. In the Calvo model, each firm had a fixed probability of $1 - \theta$ of adjusting its price during a given period and a probability of θ that it will keep its prices fixed. Hence, the expected time a price remains fixed is $1/(1 - \theta)$. The parameter θ provides a measure of the degree of price rigidity.[5]

The new Phillips curve can be derived as follows. Firms are assumed to be identical, except for their differentiated products and for their pricing history. Also, each firm is assumed to face a constant price elasticity of demand curve for its product. Given these assumptions, it can be shown that the aggregate price level evolves as a convex combination of the lagged price level p_t and the optimal price p_t*. Thus, the price level can be written as

$$p_t = \theta p_{t-1} + (1 - \theta)p_t^* \quad (2)$$

where each variable is expressed as a percent deviation from a zero inflation steady state. Since firms are identical, the fraction of $1 - \theta$ of firms that set their price at t will choose the same price p_t*. Moreover, by the law of large numbers, the index of prices for firms that keep their prices fixed during this period (θ) would simply be equal to the lagged price level. Note that under the Calvo framework, p_t* is chosen to maximize the present discounted value of profits, taking into account the constraint implied by the cost of adjusting prices. Thus, if there are no adjustment costs (perfect price flexibility), then each firm would simply set its price according to

$$p_t^* = \log \mu + mc_t^n \qquad \forall\, t \quad (3)$$

where $\mu = \varepsilon/(\varepsilon - 1)$ is the firm's desired gross markup and mc_t^n is the logarithm of nominal marginal cost. However, with the constraint, the optimal price may be expressed as

[5] The other pricing mechanism commonly used in the new Keynesian literature is the quadratic adjustment cost proposed by Rotemberg [1982]. It assumes that changing prices entails a real cost (e.g., in terms of goods or hours worked). In such case, the coefficient λ is related to the magnitude of price adjustment costs. Lombardo and Vestin [2007] observed that an interesting feature of the Calvo pricing and Rotemberg pricing mechanisms is that, to a first order of approximation, they yield the same set of dynamic equations—that is, an identical Phillips curve.

$$p_t^* = \log \mu + (1 - \beta\theta) \Sigma_{k=0}^{\infty} (\beta\theta)^k E_t [mc^n_{t,t+k}] \quad (4)$$

where β is the subjective discount factor. In setting its price at t, the firm takes into consideration the expected future path of nominal marginal cost given the probability that its price may remain unchanged for multiple periods.

To derive an expression for the inflation rate at time t, let $\pi_t = p_t - p_{t-1}$ and $\widehat{mc}_t$ the log deviation of the firm's real marginal cost from its steady state value. Combining equations 2 and 4 results in

$$\pi_t = \lambda \widehat{mc}_t + \beta E_t \{\pi_{t+1}\} \quad (5)$$

where the coefficient $\lambda = ((1 - \theta)(1 - \beta\theta))/\theta$. Note that the slope coefficient λ depends on the deep parameters of the model (i.e., θ, β). It is decreasing in the degree of price rigidity, as measured by θ, the fraction of firms that keep their prices fixed. Inflation will be less sensitive to movements in marginal cost if there is a smaller fraction of firms that adjust their prices.

Equation 5 is the standard form of the new Keynesian Phillips curve. It implies that in setting their prices at time t, firms base their decisions on the expected future behavior of marginal costs; discounting it by the subjective discount rate and taking into account the frequency of price adjustment.[6] (See Cottrell and Mazumder [2010] for a more detailed derivation of the NKPC.)

Most of the empirical work done on the new Keynesian Phillips curve has used some measure of the output gap as the indicator of real economic activity. However, under certain conditions, it can be shown that an approximate log-linear relationship exists between marginal cost and output gap.[7] Thus,

$$\widehat{mc}_t = \kappa x_t$$
$$x_t = y_t - y_t^* \quad (6)$$

where κ is the output elasticity of marginal cost, y_t is the log of output, and y_t* is the log of the natural level of output (the level that would exist if prices were perfectly flexible). Combining equations 5 and 6 yields a Phillips curve-like relationship:

$$\pi_t = \lambda \kappa x_t + \beta E_t \{\pi_{t+1}\} \quad (7)$$

This bears similarity to the traditional Phillips curve with inflation depending positively on the output gap and a "cost push" term that captures the influence of expected inflation. The main difference, however, is that this incorporates a forward-looking component.

[6] Other authors who have tried to explain the derivation of the new Keynesian Phillips curve include Roberts [1995] and Sbordone [2002].

[7] Rotemberg and Woodford [1999] showed that under certain restrictions on technology and labor market structure, within a local neighborhood of the steady state, real marginal costs are proportionately related to the output gap, such that $\widehat{mc}_t = \delta(y_t - y_t^*)$.

Equation 7 is rewritten to reflect real marginal cost as the ratio of the wage rate to the marginal product of labor—that is,

$$MC_t = (W_t / P_t)[1/(\partial Y_t / \partial N_t)] = s_t / \alpha_n \tag{8}$$

with $s_t = (W_t N_t)/(P_t Y_t)$; W_t is average compensation per hour; N_t is total hours worked; Y_t is real output; and P_t is the price level. This is labor's share of output, equivalent to unit labor costs. Let lower case letters denote percent deviations from the steady state, then

$$mc_t = s_t \tag{9}$$

Gali and Gertler [2000] argued that marginal cost measure is the more relevant variable to use in building a structural model of the Phillips curve. Output gap, they claim, is difficult to estimate since it is unobservable. Moreover, it cannot account for the impact of productivity gains on inflation, something that a measure of marginal cost can directly capture. The use of the output gap in the new Phillips curve model has likewise been met with empirical problems. Fuhrer and Moore [1995] noted that the baseline new Phillips curve implies that inflation should lead the output gap over the cycle such that an increase (decrease) in current inflation should signal a subsequent rise (decline) in the output gap. However, the data show an opposite trend. This can be seen in Figure 3, which plots the annual percent change in gross domestic product (GDP) deflator (inflator) and output gap. Output gap tends to lead inflation by a number of quarters. Meanwhile, Figure 4 graphs annual percent change in GDP deflator and marginal cost. It shows marginal cost leading inflation by a few quarters.

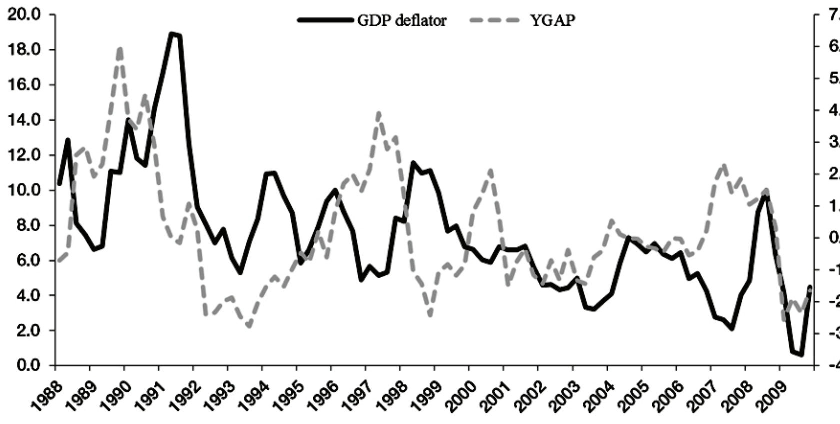

FIGURE 3. Inflation and output gap

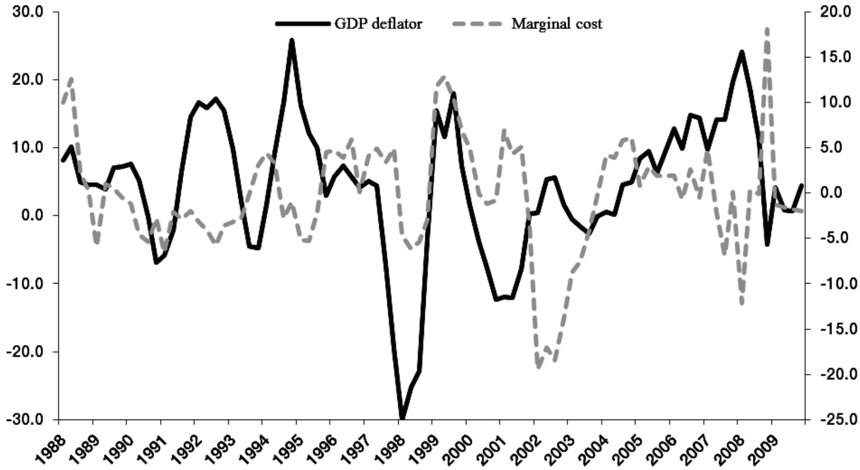

FIGURE 4. Inflation and marginal cost

3.2. New hybrid Phillips curve

It has been observed, however, that the specification in equation 7 fails to capture the observed persistence of inflation. To address this, Gali and Gertler [2000] extended the basic Calvo model to allow for a fraction of firms that use a backward-looking rule to set prices. Calvo's model posits that each firm is able to adjust its price in any given period with a fixed probability $1 - \theta$ that is independent of the time the price has been fixed. Suppose two types of firms coexist. Let $1 - \omega$ represent firms that behave like the firms in the Calvo model ("forward-looking"): they set prices optimally given the constraints in the timing of adjustments and using all the available information to forecast future marginal costs. The remaining firms (ω; "backward-looking") use a simple rule of thumb that is based on lagged inflation. Optimal prices can then be expressed as

$$p_t^* = (1 - \omega)\, p_t^f + \omega p_t^b \tag{10}$$

where p_t^f is the price set by a forward looking firm and p_t^b denotes the price set by a backward-looking firm. A subset (1 - ω) of forward-looking firms set prices as in the baseline Calvo model described in the previous section. Thus,

$$p_t^f = (1 - \beta\theta)\, \Sigma_{k=0}^{\infty} (\beta\theta)^k E_t [mc_{t+k}^n] \tag{11}$$

The backward-looking price rule can be expressed as

$$p_t^b = p_{t-1}^* + \pi_{t-1} \tag{12}$$

where p^*_{t-1} is the average price set in the most recent round of price adjustment and corrected for inflation. The correction is based on the lagged inflation rate (i.e., the lagged inflation is used to forecast current inflation). Combining equations 7, 10, 11, and 12:

$$\pi_t = \gamma_f E_t[\pi_{t+1}] + \gamma_b[\pi_{t-1}] + \lambda mc_t \tag{13}$$

The above equation is often referred to as the hybrid new Keynesian Phillips curve with the γ_f and γ_b coefficients representing the degree of "forward-lookingness" and inertia in inflation, respectively. The $\gamma_f, \gamma_b,$ and λ parameters are functions of the deep parameters ω and θ and the β as follows:

$$\lambda = (1 - \omega)(1 - \theta)(1 - \beta)\phi^{-1}$$

$$\gamma_f = \beta\theta\phi^{-1}$$
$$\gamma_b = \omega\phi^{-1}$$

where $\phi = \theta + \omega[1 - \theta(1 - \beta)]$.

Equation 13 tells us that if a larger fraction of firms are unable to update their prices each period (i.e., θ has a larger value), expected inflation weighs higher in the inflationary process. On the other hand, past inflation determines inflation more if a higher share of firms updates their prices based on a backward-looking rule of thumb. It is likewise worth noting that when all firms are forward looking, such that $\theta = 0$, the model converges to the baseline new Phillips curve discussed in the previous section.

4. Estimates of the new Keynesian Phillips Curve for the Philippines

Gali and Gertler [2000] and Gali, Gertler, and Lopez-Salido [2001, 2005] used generalized method of moments (GMM) to estimate the new Keynesian Phillips curve for the United States and the European area. The GMM is employed to handle the expectation term. Assuming that expectations are rational, they will be based on all available information; thus, expectation errors should, on average, be unrelated to the available information (the instruments). The utilization of GMM estimation is, however, not without some issues, among which is the choice of an appropriate instrument set and lag length to be used in the calculation of robust standard errors and the weighting matrix. Moreover, when the model is nonlinear, GMM estimates are sensitive to the normalization used [Kuttner and Robinson 2008]. See Guay and Pelgrin [2004] and Ma [2002] for detailed discussions on some of the issues on GMM estimation and their implication for the new Keynesian Phillips curve.

All data used are quarterly time series over the period 1988–2009. Inflation is measured as the quarterly percent change in the GDP deflator. Real marginal costs are measured as the log deviation of labor's share of output (i.e., real unit labor costs) from its mean.[8] Output gap is estimated using an adjusted HP filter. The instrument set includes four lags of inflation, two lags of the output gap, real marginal costs, and commodity price inflation. All series used, except for the output gap and GDP deflator, are for the non-agriculture business sector.[9]

Gali and Gertler [2000] recognized that in small samples, nonlinear estimation using GMM can at times be sensitive to the way the orthogonal conditions are normalized. To address this econometric issue, they used two specifications of the orthogonality conditions as the basis for their GMM estimation. Table 1 presents estimates of what Gali and Gertler [2000] referred to as the reduced-form hybrid new Keynesian Phillips curve—that is, equation 9. It is called a reduced-form since it does not estimate the deep parameters of the model. The model provides quantitative estimates on the backward-looking and forward-looking behavior for inflation dynamics.

TABLE 1. Reduced-form hybrid new Keynesian Phillips curve

$$\pi_t = \gamma_f E_t\{\pi_{t+1}\} + \gamma_b \pi_{t-1} + \lambda \widehat{mc}_t$$

Coefficient	Value	Standard error
γ_f	0.620	0.071
γ_b	0.386	0.068
λ	0.047	0.011
	$\gamma_f + \gamma_b = 1$	
γ_b	0.466	0.045
λ	0.038	0.010

Notes:

Estimated using 2SLS with Newey-West standard errors (using 12 lags). Instruments used include π_{t-1} to π_{t-4}, lags 1–2 of the output gap, real marginal costs and commodity price inflation (following Gali and Gertler [2001]).

Two important findings emerge from Table 1. First, there are more forward-looking price setters than there are backward-looking ones as given by the estimated coefficients on $\gamma_f = 0.62$ and $\gamma_b = 0.37$. Second, the slope coefficient on the real marginal cost is positive and significant. This implies that marginal costs have an important impact on inflation. The same results are obtained even if the

8 Labor's share in output is often constructed as the ratio of total labor compensation to GDP at factor costs as recorded in the National Accounts of the Philippines (NAP). However, Gollin [2002] noted that the series generated using this methodology is most likely incorrect in that it does not consider that an important part of labor income in developing countries is captured by the operating surplus (total profits) of private unincorporated enterprises (OSPUE). The share of OSPUE represents income (i.e., wages and profits) of the self-employed; and in the Philippines, it likewise reflects an estimate of the informal sector. Cognizant of these issues, I computed the marginal cost following one of the proposed adjustments of Gollin [2002]. Marginal cost was derived as the ratio of the share of compensation of employees in GDP to one minus the share of OSPUE and minus the share of indirect taxes and subsidies. This adjustment treats OSPUE as comprising the same mix of labor and profits as the overall economy.

9 It has been standard practice to use the labor share of income for the non-agriculture business sector. This is done to avoid problems in the measurement of agricultural and government output.

coefficients on inflation expectations and lagged inflation are made to sum to 1 (such that $\beta = 1$) (Kuttner and Robinson [2008]).[10]

The deep parameters, including ω, which measures the fraction of firms that are "backward looking" in setting their prices for period *t*, which were not estimated in the reduced-form, are estimated and presented in Table 2. Again, two specifications are given to account for potential econometric problems arising from the normalization of orthogonal conditions.

TABLE 2. Hybrid new Keynesian Phillips curve

$$\pi_t = (\theta\beta/\phi)E_t\pi_{t+1} + (\omega/\phi)\,\pi_{t-1} + \{[(1-\omega)(1-\theta)(1-\beta\theta)]/\phi\}\,\widehat{mc}_t$$

Coefficient	Moment condition 1[a]		Moment condition 2[b]	
	Value	Standard error	Value	Standard error
θ	0.444	0.036	0.558	0.046
β	0.951	0.011	0.945	0.014
ω	0.379	0.035	0.472	0.041
Implied λ	0.245		0.109	
		$\beta = 1$		
θ	0.436	0.028	0.529	0.034
ω	0.393	0.028	0.471	0.034
Implied λ	0.233		0.117	

Notes:

[a] Moment condition 1: $E_t\{(\phi\pi_t - \theta\beta\pi_{t+1} - \omega\pi_{t-1} - (1-\omega)(1-\theta)(1-\beta\theta)\,\widehat{mc}_t)z_t\} = 0$

[b] Moment condition 2: $E_t\{(\pi_t - (\theta\beta/\phi)\pi_{t+1} - (\omega/\phi)\pi_{t-1} - ([(1-\omega)(1-\theta)(1-\beta\theta)]/\phi)\,\widehat{mc}_t)z_t\} = 0$

z_t is an element of the time t information set; $\varphi = \theta + \omega[1 - \theta(1-\beta)]$. Estimated using 2SLS with Newey-West standard errors (using 12 lags). Instruments used include π_{t-1} to π_{t-4}, lags 1–2 of the output gap, real marginal

The structural parameter θ is estimated to be about 0.44 with a small standard error of 0.04 in the first specification. This implies that prices remain unchanged for two quarters on average. The second-moment condition results in a higher estimate of θ (0.56) and a longer period that prices are fixed—two to three quarters on average.

The Philippines experiences a higher frequency of price changes compared to the US and Euro areas. Gali and Gertler [2000] estimated the θ in the hybrid model to be around 0.8–0.87, which is equivalent to price change duration of five to eight quarters. The estimate they derived for θ using the base model is even higher at 0.83–0.92 or a price-change interval of 6–13 quarters. Gali, Gertler, and Lopez-Salido [2001, 2005] followed the methodology developed by Gali and Gertler [2000] to come up with estimates for the US and Euro areas. They attained lower values at 0.50–0.57 for the United States and 0.67–0.77 for the Euro area. For their part, Christiano, Eichenbaum, and Evans [2000] estimated that price updates occur every four quarters on average. Sbordone [2002] analysed the sticky-price

[10] Pagan [2008] observed that with this constraint, the first lag of inflation becomes an instrument for variables other than itself (instead of using longer lags). This can potentially reduce the problems with weak instruments.

hypothesis using US data by testing implications that depend only on the firm's optimal pricing problem. She estimated the price inertia in the United States to be between 2.5 and 3.5 quarters. Amato and Gerlach [2000] observed that the duration of price changes in the United States is two to three quarters, while for Spain it is six quarters. McAdam and Willman [2003] showed that price adjustments happen every 4.5–6.0 quarters in Europe, while Leith and Malley [2002] found that for the United States, UK, and Italy, price changes are every two quarters on average, and for Canada, France, and Japan about three quarters. Kuttner and Robinson [2008] estimated a longer period of price-change duration for the United States at seven to nine quarters. Taylor [1998], in providing an extensive overview of the earlier literature on price adjustments in the United States, concluded that the average frequency of price changes is about once a year. Blinder et al. [1998] surveyed about 200 US manufacturing firms and reported that 65 percent of the companies claim around one to two price changes in a year, and that the median time between price changes is three quarters.

Taylor [1998] pointed out that the frequency of wage and price changes depend on the average rate of inflation. Dotsey, King, and Wolman [1999] likewise showed that price adjustments vary with the business cycle and are particularly more frequent for higher inflation rates. Against these findings, a shorter price-change interval can be expected from the Philippines relative to countries with lower and more stable inflation. The Philippines had experienced chronic double-digit inflation during the 1980s until the 1990s. It was not until the shift to inflation targeting by the BSP in 2002 that inflation was reined in to lower levels.

In the first method, more than one-third of the price setters are backward-looking, given that the structural parameter $\omega\theta$ is estimated to be 0.38 with a standard error of 0.04. The second specification results in a higher estimate of $\omega\theta$ at 0.47. The results derived are consistent with those in the reduced-form model in that forward-looking behavior dominates backward-looking behavior in price setting. Agenor and Bayraktar [2003] estimated contracting models of the Phillips curve with backward- and forward-looking expectations and similarly found that past inflation plays a smaller role in inflation dynamics in the Philippines.

The estimates for β are nearly similar across the two specifications, although these are lower compared to the estimates for β in the new Phillips curve model. Restricting $\beta = 1$, yields the same trend as in the unrestricted case.

Roberts [2001] criticized the use of the unit labor costs as the measure for real marginal costs (and, in turn, real activity) in the hybrid new Keynesian Phillips curve. He argued that, compared to the traditional Phillips curve based on the output gap, the results generated by the hybrid model based on labor cost capture a narrower phenomenon. The use of the output gap in the traditional Phillips curve is meant to capture the effects of economic activity in all aspects of marginal cost. Moreover, Roberts [2001] observed that the models of inflation have a better fit when lags of inflation are included. This rejects the assumption of pure rational expectation.

Studies that tested the empirical validity of the NKPC had often used a specification that included a backward-looking component. All these papers had observed that there is some weight to backward-looking behavior in the inflation process. Rudd and Whelan [2001] disputed such results and contended that the findings of Gali and Gertler [2000] suffer from significant econometric problems and thus their conclusions about the backward-looking price adjustments being important are invalid. Linde [2001] presented evidence indicating that the NKPC is unable to describe the reduced-form inflation equation whether using the output gap or the labor share. Gali, Gertler, and Lopez-Salido [2005] responded to these allegations by proving that their estimates are robust, signifying an important role for the backward component.

Fuhrer and Moore [1995] used a staggered contracting model of the NKPC and noted that the persistence in inflation observed in the data cannot be explained. Amato and Gerlach [2000] demonstrated that forward-looking models do fit the data quite well, even though most research shows that the coefficient of lagged inflation is significantly greater than zero.

5. Has the Phillips Curve flattened in the Philippines?

Toward the end of the 20th century, significant changes shaped the global economy. For one, greater openness in economies has resulted in easier movement of trade, capital, and labor across regions. Although the globalization of markets brought growth to many countries, it also caused some fundamental changes in economies. Underlying economic relationships, once clearly established, have been observed to behave differently. One of these is the connection between inflation and real economic activity.

In recent years, it has been observed that inflation has become less responsive to movements in output and unemployment. This phenomenon, often referred to in the literature as the "flattening" of the Phillips curve, has been noted and empirically tested in developed economies (e.g., Roberts [2006] for the United States; Beaudry and Doyle [2000] for Canada; Bentolila, Dolado, and Jimeno [2007] for Spain) as well as in relatively small and open economies like Australia (Kuttner and Robinson [2008]). Observations that the Phillips curve is deviating from observed norms would mean that more output or employment needs to be sacrificed to achieve a permanent reduction in long-term inflation. In this section of the paper, this "flattening" of the Phillips curve is determined for the Philippines using insights from the new Keynesian macroeconomic theory.

5.1. Inflation, output gap, and unemployment rate in the Philippines: 1988–2009

Between 1988 and 2009, the Philippine economy underwent considerable changes. From being highly volatile and crisis ridden in the 1980s, the country's economy gained a relatively more stable footing in the 1990s, which has continued until the present. This is evident from Table 3, which presents standard deviations of quarterly GDP growth, price inflation, output gap, and unemployment during two sample periods—namely, 1988–2001 and 2002–2009. Between the two periods under consideration, the volatility of economic growth declined markedly by 61 percent.

The choice of the two sample periods corresponds to the adoption of inflation targeting by the BSP as its framework for the conduct of monetary policy in 2002. Thus, the two sample periods can be characterized as pre-inflation targeting (1988–2001) and inflation targeting (2002–2008). It should be mentioned, however, that prior to shifting to inflation targeting, the BSP adopted a "modified monetary targeting" policy starting in the second semester of 1995. It was observed that the liberalization of the Philippines' financial sector led to the weakening of the link between quantitative monetary targets and inflation due to some "structural breaks" in the income velocity of money, and volatilities and instabilities in the money multiplier [Lim 2006]. The modified framework was intended to enhance the effectiveness of monetary policy by complementing monetary aggregate targeting with some form of inflation targeting [Guinigundo 2005]. Monetary targets could thereby be exceeded as long as inflation targets are being met. Hence, since the latter part of 1995, the BSP has been implementing a "loose" form of inflation targeting. Nonetheless, for the purposes of this paper, the break in the sample period is 2002Q1 when the BSP formally shifted to inflation targeting as its framework for the conduct of monetary policy.

TABLE 3. Volatility of output, inflation and unemployment (standard deviations, percentage points)

	GDP growth	Inflation	Output gap	Unemployment rate
1988Q1- 2001Q4	2.82	4.12	2.09	1.70
2002Q1 – 2009Q4	1.86	2.72	1.22	1.03

In Table 3, inflation, output gap, and unemployment rate showed declining volatilities between the two sample periods. Output gap volatility had a sizable drop of 41.7 percent, while inflation and unemployment rate fell by 34.0 percent and 39.7 percent, respectively.

The significant decline in the variability of output and inflation has often been referred to as the "Great Moderation" [Stock and Watson 2003].[11] Several studies have documented this phenomenon (Cecchetti, Flores-Lagunes, and Krause [2004]; Blanchard and Simon [2001]; McConell and Perez-Quiros [2000]; Kim

[11] James Stock, a Harvard economist, coined the phrase "the great moderation" in his research paper on business cycles, which he coauthored with Mark Watson of Princeton. In 2004, the phrase gained ground when Ben S. Bernanke, then a Federal Reserve governor, gave a speech titled "The great moderation".

and Nelson [1999]). While output and inflation both experienced declining volatilites, these were at markedly different rates. The corresponding decline in inflation has not been proportional to the drop in output gap volatility. This gives rise to the assertion that the Phillips curve has flattened.

5.2. Empirical evidence

To assess whether a flattening of the Phillips curve has occurred for the Philippines, we look into the estimates of the structural parameters of the hybrid new Keynesian Phillips curve for the two sample periods under consideration: 1988 to 2001 and 2002 to 2009. These estimates are presented in Table 4.

TABLE 4. Hybrid new Keynesian Phillips curve

$$\pi_t = (\theta\beta/\phi)E_t\pi_{t+1} + (\omega/\phi)\,\pi_{t-1} + ([(1-\omega)(1-\theta)(1-\beta\theta)]/\phi)\,\widehat{mc}_t$$

Coefficient	Moment condition 1[a]		Moment condition 2[b]	
	Value	Standard error	Value	Standard error
1988–2001				
θ	0.438	0.046	0.547	0.060
β	0.959	0.014	0.951	0.018
ω	0.386	0.045	0.480	0.053
Implied λ	0.245		0.111	
$\beta = 1$				
θ	0.419	0.039	0.507	0.046
ω	0.409	0.038	0.493	0.047
Implied λ	0.241		0.123	
2002-2009				
θ	0.552	0.058	0.711	0.081
β	0.895	0.025	0.888	0.036
ω	0.277	0.048	0.368	0.060
Implied λ	0.202		0.064	
$\beta = 1$				
θ	0.462	0.040	0.569	0.047
ω	0.368	0.037	0.431	0.047
Implied λ	0.220		0.106	

Notes:

[a] Moment condition 1: $E_t\{(\phi\pi_t - \theta\beta\pi_{t+1} - \omega\pi_{t-1} - (1-\omega)(1-\theta)(1-\beta\theta)\,\widehat{mc}_t)z_t\} = 0$

[b] Moment condition 2: $E_t\{(\pi_t - (\theta\beta/\phi)\pi_{t+1} - (\omega/\phi)\pi_{t-1} - ([(1-\omega)(1-\theta)(1-\beta\theta)]/\phi)\,\widehat{mc}_t)z_t\} = 0$

z_t is an element of the time t information set; $\phi = \theta + \omega[1 - \theta(1-\beta)]$. Estimated using 2SLS with Newey-West standard errors (using 12 lags). Instruments used include π_{t-1} to π_{t-4}, lags 1–2 of the output gap, real marginal costs and commodity price inflation [Gali and Gertler 2001].

Two important observations emerge in Table 4. First, the structural parameter, θ, or the probability that a firm cannot change its price in any given period, has increased between the two subperiods in both normalizations used and even when β is restricted to 1 (except in moment-condition 2 for subperiod 2002–2008). This implies that the average duration between price changes has lengthened. Second, the parameter, $\omega\omega$, or the proportion of backward-looking price-setting firms, has declined. The value of the coefficient of lagged inflation was around 0.34–0.47, while that of future inflation was 0.51–0.61. Thus, the inflation process is based more on future expectations than on the inertia due to backward-looking price adjustment. Higher price rigidity as implied by the lengthening in average duration between price changes would result in lower sensitivity of inflation to changes in real marginal cost—a flatter Phillips curve. In contrast, the decline in the fraction of backward-looking price setters would mean that inflation is more responsive to potential shocks in the economy and to movements in the real marginal cost. This signifies a steeper Phillips curve. However, looking at the estimated values of λ, the coefficient of the real marginal cost, they decreased between the two sample periods across the different normalizations and whether or not β is restricted to 1. It appears that the impact of the increase in the parameter θ dominates—or that the Phillips curve for the Philippines has flattened.

While the "flattening" Phillips curve has been established as stylized fact, the exact reasons for this change have not been clearly defined. Roberts [2006], Williams [2006], and Mishkin [2007] inferred that it was due to the firmer anchoring of inflation expectations. Many central banks, including the BSP, have adopted inflation targeting as a framework for monetary policy, and this has helped rein inflation expectations. Bayangos et al. [2009] have shown that the inflation expectations channel is important in influencing inflation in the Philippines. Estimating a reduced-form equation model of survey-based expectations to identify the factors driving inflation expectations, they observed that current actual inflation and the inflation target announced by the monetary authorities appear to be significant in driving expectations. This implies that economic agents assess the credibility of the BSP and form their expectations based on what they have learned at the end of the current period and at the medium-term path of inflation target announced by the monetary authorities.

6. Open-economy NKPC

The model derived by Gali and Gertler [2000] has been empirically tested using US and EU data and has been shown to explain inflation dynamics reasonably well. However, the specification of the model does not allow for external influences on domestic inflation. The openness of the economy can affect inflation dynamics, given that fluctuations in the exchange rate can pass through to domestic inflation via import prices. Moreover, Borio and Filardo [2007] and Razin and Binyamini [2007] attributed the flattening of the Phillips curve to the effects of globalization (e.g., trade openness, migration, and capital account liberalization). Some studies have tried to address this issue by expanding the specification of the NKPC to include open-economy dimensions. Gali and Monacelli [2000] pointed out that the marginal cost can be redefined in terms of real consumption wage and a relative price. The relative price term, in turn, can be shown to be a function of real exchange rate and the tax wedge. Gali and Lopez-Salido [2001] included imported-input prices in a new Phillips curve for Spain and estimated different measures of marginal costs using different production functions. Similarly, Gagnon and Khan [2001] tried to redefine the marginal cost measure through the use of different types of production functions. Balakrishnan and Lopez-Salido [2002] used the same basic framework as in Gali and Lopez-Salido [2001] to demonstrate that the inclusion of open-market factors in the Phillips curve improves its fit to UK data. Genberg and Pauwels [2003] worked with Hong Kong data and their results showed that incorporating open-economy variables in the model makes it more consistent with theory.

Following Gali and Lopez-Salido [2001] and Balakrishnan and Lopez-Salido [2002], trade openness is incorporated in the NKPC with the inclusion of imported-input prices. The relevance of the use of imported intermediate goods as a measure of trade openness has gained greater ground with the advent of global outsourcing. Recent decades have seen outsourcing as a new mode of doing business for many enterprises in developed countries (e.g., United States and Europe). Firms outsource to reduce their production costs, streamline their operation, and enhance their competitiveness. Jones [2000] noted that with outsourcing, production processes that have traditionally been vertically connected (i.e., all activities are done in the same location) have been broken up or fragmented. Such fragmentation can result in lower marginal costs of production since advantage can be gained by locating in areas where intensively used factors may be more productive or available at lower costs (e.g., cheap labor in developing countries).

The growth in international specialization has been a prominent feature of the international economy [Antras and Helpman 2003]. One of the classic examples illustrating this trend was given by Feenstra [1998] when he described Mattel's global sourcing strategy in the production of its Barbie dolls: "Of the $2 export value for the dolls when they leave Hong Kong for the United States about 35 cents covers Chinese labor, 65 cents covers the cost of materials—which are imported from Taiwan, Japan, and the United States—and the remainder covers transportation and overheads, including profits earned in Hong Kong."

The Philippines has become one of the top outsourcing destinations in the world. One of the main sectors that greatly benefited from outsourcing in the country is the electronics industry, which experienced rapid growth and development with the establishment by global electronic companies of subsidiaries for the production of microchips. Statistics reveal that in the 1990s, the share of imports of intermediate inputs for the production of electronic products in the total imports of raw materials and intermediate goods and in total imports stood at 37.4 percent and 19.6 percent, respectively. By the 2000s, these ratios rose to 62.1 percent and 36.4 percent, respectively.

It should be noted that the specification of the marginal costs is dependent on the assumptions made with regard to the production function. If the elasticity of output with respect to labor is assumed to be constant, then the labor share of output will also be constant. However, if a CES production function is assumed, the share of labor will depend on its price relative to other inputs. In a small open economy like the Philippines, this would imply that labor share will depend on labor's price relative to the price of imported input goods and that marginal costs will be a function of these prices.

Thus, assuming a CES production function,

$$Y_t = F\,(N,M) = [\alpha_n (Z_t N_t)^{1-\frac{1}{\sigma}} + a_{Nm}(M_t)^{1-\frac{1}{\sigma}}]^{\frac{\sigma}{\sigma-1}} \tag{14}$$

where M_t represents imported intermediate goods, N_t is labor input, and σ is elasticity of substitution between the two inputs. From cost minimization, it is known that the following equilibrium condition holds:

$$N_t / M_t = (P_{Mt} / W_t)^{\sigma} \tag{15}$$

P_{Mt} is the price of imported goods and W_t is the nominal wage rate. Real marginal cost can be written as

$$MC = W/MP_N = (WN/Y)/[(\partial Y/\partial N)(Y/N)] = s_t/\eta_{N,Y} = s_t/[1-\alpha_m(Y_t/M_t)]^{\frac{1-\sigma}{\sigma}} \tag{16}$$

where s_t is the labor share in output.

Substituting equation 15 in equation 16 and log-linearizing the resulting equation yields the following expression for real marginal costs:

$$\widehat{mc}_t = \hat{s}_t + \phi(\widehat{p_{Mt} - w_t}) \tag{17}$$

where $\phi = ((1 - \mu s/\mu s))(\sigma - 1)$; μ is the steady-state markup, such that $\mu = 1/MC$. In equation 17, real marginal costs depend on real unit labor costs and on the relative price of imported goods and labor inputs. The parameter φ determines how changes in the ratio of relative prices lead to movements in marginal costs and, in turn, to inflation. With $\sigma > 1$, an increase in the prices of imported goods below the increase in the nominal wage will cause the marginal costs to decline. However, as $\sigma \rightarrow 1$, the production function becomes a Cobb-Douglas function and equation 17 collapses into $\widehat{mc}_t = \hat{s}_t$. In this case, the changes in the relative prices of labor and imported materials do not affect marginal costs. The effect of fluctuations in the exchange rate is captured by changes in import prices, which are then passed on to movements in marginal costs.

Substituting equation 17 in equation 5 yields the following expression:

$$\hat{\pi}_t = [(1-\theta)(1-\beta\theta)]/\theta\,(\hat{s}_t + [(1-\mu s)/\mu s](\sigma-1)(\widehat{p_{Mt}-w_t}) + \beta E_t\{\hat{\pi}_{t+1}\} \quad (18)$$

Setting this in the hybrid NKPC specification (equation 16), we get

$$\hat{\pi}_t = (\theta\beta/\phi)E_t\hat{\pi}_{t+1} + (\omega/\phi)\pi_{t-1} + [(1-\omega)(1-\theta)(1-\beta\theta)/\theta]\,\widehat{mc}_t[(\hat{s}_t + (1-\mu s/\mu s)(\sigma-1)(\widehat{p_{Mt}-w_t})] \quad (19)$$

where: $\phi = \theta + \omega[1 - \theta(1 - \beta)]$.

Equation 19 nests the baseline hybrid NKPC specification of Gali and Gertler [2000] and includes an additional term that pertains to the elasticity of substitution between the two inputs. In the above equation, as the elasticity of substitution in the production function, σ, increases, the deviations in the relative price of imported goods to wages become more important in the inflationary process.

Figure 5 plots annual percent change in GDP deflator (inflation) and the price of imported goods relative to nominal wage.[12] The graph shows that the trend of the relative prices fairly follows the path of inflation. This implies that this factor may assist in describing inflation dynamics in the Philippines.

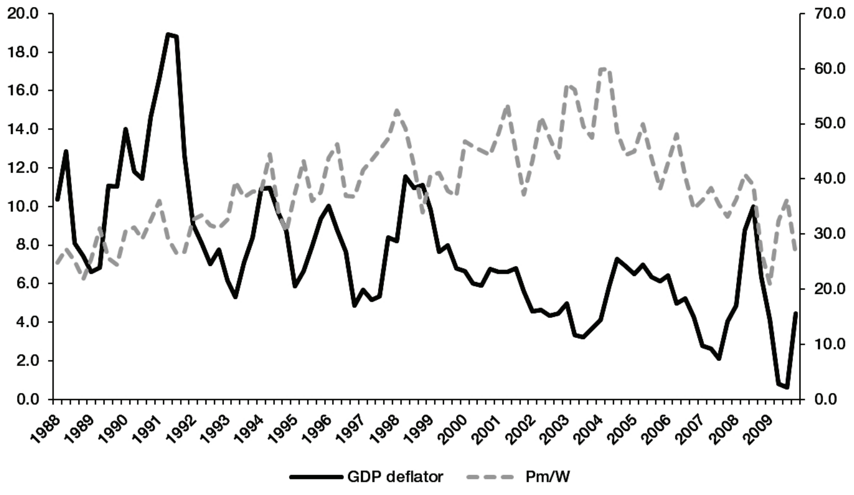

FIGURE 5. Inflation and prices of imports/wage rate

From equation 19, the parameters to be identified are β, θ, ω, σ. There should also be estimates for μ and s. Given the limitations of the estimation, only a subset of the parameters may be identified. As in the previous sections, I choose to estimate the parameters β, θ, ω. A value for σ was derived using equation 14. The

[12] Import prices are based on quarterly Unit Value Index of Imports (2000 = 100).

point estimate for σ is 1.23.[13] I assume s to be equal to 0.51, which is the average value of the labor share in GDP derived from the national accounts. The markup, μ, is set at 1.5.[14] The markup price may be on the higher end but it is within the same range as the values assumed in other countries.[15] For estimation purposes, quarterly data on principal merchandise imports from the National Accounts of the Philippines were used.[16] This is total merchandise imports less imports on consignment and imports that fall under the general category of "others". Imports on consignment include imports of intermediate materials used for the production of export goods (e.g., electronics and electrical materials). Given that export goods are not domestically consumed and hence do not affect local prices (their prices are determined in the international markets), they do not affect domestic inflation process. Thus these were excluded.[17]

In the previous section, the period under study was divided into two subperiods to account for the shift in the framework used for the conduct of monetary policy. Results showed that the shift to inflation targeting by the BSP in 2002 helped better anchor inflation expectations. Thus the sensitivity of inflation to fluctuations in real economic activity has declined between the pre-inflation targeting (1988–2001) and inflation targeting (2002–2010) periods. To control for the possible impact of the shift in the framework used for the conduct of monetary policy, the period under consideration was likewise divided in two subperiods. The results of the structural estimation are shown below in Table 5.

Table 5 shows that prices, on average, are updated every two quarters. The same price-change duration results even in the case where β is restricted to 1. Moreover, firms change their prices optimally using a forward-looking rule (except in the restricted 1988–2001 scenario); consistent with the results generated in the baseline NKPC model.

According to the estimated values of the structural parameters, the coefficient of future inflation is around 0.47 in 1988–2001 and 0.49 in 2002–2008, while that of lagged inflation is 0.50 and 0.45 in the 1988–2001 and 2002–2008 subperiods, respectively. These findings imply that between the two sample periods the

[13] I have not found any previous estimates of a similar CES production function for the Philippines that I can use for comparison.

[14] I based my estimate of the markup price on the work of Felipe and Sipin [2004]; sample period: 1980–2002.

[15] Galí, Gertler, and López-Salido [2001] assumed markup prices of 1.1 for the US and Euro areas; Balakrishnan and Lopez-Salido [2002], 1.2; Rotemberg and Woodford [1999], 1.11; and Ribon [2004], 1.02–1.7 for Israel.

[16] For comparison, I ran estimates using total merchandise imports instead of principal merchandise imports, and the results are not statistically different. The trend was the same in both estimations.

[17] Rotemberg and Woodford [1999] argued that if materials entered the gross output production function "isoelastically", then the share of materials was another possible measure of marginal cost. Batini, Jackson, and Nickell [2005] observed that including intermediate materials is significant for capturing the behavior of UK inflation. However, their model used the quadratic adjustment costs described by Rotemberg [1982] and not the Calvo framework.

inertia of inflation gradually declined as a result of the process of updating prices. Moreover, the results would indicate that monetary policy is viewed as being reasonably credible such that future expectations weigh more in pricing decisions. The stickiness in wage determination can also be an additional source of inertia in the inflation process [Ribon 2004]. This factor is expressed in the marginal-costs variable and the relative price of imports to wages, and captured in the coefficient λ. Looking at the relatively small value of λ in the different periods considered means that the general impact of wage stickiness in inflationary inertia may only be minimal.

TABLE 5. Open economy new Keynesian Phillips curve

$$\pi_t = (\theta\beta/\phi)E_t\pi_{t+1} + (\omega/\phi)\,\pi_{t-1} + ([(1-\omega)(1-\theta)(1-\beta\theta)]/\phi)\,\widehat{mc}_t\,[\hat{s}_t + (1-\mu s/\mu s)\,(\varepsilon-1)(\widehat{p_{Mt}-w_t})]$$

	1988 – 2009	
Coefficient	**Value**	**Standard error**
θ	0.502	0.034
β	0.889	0.022
ω	0.498	0.034
Implied λ	0.142	
	$\beta = 1$	
θ	0.500	0.054
ω	0.500	0.054
Implied λ	0.125	
	1988 – 2001	
θ	0.510	0.052
β	0.909	0.026
ω	0.490	0.051
Implied λ	0.137	
	$\beta = 1$	
θ	0.480	0.042
ω	0.520	0.043
Implied λ	0.130	
	2002 – 2009	
θ	0.574	0.060
β	0.816	0.054
ω	0.426	0.060
Implied λ	0.110	
	$\beta = 1$	
θ	0.532	0.057
ω	0.468	0.057
Implied λ	0.117	

Notes:

Estimated using 2SLS with Newey-West standard errors (using 12 lags). Instruments used include π_{t-1} to π_{t-4}, lags 1–2 of the output gap, real marginal costs and real import prices.

In the closed-economy version of the NKPC in the previous section, the coefficient of the marginal cost, λ, during the 1988–2001 period was estimated at 0.245 while for the 2002–2010 period it was 0.241 (first-moment condition). For the open-economy version of the NKPC with trade, the estimates for the coefficient of the marginal costs for the two subperiods were 0.137 and 0.110, respectively. The decline in the sensitivity of inflation to changes in economic activity (as captured by the coefficient λ) between the two subperiods was larger under the open-economy scenario.

Globalization factors (e.g., trade openness, migration) have been cited to explain the observed decline in the sensitivity of inflation to changes in economic activity. The argument that globalization factors lead to a declining sensitivity of inflation to economic activity in the short run is based on three observations [Iakova 2007]. First, strong international competition constrains businesses from increasing prices when demand rises. Second, increased trade and investment flows have resulted in declining responsiveness of prices to domestic demand pressures. The estimates of the NKPC for the Philippines attest to these observations. Price adjustments were found to be of longer duration in a more open economy as compared to a closed economy. Third, global migration, which has intensified in recent years, has caused wages and prices to become less sensitive to domestic demand shifts.

This study analysed the impact of increased globalization (i.e., greater trade openness) on the link between inflation and real economic activity. An area of research that is likewise worth exploring is the implications of financial crises on this relationship. This is in light of the recent financial crisis experienced by the global economy. While the period under consideration in this study covered the crisis years (i.e., 2008–2009), the analysis presented in this study focused more on changes in the relationship between inflation and real activity between the pre–IT and IT periods. Future research could deal with the impact of a financial crisis on the inflation–real activity tradeoff.

7. Policy implications

What does the observed decline in inflation sensitivity to economic activity (i.e., flatter Phillips curve) imply for the conduct of monetary policy? Cacnio [2011], using a small-scale macroeconomic model for the Philippines, simulated the effects of different shocks on inflation, output interest rates under the assumptions of "steeper" Phillips curve (i.e., higher coefficient of the real marginal cost) and "flatter" Phillips curve (i.e., lower coefficient of the real marginal cost). Simulation results showed that shocks to inflation can cause greater volatility in output under a steeper Phillips curve compared to when the Phillips curve is flatter. Also, adjustments in the interest rates were larger under the steeper Phillips curve than in the alternative model. These observations imply that inflationary shocks have less impact on interest rates and output under a flatter Phillips curve. Meanwhile, demand shocks have a much smaller effect on inflation under a flatter Phillips curve. Interest rates, therefore, need lesser adjustment.

Bean [2006] observed that a flatter Phillips curve brings mixed blessings for monetary authorities. On the one hand, it implies that demand shocks and policy errors will not translate into large movements of inflation. However, on the other hand, if inflation remains above target, bringing it down to the desired level would entail greater output variability.

8. Conclusion

The NKPC framework provides micro foundations for the link between the marginal costs of production and the inflationary process. It allows for the determination of structural parameters relating to price-setting decisions. The results generated in the paper show that the empirical characteristics of the Phillips curve in the Philippines do not differ qualitatively from those in other countries (Europe, Canada, United States, Australia, and Spain).

One of the main findings in the paper is that, on average, firms in the Philippines update their prices every two to three quarters. The proportion of firms that set their prices based on a backward-looking rule of thumb is about 38–48 percent. This implies that monetary policy, which is anchored on maintaining price stability, appears credible in that firms give more weight to future developments. From the estimates of the hybrid new Keynesian Phillips curve, the value of the coefficient of lagged inflation was around 0.34–0.47 while that of future inflation was 0.51–0.61. Thus, the inflation process is based more on future expectations than the inertia due to backward-looking price adjustment.

The flattening of the Phillips curve (i.e., the declining sensitivity of inflation to changes in real variables like output or employment) was also empirically tested for the Philippines. To do so, the study period 1988–2001 was divided into two subperiods, 1988–2001 and 2002–2008. This corresponds to the period before the BSP adopted inflation targeting as its framework for monetary policy and the period during which it began to target price stability. The adoption of inflation targeting led to a longer period between price changes and a decline in the share of firms that use a rule of thumb in updating their prices.

Since the Philippines is a small open economy, the NKPC model was extended to include open-economy factors. One of the conclusions from this exercise is that the price of imported goods relative to wages does affect the inflation process. Compared to the closed-economy version, the decline in the sensitivity of inflation to changes in economic activity (as captured by the coefficient λ) between the two subperiods was larger under the open-economy scenario. The inclusion of open-economy aspects in the analysis of the NKPC (i.e., international trade) has resulted in a flatter NKPC for the Philippines.

From a policy standpoint, a flatter Phillips curve is a mixed blessing for monetary authorities. On the one hand, it implies that demand shocks and policy errors will not translate into large movements of inflation. On the other hand, if inflation remains above target, bringing it down to the desired level would entail greater output variability.

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APPENDIX 1. Data definitions and sources

Data

The sample period covers the first quarter of 1988 to the fourth quarter of 2009. The statistics used were gathered from the National Statistics Office (NSO), the National Statistical Coordination Board (NSCB), the Philippine Institute for Development Studies (PIDS), and the Bangko Sentral ng Pilipinas (BSP).

Seasonal adjustment

Variables used to generate other measures have been adjusted for seasonality using the X-11/X-12 method (multiplicative) created by the US Bureau of Census.

Natural logarithm

Variables are expressed in natural logarithm.

GDP deflator

The GDP deflator was constructed by dividing nominal GDP by real GDP (at 1985 prices).

Imports

Principal imports into the Philippines in CIF value in million pesos.

Import prices

Import prices are based on the seasonally adjusted quarterly Unit Value Index of Imports (2000=100).

Marginal costs

Marginal costs = Employee compensation /(GDP – indirect taxes – operating surplus of private unincorporated enterprises [OSPUE])

Output gap

The output gap was estimated using a modified Hodrick-Prescott filter (with a smoothing coefficient of 1600) on seasonally adjusted real GDP to generate potential output, which was then subtracted from real GDP. The HP filter was adjusted to lessen the endpoint problem that is often associated with this filter.