Monetary policy and underlying inflation pressures: the essence of monetary policy design

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1. Introduction

The recent rise in oil and other commodity prices has called into question the decision made by the Bank of Thailand in 2000 to choose a measure based on the CPI excluding fresh food and energy ("core inflation") as the inflation target. Between the first quarter of 2004 and the third quarter of 2008, CPI inflation ("headline inflation") averaged 4.0%, whereas the average core inflation registered 1.5%. During that period core inflation had been consistently lower than headline inflation in every quarter. Among the several questions raised by policymakers, the most crucial one is: given such a divergence, is core inflation still pertinent to the conduct of monetary policy as the target measure? Other relevant questions have included: why did the central bank choose core inflation in the first place? and what does theory say?

This paper offers a justification for and assurance of the efficiency of a monetary policy design that is based on using core inflation as the policy target. Illustrated in a framework where the microeconomic foundation with rigidities of various types is the central feature, the first part of the paper starts with an important reminder of the reason why central banks need to focus on inflation as their primary objective. Instability of the general price level leads to undesired variation in the relative prices of goods, and, given the presence of price rigidity, allows only some subset of prices to adjust freely. These relative price distortions lead to inefficient resource allocation.

Once the mandate of price stability is established, the next questions are: which measure(s) of inflation, according to theory, is/are most relevant to the conduct of monetary policy? Should the monetary authority stabilise the general price level or a narrower price index? In addition to prices of goods and services that are consumed by households, should other prices such as wages or asset prices be taken into consideration?

While the literature broadly suggests that stabilising a target index that places more weight on the stickier prices is a better policy, it has mostly come to a conclusion that the monetary authority should be mindful of developments in a broad variety of prices. For example, if, in addition to prices, wages are not free to adjust, then price stabilisation may not be a good approximation of the optimal policy, and in this case monetary policy may need to stabilise wage inflation as well as price inflation. Another example occurs in the open economy context in which the monetary authority must decide between stabilising headline inflation or a narrower measure that is restricted to domestic inflation. Domestic prices are intrinsically stickier than the overall price level, as exchange rate fluctuations naturally cause import prices and hence the general price level to be more volatile. Here, the key factor in deciding whether domestic price stabilisation is optimal depends on the assumption of exchange rate pass-through. If the pass-through is full and immediate, then optimal policy requires that domestic inflation be fully stabilised. However, if the pass-through is imperfect, then strictly stabilising domestic inflation is suboptimal. In this case the general price level cannot be adjusted flexibly, rendering price-setters to look into the future movements in the overall price

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level and not just the domestic price level when making their decision. In essence, while theory has established that optimal monetary policy from a welfare-theoretic analysis is one that targets the rate of changes in sticky prices, that conclusion also depends on other features of the economy such as the degree of wage rigidity and exchange rate pass-through. As a result, while the choice of the policy target in the case of Thailand comes down to core inflation, the central bank needs to take into consideration developments in various aspects of the economy, especially when core inflation and headline inflation deviate from each other for an extended period.

In its implementation of the inflation targeting framework, the Bank of Thailand also looks at several indicators that help to gauge underlying price pressures as accurately as possible. The first type of indicators is designed to separate noise from underlying inflation signals based on different methodologies. Indicators based on smoothing and/or reweighting the general price level time series have proved especially useful, not only during the previous episodes of rising oil prices, but also at the present time given unintended price distortions caused by a heightened extent of government price controls. Moreover, with the government reducing the prices of certain public utilities temporarily (or setting them to zero in certain instances) to help low-income households, the central bank needs to be alert in adapting the existing inflation indicators and in looking for new ones so as to accurately measure underlying price pressures. The second type of inflation indicators are those from the labour market such as movements in wages and unit labour costs as well as wage setting behaviour. Third, as inflation expectations are central to inflation dynamics and given that anchoring inflation expectations is one of the most important objectives of monetary policy, indicators of inflation expectations – for example, those obtained from surveys and financial markets – play an important role in the formulation of monetary policy. All three types of indicators are closely monitored by the Bank of Thailand.

The rest of the paper is organised as follows. Section 2 briefly sets the stage by emphasising the importance of price stability using the recent ideas that are grounded in the New Keynesian framework or the so-called “new consensus in macroeconomics.” Once price stability is firmly established as the central bank mandate, section 3 subsequently focuses on the appropriate measure of inflation that needs to be stabilised in theory. Section 4 then looks at various indicators of underlying inflation and measures of inflation expectations that are used in practice. Section 5 explores an outstanding issue in the analysis of inflation in Thailand, namely, price controls and their implications for the conduct of monetary policy. Section 6 concludes. The appendix gives details on the construction of the consumer price index in Thailand.

2. The importance of price stability

Price stability, generally considered to be the primary objective of monetary authorities, is broadly characterised as an environment in which inflation is “so low and stable over time that it does not materially enter into the decisions of households and firms” (Greenspan (2002)). Indeed, as noted by Woodford (2003), a notable feature of recent developments in monetary theory and policy is the increased emphasis given to maintaining a low and stable rate of inflation. The motivation of recent theoretical work comes from the inability of some input suppliers (especially households that supply labour) as well as producers of goods and services to adjust wages and prices for a period of time in response to various shocks that prevent the economy from producing efficiently *in the short run*.

From a public policy point of view, there are at least two approaches to solving this inefficiency. One is to remove structural inflexibility in wages and prices through, for example, an elimination of protracted wage-price contracts. This approach is perhaps not always possible in the real world. The other is to create an environment for firms in which they are

content with existing prices, even though they cannot change their prices due to the structural constraints. This is what monetary policy aims to achieve. This approach, now more or less a consensus, posits that inflation has a deadweight loss – that is, it causes inefficient allocation and utilisation of resources through relative price distortion. The loss arises when individual prices, which signal supply and demand by the household and business sectors, cannot adjust freely and instantaneously while the general price level changes. Consequently, the profitability of producing goods and services no longer reflects the relative social costs of producing them, which in turn yields a suboptimal allocation of resources[i] (see endnotes for technical details). Under this view, the central bank should use monetary policy to simulate a flexible-price environment by generating and committing to price stabilisation.[ii]

3. Which measure of inflation to stabilise in theory?

3.1. Stabilising movements in sticky prices

Given the constraint on price adjustments and the consequent relative price distortions caused by inflation, recent research shows, in a simplified setting abstracting from such frictions as the downward nominal wage rigidity or the zero lower bound on nominal interest rates, that monetary policy should aim to engineer zero inflation. In reality, with imperfect inflation measurement and other rigidities and constraints, monetary policy should aim to obtain a low and stable (ie near zero) inflation trend. In particular, it should aim to stabilise sticky prices – rather than a broader price index that puts much weight on prices that already can adjust frequently.

An analytical framework can be constructed such that prices in one sector are more rigid than those in another; within this framework, it can be shown that society benefits more if monetary authorities place more emphasis on stabilising inflation in the sticky-price sector. To be precise, *the welfare loss function puts a higher weight on variations in the sticky-price sector relative to those in the flexible price counterpart*.[iii] In a simplified setting of Aoki (2001), imperfection in price adjustments that is the root cause of relative price distortions is located in the sticky-price sector only and not in the flexible price sector. In such an environment, complete stabilisation of an aggregate price index is not optimal; instead, stabilisation of inflation in the sticky-price sector is a better policy.[3] In a related setting, Benigno (2004) considers a case of a monetary union consisting of two countries, which can be interpreted as a two-sector closed economy with completely segmented labour markets, to show that a policy that is nearly optimal is characterised by targeting an inflation index that puts a higher weight on inflation in the region with a higher degree of nominal rigidity.

In this simplified framework, theory suggests that optimal monetary policy should focus on stabilising a measure of sticky prices, which is interpreted as core inflation. Central banks should not lose sight of other developments in the economy, however, especially those that have the potential to affect the public's formation of expectations. For instance, if the rate of change in the price of a weighty item excluded from the CPI measure deviates from its trend over an extended period of time, perhaps on account of a large persistent shock, then overall inflation can tend away from the central bank's core measure and core inflation would appear

[3] In reality, prices regulated by the authorities are present in some economies and are no doubt very sticky. However, such prices respond differently to economic fundamentals compared with freely determined prices. Given that regulated prices are artificially sticky, and not rationally set by profit-maximising firms, the notion of stabilising sticky prices obtained from the basic New Keynesian model cannot be construed to include regulated prices.

an inadequate measure of underlying inflation. According to Mishkin (2008a), "[A] prolonged divergence between core and headline measures of inflation could complicate central bank communications with the public, because core inflation would require some adjustment before it would provide a clear gauge of underlying inflation." During those episodes, in the interest of expectation management, which is crucial to a central bank's inflation trend anchoring, central banks have to work hard to ensure effective communication with the public about the underlying price pressures in the economy to avoid the so-called second-round effects that are prone to occur during such episodes.

Similar questions regarding the choice of stabilising a narrow or broad price index also arise in the open economy context. In an open economy, movements in foreign import prices and exchange rates result in a difference between domestic inflation and overall price inflation. Gali and Monacelli (2005) use the Phillips curve to show that the dynamics of domestic inflation in their open-economy model can still be described by an equation analogous to that associated with a closed economy. However, the determinants of the real marginal cost, in addition to domestic output and technology, are also foreign output and the terms of trade, as changes in foreign demand affects domestic resource utilisation while changes in the terms of trade affect the relative price of foreign goods with respect to domestic goods. As the welfare loss function in this setting depends on variations in domestic inflation and not overall inflation – imperfection in price adjustments is exclusively located in the domestic sector and not in the foreign counterpart – *optimal policy requires that domestic inflation be fully stabilised, while allowing headline inflation, and implicitly the nominal exchange rate, to adjust as needed in order to reproduce the response of the terms of trade that would be obtained under flexible prices*.[iv] In short, this finding in the open-economy context has a fundamental idea that is consistent with targeting the inflation rate of the sector that has more nominal inertia, and also resonates with the economic interdependency and increased globalisation of late. Fluctuations in oil prices – as reflected in the erstwhile upswing caused by surging demand from a large and rapidly growing Asian economy, or in the recent collapse in oil prices caused by an ongoing slowdown in activity in many foreign economies, especially the world's largest one – result in the overall price level of any small open economy possibly not accurately reflecting underlying price pressures. In such circumstances the monetary authority should look through headline inflation and focus instead on domestic inflation.

Nevertheless, it is important to note that Gali and Monacelli abstract from several channels that potentially render a strict domestic inflation targeting policy suboptimal. For example, in the case where foreign commodity prices have a distinct trend or the exchange rate pass-through is not immediate and full, both the domestic price *and* the general price level are rigid – the latter now inherits inertia from the external economy in addition to the domestic price that is intrinsically inflexible. In this case, responding to movements in the general price level may be appropriate. In all, no matter what assumptions are made regarding the degree or speed of foreign inflation pass-through, monetary policy should focus on a measure of inflation that reflects nominal rigidities that give rise to inefficiency in resource allocation.

3.2. Stabilising movements in other prices?

Wages. In the presence of sticky prices *and* sticky wages, various theoretical works such as Erceg, Henderson and Levin (2000), Giannoni and Woodford (2003), and Woodford (2003) have shown policies that focus exclusively on stabilising price inflation to be suboptimal. Intuitively, in addition to variations in the output gap and price inflation, fluctuations in wage inflation, subject to the sluggish response of nominal wage, bring about relative wage distortions that result in an inefficient allocation of labour and a consequent welfare loss. As a result, given wage rigidities, strict targeting of price inflation is no longer optimal, and theory suggests that central banks should target a weighted average of price and wage inflation, with the weights proportional to the degree of rigidity.[v] Nevertheless, problems in the measurement of labour costs may partly explain a small role of wages, relative to prices, in

many central banks' price stability objective. Bernanke (2008) observes that in the United States, compensation per hour in the nonfarm business sector, a commonly used measure of labour cost, "displays substantial volatility from quarter to quarter and year to year, is often revised significantly, and includes compensation that is largely unrelated to marginal costs." Several problems can also be found in the Thai wage data. For example, wages in the public sector turn out to be higher than those in the private sector. Hence, *although theory suggests wage inflation should be explicitly included in their target, data availability and data quality – let alone confidence in various functional forms and accuracy of calibrated/estimated structural parameters – possibly prevent central banks from having done so in practice*. Although this leaves out wage inflation as a primary target of central banks, we regularly monitor various measures of labour market pressures so as to gauge as accurately as possible the overall price pressures in the economy.

Asset prices. Although a bursting asset price bubble potentially has deleterious effects on the economy, several arguments have been put forward against an explicit inclusion of asset price inflation in monetary policy rules. First, a central bank needs to identify the existence of a "bubble" – whether asset prices have moved away from their equilibrium level to such an extent that asset price fluctuations affect output and inflation. Identification is not an easy task. Furthermore, as Mishkin (2008b) notes, attempts to influence asset prices when the central bank is uncertain about the presence or extent of a bubble can interfere with the role of asset prices in allocating resources. Second, once a bubble is large enough to be identified reliably, argues Bean (2007), it is perhaps especially difficult for the central bank to predict the timing and strength of monetary policy transmission from interest rate changes to asset price inflation compared to the effects of the interest rate on CPI inflation. As bubbles are departures from normal behaviour, impacts of the usual tool of monetary policy – that is, the setting of overnight interest rates – are not exactly clear and to a certain extent can be "blunt." Instead of including asset price inflation as a monetary policy target, Goodhart (2007) suggests using another instrument in response to asset price fluctuations, namely, countercyclical prudential regulations that are restrictive during an episode of asset price bubbles and stimulatory during an episode of asset price downturns.

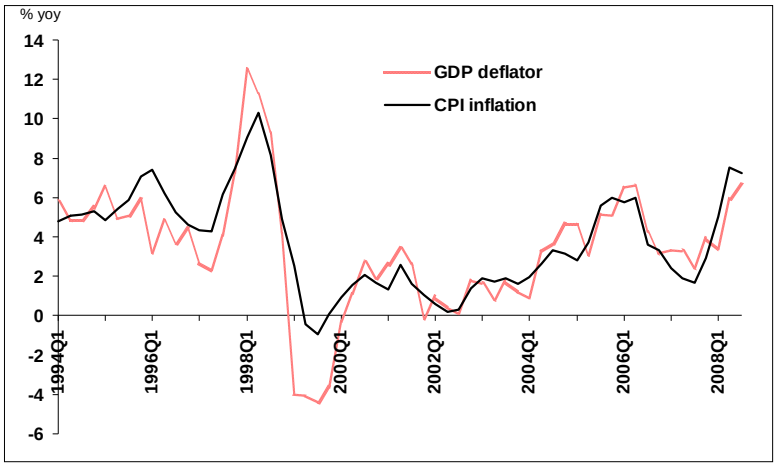
4. Indicators of underlying inflation and measures of inflation expectations

4.1. CPI as a proxy for the general price level

Given that households and firms in Thailand appear to use CPI inflation, which is transparent and well understood by the public, to index wages, salaries, pensions and long-term contracts, and that data on CPI inflation are timely, published regularly, and not subject to revision, the Bank of Thailand considers CPI inflation as a reliable measure of the change in the general price level, and uses it to form a basis for calculation of underlying inflation, which ideally approximates movements of changes in sticky prices in the economy. The other available proxy for the general price level is the GDP deflator (in Thailand the price deflator for personal consumption expenditure is not available). However, the GDP deflator is released only on a quarterly basis, with the difference between inflation based on the CPI and the GDP deflator being relatively minor, except during the period in which the economy experiences large terms-of-trade shocks such as the 1997 currency crisis, as shown in figure 1.

Figure 1

CPI inflation and GDP deflator



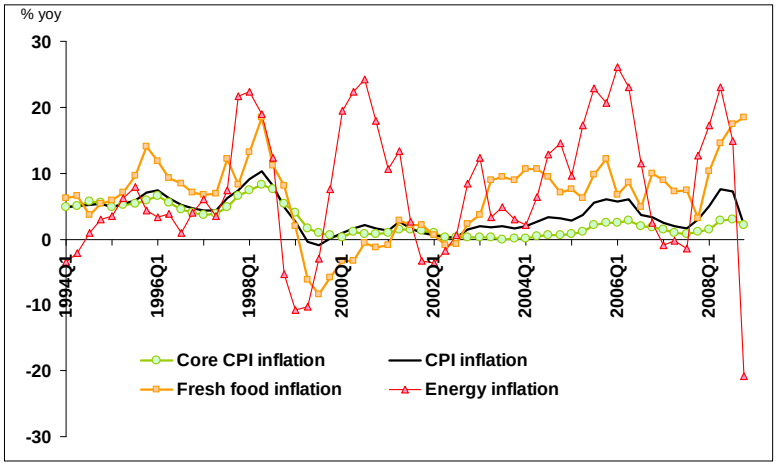
Sources: Ministry of Commerce and the National Economic and Social Development Board.

4.2. Official target: core inflation based on fixed-item exclusion

In calculating underlying inflation, the Bank of Thailand has used the fixed-item exclusion approach – that is, excluding the prices of fresh food and energy from the CPI. The rationale behind the exclusion is that these prices are the most volatile relative to other prices in the CPI, as illustrated in figure 2.

Figure 2

CPI, core CPI, fresh food and energy inflation



Source: Ministry of Commerce.

Core CPI inflation has been a monetary policy target in Thailand since the adoption of the inflation targeting framework in May 2000. There have been criticisms of whether core inflation is an appropriate target, particularly in the past few years during which headline inflation and core inflation drifted apart given continuous rises in food and energy prices; see Khemangkorn et al (2008) for details. Consequently, the Bank of Thailand has not placed its sole emphasis on developments in core inflation but instead on a variety of underlying inflation indicators.

4.3. Measures of underlying inflation other than core inflation

4.3.1. Measures based on price inflation

According to Roberts (2005), there are two broad approaches to constructing measures of underlying inflation. The first is to estimate underlying inflation by using a theoretical model with economic restrictions (eg Quah and Vahey (1995)). The second is based on statistical methods such as reweighting or smoothing as described below.

Table 1

Underlying inflation indicators

	No reweighting *across items*	**Reweighting *across items***
No smoothing *across time*	– CPI	– Fixed-item exclusion (core CPI) – Trimmed mean
Smoothing *across time*	– Simple averaging; moving averaging – Exponential smoothing	– Unobserved component model

Table 1, adapted from Brischetto and Richards (2007), shows underlying inflation indicators currently monitored by the Bank of Thailand. As mentioned above, the CPI forms the basis for the calculation of underlying inflation. Smoothing the changes in the CPI across time while leaving the weights given to the price of each CPI component unchanged gives, for instance, simple averaging, moving averaging, and exponential smoothing. Reweighting the CPI components permanently or period by period gives core CPI inflation or trimmed mean inflation. One can also both reweight each CPI component and smooth the resulting trend across time to obtain a measure of underlying inflation using an unobserved component model. Details of the construction, advantages and disadvantages of these methodologies are given in Khemangkorn and Tanboon (2007) and Sutthasri (2008), and are summarised as follows.

Fixed-item exclusion measure. This approach gives zero weights to items in the CPI basket whose prices are considered most volatile – usually unprocessed foods and energy. Sometimes the excluded items are in the fresh food category only. Occasionally, not only food and energy but also mortgage interest payments are left out. A caution is in order. This approach relies on an assumption that prices of the excluded items are the most volatile in every period. If this assumption does not hold at any time, such an indicator may fail accurately to capture underlying inflation, especially when price movements of the excluded items exhibit a distinct trend following persistent demand shocks, thereby leading to bias over the long run.

Trimmed mean inflation. To ensure that prices of the excluded CPI components are indeed the most volatile in each period, this approach constructs a weighted average based on the ranked distribution of price changes of all CPI components. This is in contrast to the fixed-item exclusion above because the present methodology does not permanently exclude the same items in every period. Trimming can be symmetric or asymmetric depending on the distribution of price movements. However, one problem with the trimmed mean inflation measure involves communication with the public because the excluded items vary over time. In addition, it is subject to revision, especially when the index is constructed on the month-on-month basis, as new data may alter the seasonal factors and consequently the rate of change in the price of each CPI component.

Kalman-smoothed inflation measure. Given that underlying inflation is unobserved, one way to estimate it is to use the unobserved component model with the Kalman filter. This methodology is based on Bryan, Cecchetti and Sullivan (2002), whereby movements in the price of each CPI component depend on changes in the common trend and an idiosyncratic shock specific to that CPI component. An advantage of this methodology is that it accords policymakers the judgment to alter the signal parameters when the economic environment changes. However, the problem of this leeway is the difficulty in communicating with the public and the possibility of revision following changes in the signal parameters.

Results for Thailand

Figure 3, which shows indicators of underlying inflation constructed by Sutthasri (2008) based on the concepts outlined above, illustrates the necessity of having inflation measures other than a single core inflation indicator. One policy challenge drawn from the Thai experience is that core inflation possibly reflects pressures in economic activities only partially during certain episodes.

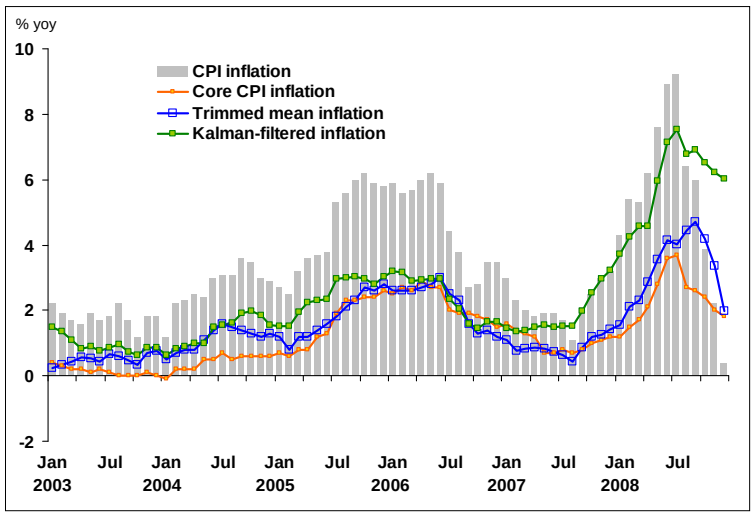
In particular, during 2003−05, just after the Thai economy came out of the crisis, there were greater inflationary risks as a result of higher economic growth, credit expansion, a tightening labour market – not to mention a continued rise in oil prices. Meanwhile, the trend in core inflation at the time did not reflect any inflationary pressures. This was due to a decline in rent, which constitutes 21% of the core CPI basket and 16% of the CPI basket. Consequently, a larger negative contribution of rent weighed down on core inflation to a level close to zero, which is the lower bound of the target range. In this case, the potential failure of core inflation accurately to gauge pressures in the economy necessitates the Monetary Policy Committee to look for alternative indicators of underlying price pressures with more flexibility to capture the changing dynamics of the economy. By either fully or partially excluding rent from overall inflation, measures of underlying inflation such as a trimmed mean are more appropriate for inflation analysis.

Another instance in which measures of underlying inflation other than core inflation serve as a more accurate inflation gauge is when prices of permanently excluded items in the core CPI basket exhibit a distinct trend. For instance, between January 2004 and July 2008, the gap between CPI inflation and core inflation was persistently large. Conversely, the counterparts for the indicators based on trimming or filtering were smaller, as these indicators did not miss an upward inflation trend in the excluded items – arguably resulting from demand pressures rather than supply shocks – that is left out in the calculation of core inflation. Consequently, by looking at core inflation alone, we may fail accurately to detect inflationary pressures.

The problem with exclusively focusing on core inflation has also become more apparent, especially recently, when there are extreme price distortions caused by the ongoing government measures that involve price controls and extensive subsidies in response to rapid increases in the general costs of living and, most recently, to a subsequent slowdown in economic activity (more on the implication of price controls for the conduct of monetary policy below).

Figure 3

Underlying inflation indicators



Source: Bank of Thailand.

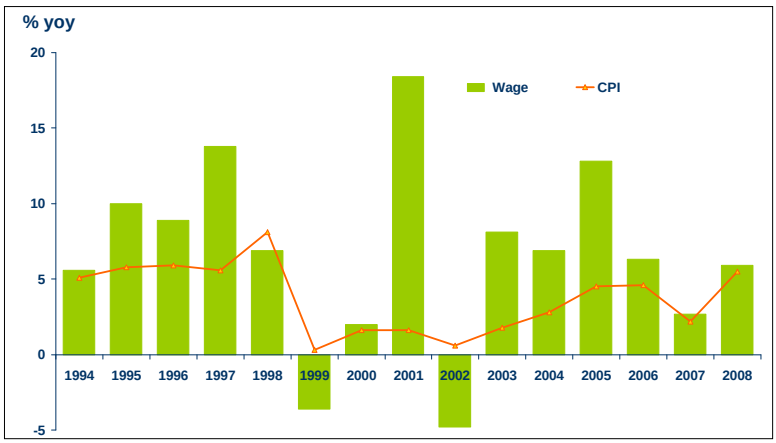
4.3.2. Measures based on wage inflation

Wages have the potential to play a crucial role in inflation dynamics. Given that the key variable that drives inflation dynamics in the New Keynesian Phillips curve is real marginal cost, which in turn is primarily driven by real wage, labour markets provide vital information about the future path of inflation. Data in Thailand are less than perfect, unfortunately, given that the large informal sector within the country and the continuous inflow of (legal and illegal) migrant workers from neighbouring countries render the measurement of labour market pressures especially difficult. Nevertheless, the Bank of Thailand attempts to extract signals from labour market data and regularly monitors the following measures.

Wage and hourly compensation. Hourly compensation is defined as all payments made directly to workers that include wages, salaries, overtime premiums, bonuses and employee benefits. (For ease of exposition, in what follows we use the term "wage" more broadly to mean hourly compensation). As shown in figure 4, on average wage inflation is higher than CPI inflation in almost every year, except during 1998−99 owing to the financial crisis and devaluation of the baht. CPI inflation and wage inflation in Thailand appear to converge in the past 15 years, with the correlation coefficient over 1994−2008 being equal to 0.44. It should be noted that the National Statistical Office modified survey questions in 2001, which means that data before and after 2001 are not on the same compilation basis. Consequently we calculate correlation between CPI inflation and wage inflation over 2002−08 and find the coefficient to be 0.64. A positive correlation means that in a period of rising inflation, wage inflation increases as well. In order to gauge pressures in the labour market and their subsequent effects on prices meaningfully, we need to examine whether the higher growth in *real* wage *net of changes in productivity* is increasing. Under that circumstance firms are bearing an increase in costs that is not due to an increase in productivity, and that makes firms likely to pass on the higher costs to consumers. Here, the notion of unit labour costs is useful as an indicator of price pressures.

Figure 4

CPI inflation and wage inflation



Remark: The term "wage" is used more broadly to refer to hourly compensation.

Sources: Ministry of Commerce; National Statistical Office; authors' calculation.

Unit labour costs. Computed as wage divided by output per hour, the (nominal) unit labour cost is a widely known indicator of labour market pressures. Intuitively, given that costs associated with labour represent a majority of input costs, rising wages will eventually affect prices.[4] A related notion, the real unit labour cost, which is computed as real wage divided by output per hour, is a potentially useful measure of inflation because it provides a direct comparison between real wage and labour productivity: if real wage rises faster than labour productivity, firms are worse off and need to raise prices if they can. Empirical results in Woodford (2001) and Sbordone (2002) suggest that real unit labour cost, which proxies real marginal cost, is the driving variable in the New Keynesian Phillips curve (and is a better explanatory variable for inflation relative to the output gap). This structural relationship forms a basis for our analysis of inflation. The top panel of figure 5 shows the components of the real unit labour cost, namely, real wage and labour productivity. The bottom panel attempts to portray the relationship between inflation and the real unit labour cost (the latter is shown in terms of percentage deviation from trend). A quick calculation shows correlation between the two variables to be 0.08. We also find that the real unit labour cost leads inflation in two quarters, with a correlation coefficient of around 0.35.

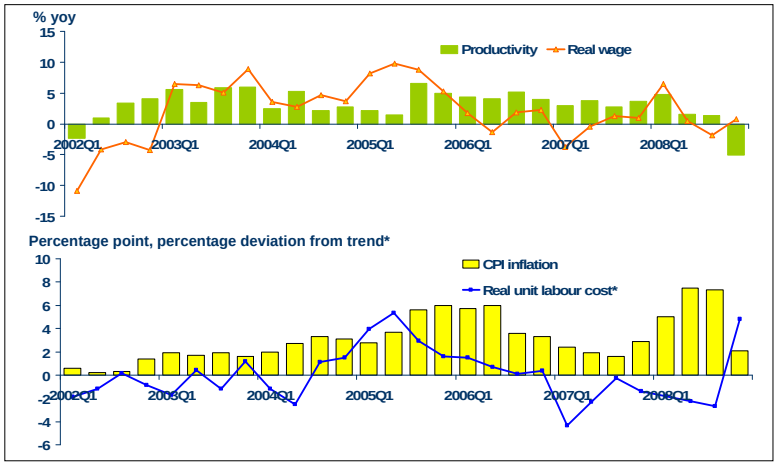
What we have learned from looking at pressures in the labour market is that there appears to be a very small degree of pass-through of labour market pressures to prices. That the degree of pass-through is not full and immediate is perhaps not surprising given that there are several factors that can affect firms' pricing powers, such as economic conditions, the degree of competitiveness in both domestic and foreign markets, and, especially in the case of Thailand, the extent of price controls by the authorities (more on this on section 5). For instance, over 2004−05 when the real unit labour cost was rising as real wage grew faster than labour productivity, with the economy expanding, firms could pass on the higher costs to

[4] However, Banerji (2005) finds a weak relationship between inflation and the nominal unit labour cost, using the Bry-Boschan peak-trough procedure on the six-month smoothed annualised rate of growth in the CPI and the unit labour cost (as well as the employment cost and the average hourly earnings indices). Banerji concludes that labour cost inflation cannot be relied upon as an accurate predictor of cyclical movements in general consumer price inflation.

prices, and here we witnessed rising inflation over this period. In contrast, during 2008 when the real unit labour cost was rising again as productivity grew at a negative rate in the fourth quarter following a significant slowdown in the world economy, firms were unlikely to raise their prices even though the real unit labour cost was on the rise, but instead cut employment in order to reduce labour costs. Here we see that there are other factors at play that can affect the pass-through of labour market pressures onto prices, and simply looking at wages will not be enough.

Figure 5

Wage, productivity, unit labour cost and inflation



Sources: National Economic and Social Development Board; National Statistics Office; authors' calculation.

Minimum wage. Another important indicator of labour market pressures is minimum wage. Although only 7% of the labour force actually earn the minimum wage, the rest earn wages that move in line with movements of the minimum wage to some extent. The Central Wage Committee is a tripartite minimum-wage setting panel consisting of employers, employees and state authorities (including a representative from the central bank). The collective bargaining process reveals an important feature of the wage-setting process in Thailand that is rather backward looking: the minimum wage is generally adjusted only once a year and is indexed to the previous year's inflation rate. Even in the periods of high inflation such as during 1994−96 and 2008, wage setting is still conducted in a backward-looking manner (although resetting can occur during the year). In terms of the pricing power of labour, wage setters in Thailand do not have much bargaining power, in part because of the presence of (illegal) foreign labour and weak labour unions. Regulation by the authority features prominently in Thailand to the extent that only part of requested increase in wages is granted by the tripartite committee.

4.4. Measuring and assessing inflation expectations

Inflation expectations of households and firms are a key factor in determining the actual behaviour of inflation. As inflation results from the aggregate consequences of purposeful price-setting decisions by forward-looking firms, today's inflation depends critically on current marginal cost and particularly on expected future inflation. Given that the traditional Phillips

curve explains only a modest part of inflation fluctuations, policymakers have focused on measuring and assessing inflation expectations.[5]

In Thailand, we primarily rely on two sources in assessing inflation expectations, namely, surveys of businesses, and information gathered from financial markets. With regard to survey-based measures of expectations, there are two important points are. First, respondents appear to give estimates based on recent and past inflation instead of future inflation; such behaviour in effect gives rise to expectations that are formed in a rather backward-looking manner. Second, the survey previously asked respondents about the range in which year-ahead inflation was expected to lie so as to facilitate responses. Given an important drawback that the only information we gain from the survey is how the proportions of firms with different inflation projections change (see figure 6), we have recently modified survey questions to elicit specific point estimates and hope to obtain a more accurate measure of inflation expectations.

With regard to measures of inflation expectations based on information from the financial markets, we look at movements of implied forward interest rates as indicators of changes in financial market expectations of future inflation. We estimate the term structure of interest rates using government bond yields; the estimated term structure allows us to extract the implied forward rates at various points in the future. By assuming in the following equation

$$\Delta i_t = \Delta r_t + \Delta \pi_t^e + \Delta \eta_t$$

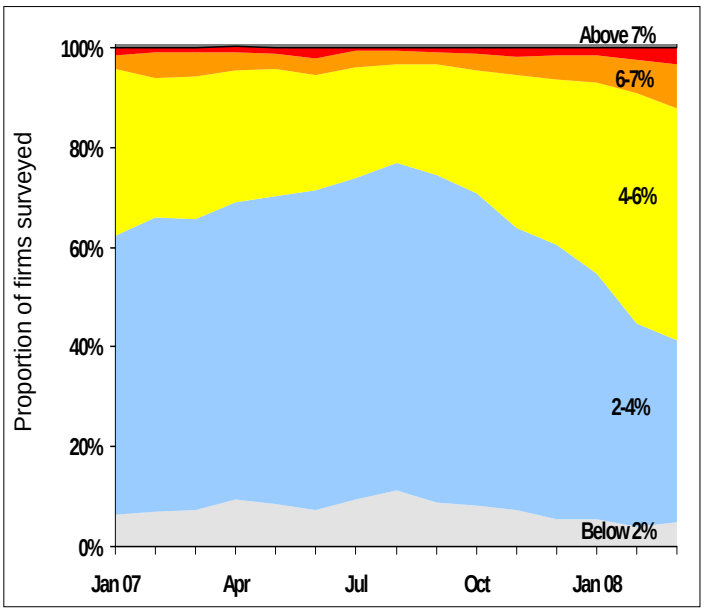
that real interest rates are stable ($\Delta r_t = 0$) and that changes in the risk premium are relatively small ($\Delta \eta_t = 0$) in the long end, changes in the implied forward curve in the long end can be taken to approximate changes in inflation expectations ($\Delta i_t = \Delta \pi_t^e$).

How the above inflation expectations indicators are used in the conduct of monetary policy can be illustrated as follows. During the first half of 2008 when commodity prices were on the rise, figures 6 and 7 show that, although the survey-based one-year-ahead inflation expectations are found to be increased in line with inflation at that time, the long-term inflation expectations from the implied forward curve remain mostly unchanged.

[5] Inflation expectations also have the potential to affect inflation persistence. Once instance is during 1971−76, when the increase in inflation in Thailand was due to temporary supply shocks. However, inflation continued to be elevated for several subsequent years over 1977−80. Khemangkorn et al (2008) find that such a persistent effect was in part explained by a monetary policy that was too accommodating at the time, owing to the pegged exchange rate regime that obliged domestic monetary policy to follow the loose monetary policy stance of the United States. Their finding, based on a Taylor-type rule, shows that inflation persistence tends to increase in an environment of too loose a monetary policy.

Figure 6

Survey-based one-year-ahead inflation expectations

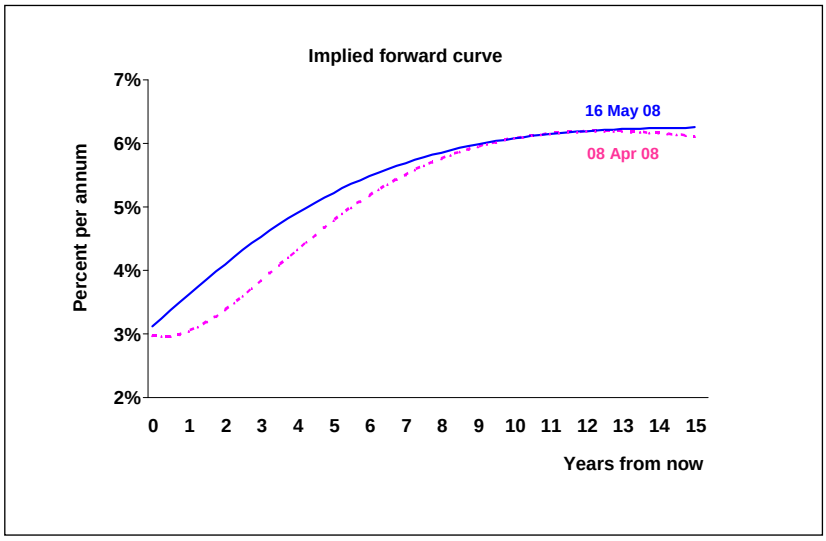


Remark: Different shades denote different ranges of inflation expectations.

Source: Bank of Thailand.

Figure 7

Market-implied inflation expectations



Source: Calculation by Bank of Thailand staff.

5. An outstanding issue in Thailand: price regulation

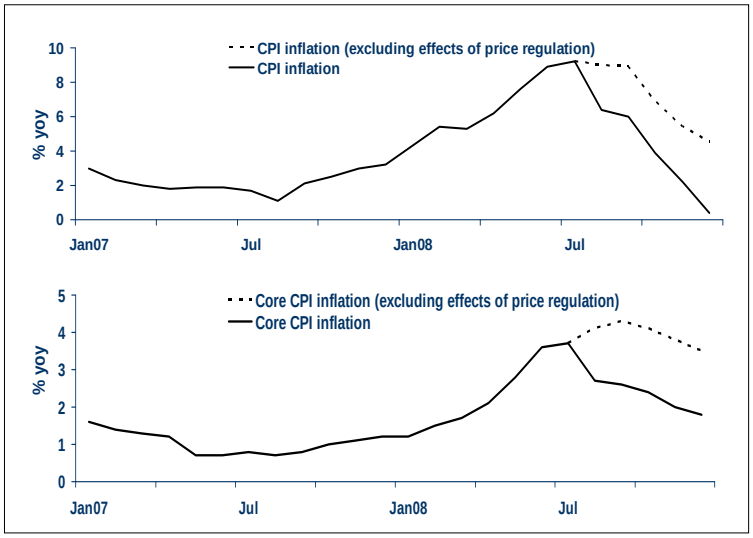
In addition to closely monitoring the prices of over 200 items in both the consumer and producer baskets since 2005, with the weights of the regulated items in CPI and core CPI baskets at around one third, the Thai government subsequently introduced a new package of six measures designed to benefit low-income households, effective from August 2008. These

measures essentially entail free or reduced prices in household use of tap water, electricity and public transport if consumed within certain limits, with the government taking up the shortfall in revenues. While the weights of these utilities in the CPI and the core CPI baskets – approximately 9% and 2%, respectively – may look like a small portion in the baskets, but when those prices are reduced by 36−100%, the impacts of these government measures can be significant, with the CPI and the core CPI falling immediately by 3.4 and 1.7 percentage points in August 2008 on a year-on-year basis.

An important implication for the conduct of monetary policy of these government measures is that the monetary authority needs to look for appropriate measures of underlying inflationary pressures. The above government intervention inevitably obscures measures of broad inflationary pressures and confounds seasonal patterns in various prices – the latter in effect distorts the construction of underlying inflation indicators. The Bank of Thailand consequently excludes the effects of these regulated prices and finds that, in the absence of government measures, CPI and core CPI inflation are significantly higher as shown in figure 8. At the same time, the trimmed mean and Kalman-filtered inflation measures appear to provide a more accurate picture of underlying inflationary pressures, which is not distorted by artificial reduction in prices controlled by the authority.

Figure 8

Price regulation and inflation



Sources: Ministry of Commerce; Bank of Thailand; authors' calculation.

6. Conclusions

In the New Keynesian framework, monetary policy has a unique role in rectifying resource misallocation caused by price rigidity. Given that firms cannot adjust their prices as often as they wish, the average markup will vary over time in response to shocks and can thus be different from the optimal markup firms would want to charge if prices were flexible. Consequently, given the predetermined prices, the goal of monetary policy is to stabilise the current value and the future path of marginal cost at a level consistent with firms' optimal markup. If that policy is credible, no firm will have an incentive to change their prices regardless of whether they have the opportunity to do so, because they are effectively charging their optimal markup now, thanks to monetary policy, and will continue to do so

indefinitely. As a result, the aggregate price level is fully stabilised. Price stability is thus closely associated with optimality at the micro level and the attainment of the efficient allocation.

In theory, with regard to the appropriate inflation stabilisation policy – stabilising core inflation versus headline inflation, domestic inflation versus overall inflation, price inflation versus wage inflation – theory broadly suggests that optimal monetary policy should stabilise inflation in the sticky-price sector, because this is where the restriction of price adjustments that is the source of allocatory inefficiency lies. Consequently, much of the literature points to stabilising core inflation in the closed economy, stabilising domestic inflation in the open economy, and stabilising a combination of price and wage inflation if there are nominal rigidities in both goods and labour markets. Nevertheless, it is important to keep in mind that these theoretical results depend on the model setups and the associated assumptions. For instance, in the open-economy context, if full and immediate exchange rate pass-through is assumed, stabilising domestic inflation is a better policy. When this assumption is relaxed so that import prices become sticky, there are now inefficiencies in the markets for imported goods as well as domestic goods. In this environment monetary policy should stabilise prices in both markets by targeting overall inflation. In the end, regardless of the setup and model assumptions, the gist of optimal policy is that the monetary authority should stabilise the inflation measure corresponding to where price rigidity is located.

In practice, once the monetary authority chooses a preferred gauge on inflation, which reflects as far as possible the persistent component of inflation, as policy target to anchor expectations, it also considers a variety of inflation measures as supplementary indicators of price pressures. As is well known, there is no single indicator that corresponds perfectly to what the central bank considers to be inflation in the sticky-price sector(s) according to theory. The Bank of Thailand recognises the limitations of core inflation. Furthermore, even though we have been monitoring a number of underlying inflation indicators, there are several factors that have the potential to influence inflation dynamics, and they are consequently under our careful observation. We also keep a close watch on changes in equity and bond prices as well as real estate prices – because such asset prices potentially provide useful information about the inflation outlook – and also on the expansion in credits as this in turn facilitates increases in asset prices. In summary, while our evaluation of inflation pressures primarily focuses on developments of a measure that we consider to best reflect underlying price pressures on average, we are aware of and keep ourselves alert to a variety of prices and costs that directly or indirectly indicate pressures in the economy, to ensure that our commitment to maintaining price stability is fulfilled to the best of our ability.

Appendix:
Consumer price index in Thailand

Methodology. The consumer price index (CPI) and the core consumer price index (core CPI) are published by the Bureau of Trade and Economic Indices of the Ministry of Commerce on a monthly basis, and are usually released on the first working day of the following month. The core CPI is defined as the CPI excluding unprocessed food and energy prices.

The Bureau constructs the CPI as a fixed-weight average of prices of individual goods and services using a Laspeyres formula. In general, the CPI measures the change in the price of goods and services purchased by representative households in some base period. The base period is generally updated every four years. Inflation figures released since January 2004 are based on consumption patterns in 2002, with the weights used in the construction of the CPI obtained from the National Statistical Office based on a household expenditure survey. The new CPI series based on consumption patterns in 2006 will soon be released in the first half of 2009.

Coverage. The CPI and the core CPI cover 374 and 266 items, respectively. CPI and core CPI components are shown in Table A below.

Table A

Disaggregated components in the CPI and the core CPI

Components	Weight	
	CPI	Core CPI
1. Food and beverages	36.06	
2. Apparel and footwear	3.40	
3. Housing and furnishing	23.86	
4. Medical and personal care	6.04	
5. Transport and communications	21.98	
6. Recreation and education	5.82	
7. Tobacco and alcoholic beverages	2.83	
Total	**100.0**	**75.95**

The overall CPI basket can also be classified into three categories: unprocessed food, energy items, and core CPI with the weights of 15.00%, 9.05%, and 75.95% respectively. Unprocessed food consists of four subcategories: (1) rice, flour and cereal products; (2) meat, poultry and fish; (3) eggs and dairy products; and (4) fruit and vegetables. Energy consists of three subcategories: (1) fuel; (2) cooking gas; and (3) electricity.

Caveats. As is well known, the CPI is arguably biased. One instance is substitution bias coming from the Laspeyres formula. The formula assumes that households must purchase the same basket of products as surveyed in the base period – which is not necessarily true when households substitute away from the higher-priced products. Another instance of bias in the CPI arises when new products enter the market, as they will not be incorporated into the CPI calculation until the CPI basket has been updated. This type of bias is known as new product bias. Other types of bias are outlet substitution bias and quality bias; see a classic

study by Boskin et al (1996) for further details. The size of bias partly depends on how frequently the basket has been updated: the longer the time between the revisions of the basket, the more severe the bias. The consensus in international findings is that the size of bias is quite small, but most central banks, including the Bank of Thailand, are still interested in finding the size of bias precisely in order to measure inflation as accurately as possible.

Technical notes

[i] One may wonder how exactly inflation affects a household's welfare, given that the arguments of household utility functions generally are assumed to be the *quantities* of various goods and services, but not their *prices*. A second-order Taylor expansion of the household's utility around a steady state with constant prices yields the household's welfare loss, which is a function of variations in a measure of real activity (ie the output gap) and the cross-sectional variance of relative prices – the latter can be shown to increase with inflation. The welfare loss function can be written algebraically as

$$\begin{aligned} \mathcal{W} &= \frac{1}{2}E_0\sum_{t=0}^{\infty}\beta^t\left[\left(\sigma+\frac{\varphi+\alpha}{1-\alpha}\right)x_t^2+\frac{\varepsilon}{\Theta}var\left(p_{i,t}\right)\right] \\ &= \frac{1}{2}E_0\sum_{t=0}^{\infty}\beta^t\left[\left(\sigma+\frac{\varphi+\alpha}{1-\alpha}\right)x_t^2+\frac{\varepsilon}{\lambda}\pi_t^2\right] \end{aligned}$$

where the second equation uses the fact that price dispersion is directly related to inflation. Focusing on the inflation term, welfare loss is increasing in the elasticity substitution among different goods (ε) and in the degree of price rigidity (which is inversely related to λ). Intuitively, given price dispersions, the more easily goods can be substituted for each other, the stronger the degree of resource misallocation and the higher the welfare loss. Second, the more strongly prices change, the higher the degree of price dispersions, as prices fail to adjust in tandem, leading to a higher welfare loss. As a result, the desirability of minimising relative price distortions provides a key rationale for monetary policy to promote price stability by targeting inflation.

[ii] Consider a *structural* environment in which firms find it costly to change prices. These firms normally have to stick with "pre-fixed" prices until they have an opportunity to adjust them. Consequently, the *aggregate* price level today will depend on last period's aggregate price level and today's new prices set by those firms that are allowed to change their prices. In other words, there is persistence in the aggregate price level, and this persistence comes from structural inability to change prices freely in response to shocks at any date and state. To maximise a stream of expected future profits, the "rigid-price" firms, when they can, decide on new prices, taking as givens the prices of all other goods, aggregate demand, and the real disturbances.

Consider now the world in which there is zero inflation *on average*. In this case, when these rigid-price firms actually get a chance to change their prices, it turns out that they will voluntarily maintain their prices at the average of existing prices. They do this only when they can operate in the consistent belief that, on average, other firms behave similarly by keeping their prices unchanged. In aggregate, then, the average of existing prices never changes and so the new "sticky" prices chosen will be the same prevailing prices, thereby keeping the general price level unchanged. In the absence of price dispersion, the relative prices among various goods and services are not distorted, and resources can be efficiently allocated even when certain prices cannot instantaneously change in response to shocks.

[iii] Aoki (2001) and Woodford (2003) use a two-sector dynamic stochastic general equilibrium model in which prices are fully flexible in one sector but sticky in the other to show that the period loss function depends on variations in (1) the rate of inflation in each sector individually; (2) the deviation of the output gap from its efficient level; and (3) the deviation of the relative price between the two sectors from its natural (ie efficient or flexible-price) counterpart:

$$L_t = \sum_{j=1}^{2} w_j \pi_{jt}^2 + \lambda_x \left(x_t - x^*\right)^2 + \lambda_R \left(p_{Rt} - p_{Rt}^n\right)^2$$

where

$$w_j = \frac{n_j}{\kappa_j}\left(n_1 \kappa_1^{-1} + n_2 \kappa_2^{-1}\right)^{-1}$$

Here w_j, the weight given to the inflation variation in sector *j*, is increasing in n_j (the share of sector *j* in national income) but decreasing in κ_j (a smaller value of which indicates a higher degree of price rigidity). It can be shown that a policy that completely stabilises the price index for the sticky-price sector is optimal, because it achieves the same allocation of resources as would occur under price flexibility. However, *such a policy does not completely stabilise the broader price index. This is because for the relative price, p_{Rt}, to track the natural counterpart while the sticky-price index remains constant, there must be a variable inflation rate in the flexible-price sector insofar as the natural relative price is a function solely of exogenous disturbances.*

iv A second-order approximation to the welfare of the representative household in Gali and Monacelli (2005) yields a period welfare loss that is a function of the variances in the domestic output gap and inflation in the home country:

$$L_t = \frac{1}{2}(1-\alpha)\left[(1+\varphi)\, x_t^2 + \frac{\varepsilon}{\lambda}\pi_{H,t}^2\right]$$

This welfare loss function is almost identical to the closed economy counterpart given in endnote 1, except that domestic inflation, not the overall inflation, being the relevant inflation variable. It should be noted that in the present model several parameters are assumed to take certain values (including the coefficient of relative risk aversion (σ), which is set to 1) so that a second-order approximation to welfare can easily be derived analytically. Furthermore, Gali and Monacelli also abstract from several channels that may potentially render a strict domestic inflation targeting policy suboptimal (eg imperfect pass-through).

v The mechanics underlying Erceg, Henderson and Levin (2000) can be described as follows. A second-order Taylor approximation to the household's lifetime utility yields a welfare loss:

$$\mathcal{W} = \frac{1}{2} E_0 \sum_{t=0}^{\infty} \beta^t \left[\left(\sigma + \frac{\varphi+\alpha}{1-\alpha}\right) x_t^2 + \frac{\varepsilon_p}{\lambda_p}\left(\pi_t^p\right)^2 + (1-\alpha)\frac{\varepsilon_w}{\lambda_w}\left(\pi_t^w\right)^2\right]$$

The presence of sticky wages implies an additional welfare loss that arises because of fluctuations in wage inflation. In the last term of the above expression the contribution of wage inflation volatility to welfare loss is increasing in the elasticity of output with respect to labour input ($1-\alpha$), the elasticity of substitution among labour types (ε_w), and the wage stickiness (which is inversely related to λ_w). Given the above welfare loss function, for a certain parameterisation so that an analytical solution exists, the optimal policy is to target a weighted average of price and wage inflation defined as

$$\pi_t \equiv (1-\vartheta)\,\pi_t^p + \vartheta \pi_t^w$$

where

$$\vartheta = \frac{\lambda_p}{\lambda_p + \lambda_w}$$

is the weight on wage inflation, which is increasing in the degree of wage rigidity.

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