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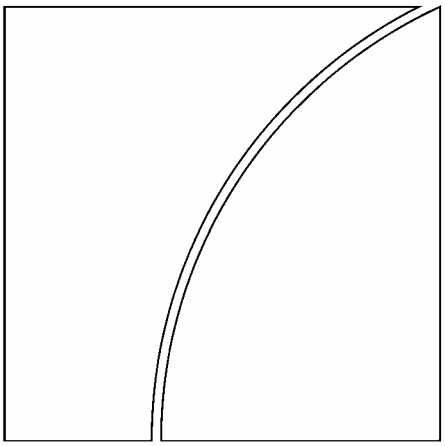

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The evolving inflation process: an overview

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Abstract

This paper reviews analytical work carried out by central banks that participated in the Autumn Meeting of Central Bank Economists on "The evolving inflation process" which the BIS hosted on 28-29 October 2005. The paper first discusses efforts to document the univariate statistical properties of inflation and how they have changed over the last decades. It then reviews studies of disaggregated or micro inflation data and evidence from surveys of firms concerning their pricing behaviour. Using this micro evidence as background, the paper also attempts to understand the proximate causes for any changes in the inflation process, such as disparities in the price behaviour of tradables and non-tradables or movements in energy prices. The paper then summarises central bank research on changes in the ultimate determinants of factors impinging on the inflation process, for example a changing monetary policy regime, increased globalisation or a legislative reform of the labour market.

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William Melick and Gabriele Galati

Introduction[1]

The dramatic decline in inflation and in the variability of both inflation and output around most of the globe over the past two decades, termed the "Great Moderation" or "Great Stability", is a most welcome development that leaves monetary policymakers wondering if this favourable economic performance can be extended.[2] Given that the long-run inflation rate is determined by monetary factors, central banks are keenly interested in understanding what explains the favourable changes in the inflation process.

In particular, monetary policymakers are attempting to ascertain whether this "Great Moderation" is of their own doing or attributable to other forces such as structural economic reforms, increased integration of world markets or simply good fortune. Disentangling these influences is critical for deciding on the appropriate framework and course of monetary policy in the coming years. For example, does the muted reaction of inflation to the recent sharp rise in oil prices, which is in stark contrast with the high inflation in the 1970s, reflect the fact that inflation expectations are now firmly anchored by improved monetary policymaking? And should anecdotal evidence of a smaller pass-through of exchange rate changes into domestic prices be taken as evidence that inflation expectations are now firmly anchored?

This paper reviews analytical work carried out on these issues by central banks that participated in the Autumn Meeting of Central Bank Economists on "The evolving inflation process" which the BIS hosted on 28-29 October 2005. The first part of the paper focuses on efforts to document the univariate statistical properties of inflation, with careful attention paid to changes in these univariate processes. The second section reviews studies of disaggregated or micro inflation data and evidence from surveys of firms concerning their pricing behaviour. Using this micro evidence as background, the second section also attempts to understand the proximate causes for any changes in the inflation process, such as disparities in the price behaviour of tradables and non-tradables or movements in energy prices. The third section summarises central bank research on changes in the ultimate determinants of factors impinging on the inflation process, for example a changing monetary policy regime, increased globalisation or a legislative reform of the labour market. The final section describes likely directions for future research on the nature of the changing inflation process.

1. Documenting changes in the aggregate inflation process

With regard to inflation, the "Great Moderation" is often documented using a univariate autoregressive model where inflation or the change in inflation is regressed on lags of inflation. Prominent examples of this approach can be found in Cogley and Sargent (2001) and Levin and Piger (2004). The constant term and the sum of the coefficients on lagged inflation can be used to recover both the mean or average rate of inflation as well as a measure of inflation persistence.

Quite a few of the papers presented at the Autumn Meeting estimated these univariate processes for inflation with a universal finding of a decline in the mean rate of inflation. For industrialised countries,

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[1] This paper was written while William Melick was visiting the BIS. The views expressed are our own and do not reflect those of the central banks that were represented at the Autumn Meeting of Central Bank Economists on "The evolving inflation process" or of the Bank for International Settlements.

[2] The labels "Great Moderation" and "Great Stability" come from Stock and Watson (2003) and Bean (2005) respectively.

the mean rate of inflation has often been judged to have fallen by the order of 10 percentage points, while declines have been of the order of 20 to 30 percentage points for developing countries.[3] Not surprisingly, in the context of the univariate models, the change in the mean rate of inflation is almost always judged to be statistically significant.

Research by the ECB emphasises the importance of the degree of inflation persistence for monetary policy for several reasons. First, a high degree of inflation persistence implies that stabilising inflation following adverse shocks may require higher transitory output costs. Second, with highly persistent inflation, inflation expectations may become unanchored. Lastly, a high degree of inflation persistence and its consequences can pose challenges for monetary policy implementation and communication, for example when a stronger monetary policy tightening is required in reaction to an adverse price shock. Most studies find a decline in the persistence of inflation, suggesting that a given shock that boosts the inflation rate now has a smaller and/or less protracted impact. Averaging across all these studies, the typical result is that persistence has fallen roughly by half.[4] However, there is a substantial degree of dispersion around this average result, with some studies reporting no change in persistence, eg Chantanahom, Poonpatpibul and Vongsinsirikul (2004) for Thailand, and others reporting that the inflation process no longer displays any persistence. Particularly sharp declines in persistence were seen in Canada, the United Kingdom and Chile, with a more moderate decline in persistence in Switzerland and the United States. Evidence of persistence among the members of European Monetary Union (EMU) has been somewhat mixed. For example, Angeloni, Aucremanne and Ciccarelli (2005) present evidence of a decline in persistence for several euro economies, while Bilke (2005) finds that persistence in France has not changed although there is a clear break in the mean in the mid-1980s. Ziebarth (2005) reports a sharp decline in persistence for Germany and Aucremanne and Collin (2005) show that persistence in Belgian inflation has declined.

As is well known (Perron (1990)), tests for persistence can be biased by a failure to account for a structural break in the mean of a series, which is likely to have happened in many economies that switched or strengthened their monetary policy regime. Kent (Reserve Bank of Australia (2005)) emphasises this point in discussing a sharp decline in the persistence of Australian inflation, a finding shared with Cecchetti and Debelle (2004).

In order to control for potential bias, central bank researchers have allowed for structural breaks in a number of ways: split samples, rolling regressions, and time-varying parameters. Nonetheless, amongst the papers there is some debate concerning the statistical significance of the decline in persistence. Using a split sample, Roberts (Federal Reserve Board (2005)) finds an economically large, but statistically insignificant, decline in persistence. Aucremanne and Collin (2005) conclude that the decline in Belgian inflation persistence is significant by comparing unit root hypothesis tests from a series of rolling regressions. For Canada, Coletti and Demers (2004) argue that the decline in persistence is sensitive to the choice of which years to include in the high persistence regime. Savioz and Maag (2005) use a sup-Wald test from rolling regressions to document a statistically significant break in the inflation process for Switzerland.

Central banks are using a variety of methods to further pinpoint the nature of the changes in the inflation process and investigate possible explanations. Most commonly, results from univariate inflation regressions are compared across economies, in order to get a sense of whether the change in the inflation process is country-specific. García and Valdés (Central Bank of Chile (2005)) compare the experiences of economies in both the developing and the developed world. They find that the dramatic improvement in the Chilean inflation process is almost matched by the improvements seen in Canada and the United Kingdom, while Mexico, Colombia and Norway have enjoyed a much smaller moderation in the inflation process. Sweden and Israel fall between these experiences.

Another technique used to shed light on the evolution of the inflation process is a comparison of the univariate inflation process across sectors. Angeloni, Aucremanne and Ciccarelli (2005) compare the sectoral inflation process across five euro countries.[5] Using Bayesian estimation routines that allow for

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[3] See Rogoff (2003) for more extensive documentation of the decline in inflation rates.

[4] Persistence is measured as the sum of the coefficients on lagged inflation in univariate autoregressive estimations. Given that this sum is usually between zero and one, sharp disparities in this measure are not observed when comparing industrialised and developing countries.

[5] Belgium, France, Germany, Italy and Spain.

time-varying parameters, these researchers find that changes in the persistence of inflation are more common across sectors than countries. They also find that persistence in services inflation shows one of the largest downward adjustments. Tests for changes in the sectoral processes at the time of important developments in the move to monetary union are all negative.

Aucremanne and Collin (2005) estimate rolling regressions across 60 consumer price index (CPI) product categories in Belgium and find that the mean declined in a fairly synchronised fashion, except for services, for which it occurred later. As to the degree of inflation persistence, they first of all find a substantial degree of heterogeneity across sectors. Persistence is lowest for energy and unprocessed food and higher for processed food, services and non-energy industrial goods.

This sectoral pattern is consistently found in other studies for the euro area or euro area countries (Altissimo, Benigno and Rodriguez-Palenzuela (2004) for France, Germany and Italy, and Bilke (2004) for France). For the more persistent sectors there is evidence of a decline in persistence in Belgium, which again is fairly synchronised except for services, for which it occurred later.

The finding of heterogeneity in the inflation process across sectors is reinforced by examinations of differences in the inflation process for tradables and non-tradables. Two examples are New Zealand and Spain. Hodgetts (Reserve Bank of New Zealand (2005)) documents that non-tradables inflation was higher than tradables inflation in New Zealand during the 1970s and 1980s. Over the past 15 years, the gap has narrowed but has not been eliminated, a development which according to Hodgetts has been seen in many countries. During this period, non-tradables inflation in New Zealand has been closely tied to the business cycle, with Kite (2005a) explaining this pattern as the result of procyclical patterns in construction and rental prices. The narrowing of the tradables/non-tradables gap is certainly consistent with the changes in the behaviour of services prices documented in the sectoral investigations.

For Spain, Burriel and Hernando (Banco de España (2005)) document a similar pattern for the differential between tradable and non-tradable inflation rates, describing the differential as the “dual inflation phenomenon”. Structural interpretations of this phenomenon will be discussed at length below. Of course, some care must be exercised in separating product prices into these two broad categories. Burstein, Eichenbaum and Rebelo (2004) argue that products commonly classified as tradable may well be better viewed as non-tradable due to transportation costs to get the product to the final point of sale as well as retail and marketing expenses. Nonetheless, these tradable/non-tradable findings for Spain are in line with those for New Zealand, providing further evidence of important heterogeneity in sectoral inflation processes. This heterogeneity might provide some insights into the ultimate explanations for changes in the inflation process discussed in Section 3.

On balance, the research on changes in the aggregate inflation process provides several key findings. First, not surprisingly, there can be little doubt of an important shift in the mean rate of inflation in almost all countries. Second, there are signs that inflation persistence might have fallen along with the mean rate of inflation. The inflation process has changed for both industrial and developing countries. Finally, the inflation process, and changes in that process, vary across sectors, providing a suggestion for fruitful directions for future research.

2. Proximate factors in the inflation process and their implications

The careful documentation of changes in the inflation process naturally leads to the question of what factors explain the observed changes. Possible factors can be separated into two levels: proximate and ultimate factors. The term proximate refers to an explanation for a change in pricing behaviour that is itself caused by a change in a deeper or structural force in the economy, which is an ultimate determinant of the inflation process. For example, changes in the statistical behaviour of wages or inflation expectations may explain changes in the inflation process, but these proximate determinants might themselves be explained by a deeper structural change in the economy, such as legislative reforms of the labour market or a change in the monetary policy regime. This section considers proximate factors, starting with a careful examination of firm pricing behaviour, using the detailed data that underlies price index calculations as well as data taken from surveys of firms. Given a better understanding of firm behaviour, the section continues with a relatively narrow view of what factors should impact a firm’s production costs and then broadens this view to consider changes in inflation expectations as well as the effect of these proximate changes on Phillips curve estimates.

The fundamental determinants behind changes in the inflation process will be discussed in turn in the third section of the paper, but such a discussion requires that the patterns in the proximate determinants of the inflation process be well established.

(a) Microeconomic analysis of pricing behaviour

The findings of a change in the univariate inflation process discussed in Section 1 have prompted an examination at the microeconomic level of the behaviour of firms when setting prices. The investigation has proceeded along two lines, using the underlying data compiled by the statistical agencies responsible for producing consumer and producer price indices (CPI and PPI respectively) and using data complied from surveys of firms. For central banks within the Eurosystem, this work has been carried out under the auspices of the Inflation Persistence Network (IPN). Angeloni et al (2004) provide an overview of the work of the IPN as well as a preliminary summary of its findings.

Using the underlying data for the construction of CPI and PPI allows researchers to gain a better sense of the frequency and magnitude of price changes. Dhyne et al (2005) present a detailed and careful examination of the individual pricing records for the CPI in the euro area. In brief, they find that consumer prices are adjusted relatively infrequently, about once per year on average. When prices are adjusted, the adjustments tend to be large, on the order of 10 per cent. Price declines are about as likely as price increases, with the exception of services prices, which rarely decrease. Finally, there are large differences in the degree of price flexibility across sectors that are common across countries. Energy prices and prices for unprocessed foods are the most flexible, while non-energy industrial goods and services prices are the least flexible. Baudry et al (2004) report similar findings when examining data for France, while Aucremanne and Dhyne (2004) report similar sectoral patterns for Belgium. These findings for the euro area are broadly consistent with those for the United States reported by Bils and Klenow (2004) and Klenow and Kryvtsov (2005), although prices appear to be adjusted slightly more often in the United States.[6]

Angeloni, Aucremanne and Ciccarelli (2005) also examine underlying CPI data around the time of important developments in monetary union. They find no change in pricing behaviour in 1996, at the time of key policy announcements on monetary union by Italy and Spain, or in 1998, at the time of the publication of convergence reports by the European Commission and the European Monetary Institute. They do find a large increase in the frequency of price changes in the first quarter of 2002, the time of the euro cash changeover. Interestingly, the frequency of both price increases and price decreases spiked at this point in time, contrary to public perceptions of a preponderance of price increases. Following the changeover, the frequency of price changes returned to its initial level. With regard to changes in tax rates, there is evidence that in several countries in the euro area value added tax (VAT) increases are passed through almost in their entirety to consumers, while the pass-through for VAT decreases is smaller (see eg Aucremanne and Dhyne (2005), Dhyne et al (2005) and Jonker et al (2004)).

Central bank researchers have also looked at the underlying data for the PPI to gain insights into the fundamentals of the inflation process. Álvarez, Burriel and Hernando (2005b) analyse Spanish PPI data and find that the patterns of changes in producer prices are very similar to the patterns for consumer prices. Stahl (2005) presents a detailed examination of German metalworking firms and finds that increases in competitors' prices and capacity overutilisation often lie behind a firm's decision to raise prices.

One puzzle emerging from the detailed examination of CPI and PPI data is that the (unconditional) aggregate hazard rate for price changes is often found to be decreasing; that is, a price change becomes less likely the longer the price has remained unchanged. This finding would imply substantial persistence, which is at odds with the aggregate evidence discussed in Section 1. Moreover, the finding is also at odds with the many theories of pricing behaviour that posit an increasing hazard rate. Álvarez, Burriel and Hernando (2005a) show theoretically and empirically, using Spanish data, that the decreasing hazard rate is the result of aggregating over firms with different hazard rates. Using Austrian data, Baumgartner et al (2005) confirm this result and show that a weighted aggregation

[6] For an overview of the frequency of price changes in different countries, see Dhyne et al (2005).

produces a hazard rate that is not decreasing and has a prominent spike at a duration of one year. Panel data regressions that account for unobservable heterogeneity show that the longer a price has remained constant the more likely it is to be changed. Aucremanne and Dhyne (2005) also address the issue of the declining aggregate hazards. Taking account of heterogeneity and acknowledging the role of accumulated sectoral inflation since the last price change, they find, however, that hazards are slightly increasing.

Following the work of Blinder (1991), central banks have also conducted surveys of firms to gain a better understanding of the price setting process. Much of the work by central banks is under the auspices of the IPN, where 11,000 firms located in nine different countries were surveyed. Using the data from these surveys, Fabiani et al (2005) conclude that the majority of firms are price discriminating, monopolistic competitors that usually set prices by marking up costs. Those firms in more competitive sectors have more flexible prices. One third of the firms set prices in a time-dependent fashion (at a fixed interval, for example once a quarter or once a year), while the remaining firms, at least at times, use state-dependent pricing strategies (at various intervals depending on the condition of the market in which the firm operates). These shares are consistent with the findings of Blinder et al (1998) for the United States. Price stickiness appears more likely to relate to a concern about customer relationships through either explicit or implicit contracts than a concern about menu costs associated with changing prices. Firms also appear to adjust asymmetrically to shocks, with cost shocks most often explaining an increase in prices and demand shocks most often accounting for a decline in prices. Firms seem hesitant to raise prices in the event of an increase in demand and are hesitant to lower prices when input costs fall. These results are consistent with Rotemberg's (2005) notion that views about fairness are important in firm pricing decisions.

Consistent with studies of the detailed data used to construct CPIs and PPIs, surveys of firms reveal that the average firm changes prices about once a year. Most of the survey evidence is consistent across countries, although evidence for the United Kingdom reported by Hall, Walsh and Yates (2000) shows that roughly 80 per cent of UK firms set prices according to a time-dependent procedure. According to Kwapil, Baumgartner and Scharler (2005), Austrian firms appear somewhat less likely to use state-dependent pricing than other firms in the euro area. The findings of Loupias and Ricart (2004) suggest that French firms behave much like the typical euro area firm. Aucremanne and Druant (2005) broadly find similar survey results to those in the other euro area countries, but show that "non-optimal" rule-of-thumb behaviour in price-reviewing is relatively important in the service sector.

Álvarez, Burriel and Hernando (2005b), using micro PPI data, and Álvarez and Hernando (2005), using firm survey data, corroborate the finding that firms in more competitive industries have more flexible pricing. They also show that firms with more flexible prices are more likely to have a lower share of labour costs and a higher energy intensity in production.

Outside of the euro area, a survey of 170 firms conducted by the Bank of Canada in 2002/03 (Amirault, Kwan and Wilkinson (2004)) showed a much higher degree of price flexibility than in the euro area, with one half of the firms changing prices at least once a quarter. Firms also reported an increase in price flexibility over the past decade and indicated that they respond to changes in competitors' prices, input costs and demand when setting prices.

A recent empirical study of the components of the CPI, GDP deflator and corporate goods price index in Japan reveals that the pricing behaviour of Japanese firms exhibits many similarities with that of US or European firms (Higo, Nishizaki, Saita and Takagawa (2005)). An important feature of the analysis of Higo, Nishizaki, Saita and Takagawa (2005) is that it also sheds some light on changes in the pricing behaviour over time. Comparing the frequency of price changes in two periods, 1989–1993 and 1999–2003, the study highlights several interesting results. First, the frequency of price changes for services was markedly low compared to other categories in both periods. The authors suggest that this indicates that menu costs are important for services prices. Second, the frequency of price changes for services declined during the 1990s, arguably reflecting in part the stabilisation of nominal wages. Third, the frequency of price changes for goods has increased, suggesting that factors other than menu costs or nominal wage dynamics played a role. Fourth, survival ratios for goods prices decreased markedly in the second period, while survival ratios for services have increased.

(b) Production function and markup approaches

Although the microeconomic evidence just discussed yields valuable insights into firm behaviour, this evidence has not been accumulated over a very long period of time. Continued monitoring of these

microeconomic data will allow for a better understanding of future changes in the inflation process. Unfortunately, with the exception of work carried out by the Bank of Japan, the short time period currently covered by these datasets does not allow for a substantial analysis of changes in firm behaviour over long time periods and hence for shedding light on the factors underlying the changes in the inflation process observed at the macro level.

In order to examine the evolution of the inflation process, central banks turn to more aggregate data. At this level of aggregation, central banks often model firms as setting prices based on a markup over costs, a strategy verified in part on microeconomic survey evidence discussed above. A standard production function then suggests that labour costs and labour productivity should be important determinants of a firm's cost structures and hence of its pricing decisions. Thus, it is quite common to begin any analysis of changes in the inflation process at the aggregate level with a decomposition of inflation into components such as wages and labour productivity. In this line of research much attention is paid to the timing of the change in the behaviour of wages and productivity, as well as whether or not these changes are viewed as temporary or permanent.

Many central banks report a moderation in the rate of increase in labour costs as well as a surge in productivity over the past decade. The key issue is whether firms pass on the cost savings to customers, in which case prices will fall and wages remain constant, or instead to labour, in which case nominal wages will increase but prices will not fall. For example, Hallsten, Hedén and Svensson (Sveriges Riksbank (2005)) document that Swedish labour costs have been increasing at a declining rate since the late 1990s. At the same time, labour productivity has been growing more rapidly, implying a sharp decline in unit labour costs. Within the context of a markup model, such a drop will only lead to a decline in prices if firms pass their lower costs on to their customers in the form of lower prices. In fact this appears to be at least partially the case. Estimates by Adolfson et al (2005) using a dynamic stochastic general equilibrium (DSGE) model indicate that the increase in labour productivity has reduced the Swedish inflation rate by between 0.5 and 1.0 percentage point since 2003. Interestingly, gains in labour productivity are found to have had little effect on the overall inflation rate in the period 2000–02. This evidence is roughly consistent with that from firm surveys, which suggests that firms are initially reluctant to pass on favourable cost shocks into lower prices.

Dwyer and Leong (2001) find gains in productivity growth in Australia across many industries, with notable increases in the productivity of non-tradables. As is typical, they too report that workers did not capture all of the gains in productivity, with firms enjoying an improvement in unit labour costs. Kent (2005), using a markup model, estimates that changes in unit labour costs account for 80 per cent of the changes in the final retail prices of goods and services. Thus, the gain in productivity aided the move to a lower inflation environment in Australia.

Roberts (2005) reports on a similar development in the United States. Starting in the late 1990s, productivity accelerated, initially leading to higher profits due to sticky wages and prices. However, US firms eventually passed on these cost savings, which helped to push down inflation. The timing of this reduction in inflation is key: eventually nominal wages will increase with the gains in productivity, but as the author notes, this could take some time.

However, quantifying this effect is complicated by difficulties with data on employee compensation. In the United States, stock options have become an important but highly variable part of compensation. This stems in part from the fact that the option is not recorded as compensation until it is exercised, and option exercises tend to be quite volatile. A preferred method, advocated by the International Accounting Standards Board (IASB), would count the value of the option as compensation when the option is granted, as option grants tend to be smoother than exercises. In addition, US wage data are often substantially revised. The problem of large revisions to wage data is also seen in many other countries.

The Reserve Bank of New Zealand also has used a markup model to help understand inflation developments. As noted by Hodgetts (2005), this requires a view that production function coefficients, such as the output elasticity of labour, are relatively stable and that the markup from costs to prices is predictable. In the past, these assumptions seemed warranted, with the markup moving with the business cycle. However, of late this model has become less helpful for the Bank. Work by Hampton (2001a) demonstrates that in the 1980s wages tended to lead prices, but this behaviour was reversed in the 1990s. This interesting finding suggests that in the 1990s price competition from abroad dominated. Noting that capital also enters the production function, Guo (People's Bank of China (2005)) finds some evidence that large increases in investment are associated with higher rates of inflation.

Researchers at the Bank of Spain have used the insights from a markup model to gain a better understanding of the forces behind both the "dual inflation" phenomenon (mentioned previously), as well as the differential between Spanish inflation and inflation in the rest of the euro area. Estrada and Lopéz-Salido (2004) and Lopéz-Salido and Pérez-Quirós (2005) assume a Cobb-Douglas production function for Spanish firms in order to decompose changes in the rate of Spanish tradables and non-tradables inflation into changes in markups, changes in productivity and changes in wage rates. They find that in the 1980s non-tradables inflation was higher than tradables inflation due to high productivity growth in tradables, consistent with the Balassa–Samuelson hypothesis. However, in the 1990s, the comparatively higher rate of inflation for non-tradables was the result of a decline in the markup for tradables. The decline in the markup for tradables in the 1990s also helps explain the narrowing of the differential between Spanish inflation and inflation in the rest of the euro area. Since Spain has entered monetary union, the differential has fluctuated around 1 percentage point and appears to be related to a fall in productivity growth and an increase in margins in Spanish non-tradables. Lopéz-Salido, Restoy and Vallés (2005), using a structural model, argue that the simultaneous presence of "dual inflation" within the Spanish economy and a differential between Spanish and euro area inflation can only be explained by the combination of an aggregate demand expansion biased towards consumption of non-tradable goods, and price and wage rigidities (such as wage indexation clauses).

Research at the Netherlands Bank also examines inflation differentials in the euro area, focusing on the prospects for new member states. Maier (2004) argues that inflation differentials will likely fall to somewhere between 2 and 5 percentage points, well above what might be attributed to Balassa-Samuelson effects. This view that inflation differentials are not completely explained by differences in tradables and non-tradables productivity gaps is also shared by researchers at the ECB (Noyer (2001)).

The specification of the production function can be generalised to include more factors than just labour and capital. In particular, it is common to include imported intermediate goods as well as natural resources such as energy. With these extensions comes the question of whether the pass-through of changes in energy prices into the CPI has fallen, accounting for some of the evolution in the inflation process. Of course, the issue of a lower rate of pass-through is distinct from the question of whether or not shocks to energy prices have fallen – a topic discussed in the third section of this paper.

The inclusion of imports leads to an examination of the effect of exchange rate changes on the inflation process and the issue of whether exchange rate pass-through has declined. Of course, examining the effect of exchange rate changes on inflation is also justified by the fact that imported final goods are directly entered in the CPI basket. Here again, timing and perceptions are key, with researchers making a distinction between short-run and long-run estimates of pass-through. Clearly, the effect of a change in the exchange rate is determined in part by whether the change is viewed as temporary or permanent. The analysis of the pass-through of exchange rate changes into CPI inflation is conducted in two steps: a first stage pass-through of an appreciation or depreciation into import prices, and a second stage pass-through into consumer prices.

There are mixed empirical findings on whether the size and timing of first stage pass-through has changed in the past two decades or so. Campa and Goldberg (2004) find that both short-run and long-run first stage pass-through declined for roughly two thirds of the 21 OECD countries they examined. Bailliu and Fujii (2004) and Sekine (2005) report similar findings for a study of 11 and seven industrial countries respectively. These results stand in contrast to estimates for New Zealand (Hampton (2001b)) and Australia (Dwyer and Leong (2001)), which show an unchanging complete pass-through into import prices. Individual studies of other open industrial economies such as Australia, Canada, Sweden and the United Kingdom also find no significant change in first stage pass-through.

With regard to second stage pass-through to consumer prices, there appears to be more of a consensus. Numerous studies report a fall in both the short-run and long-run pass-through coefficients. This applies to studies of industrial countries (Bailliu and Fujii (2004), Gagnon and Ihrig (2004), McCarthy (2000), Sekine (2005) and Stulz (2005)) and of emerging and developing economies (Frankel et al (2005)). To give a few examples, using data prior to 1985, the pass-through coefficient into the CPI for New Zealand was estimated to be about 0.3, meaning that every 1 percentage point appreciation in the trade-weighted exchange rate was associated with a roughly 0.3 percentage point reduction in CPI inflation. This was viewed as complete pass-through given that the overall import content of the CPI was estimated at about 20 per cent. Current estimates (Hampton 2001b) put the coefficient at 0.15 per cent. Kent (2005) reports a decline in second stage pass-through for Australia, consistent with the findings of Heath, Roberts and Bulman (2004).

Holmsen and Røstøen (Central Bank of Norway (2005)), using data from 1991 to the present, estimate that a 10 per cent appreciation of the krone is associated with a 0.5 percentage point decline in CPI inflation in the first year and a 2 percentage point reduction in the following year. Previously, these pass-through coefficients were estimated to be a 1.5 percentage point reduction in the first year and a 2.5 percentage point reduction in the second year. Declines in pass-through coefficients are also noted for Canada (Leung (2003) and Sweden (Adolfson (1997, 2004)). García (2004) and García and Restrepo (2001) document a large decline in the long-run pass-through coefficient for Chile from 0.5 to roughly 0.25 beginning in 1999. Atypically, more recent estimates for Chile show a return of the pass-through coefficient to near its original level.

Similar to the findings on exchange rate pass-through, several central banks participating in the Autumn Economists' Meeting find evidence of a decreased sensitivity of inflation to changes in energy prices. This finding is of particular interest given the recent sharp rise in energy prices. For the United States, Roberts (2005) shows that energy prices had a large and statistically significant impact on inflation for estimates using data through 1984. Estimates using data since 1984 find no impact of energy prices. Moreover, this effect is larger than would be expected due simply to the declining energy intensity of production. These findings are consistent with Hooker (1996). Murchison (Bank of Canada (2005)) also reports no impact of energy prices on consumer prices for Canada. Somewhat in contrast, García and Valdés (2005) maintain that changes in oil prices are an important driver of the inflation process in Chile. They report that a 30 per cent increase in oil prices, if assumed to be a permanent shock, leads to a 2.4 percentage point increase in CPI inflation in the first year and a 1.4 and 0.6 percentage point increase in the following two years respectively. Moreover, they note that these estimates reflect a judgmental reduction from former estimates that were twice as large.

Kim (2005) considers an interesting decomposition of items in the Korean CPI into those items most likely to be affected by demand shocks, by supply shocks and by foreign variables such as exchange rates and oil prices. This classification scheme is roughly consistent with the above discussion that considers variables in the production function, exchange rates and energy prices. This line of research finds that the Korean CPI is becoming less and less sensitive to demand shocks and increasingly sensitive to supply shocks and foreign developments.

Rich and Steindel (Federal Reserve Bank of New York (2005)) consider the ability of various measures of the core rate of inflation, for example consumer prices excluding food and energy, to forecast movements in the underlying trend rate of inflation. They find that all of the core inflation measures perform equally well, doing a good job of tracking the trend rate of inflation contemporaneously but offering little in the way of forecasting future movements in the trend rate.

(c) Expectations

In even the simplest of macroeconomic models, inflation expectations play an important role in the determination of actual inflation.[7] It then comes as no surprise that central banks pay close attention to inflation expectations when trying to understand the inflation process. Much attention is paid to changes in inflation expectations following a change in the monetary policy regime. New Zealand has seen a move to lower and more stable inflation expectations. Survey measures of expected inflation began to fall in the early 1990s, not long after the adoption of inflation targeting. However, expectations did not fall as rapidly as actual inflation. Expectations settled at a point a bit below 2 per cent, a rate consistent with the then current inflation target range of 0–2 per cent. Subsequently, expected inflation edged up a bit, largely in line with changes in the inflation target to the range 0–3 per cent in 1996 and the range 1–3 per cent in 2002. Ranchhod (2003) discusses the various surveys of inflation expectations in New Zealand. Expected inflation from the household survey is above actual inflation while expectations taken from the Reserve Bank's survey of businesses are much closer to actual inflation. Expectations have been quite stable of late, showing little tendency to move with the cycle, with large changes in the exchange rate or to actual inflation (Basdevant (2003)).

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[7] For example, under the quantity theory, an increase in expected inflation will lead to a rise in actual inflation through an increase in velocity. The role of inflation expectations in affecting current behaviour of price-setters is confirmed by the empirical analysis based on survey data conducted in Fabiani et al (2005). Their empirical results are seen as providing some support for New Keynesian Phillips curve models.

In Canada, inflation expectations also began to fall in the early 1990s and now appear to be better anchored to the 2 per cent midpoint of the target inflation range. Longworth (2002) also argues that the formation of inflation expectations is now forward-looking, meaning that any shock to inflation is likely to have a smaller long-term effect. This claim is consistent with the statistical finding of a decline in inflation persistence. Data for Chile also show inflation expectations that are anchored in the middle of the current inflation target range (Garcia and Valdés (2005)). Both surveys of analysts and expectations measures extracted from nominal and indexed Treasury yields show expectations centred around 3 per cent.

In the United States, there has been a change in the inflation expectations of both professional forecasters and households. Since 1998, inflation expectations taken from the Survey of Professional Forecasters have remained remarkably stable, with the 10-year-ahead expectation for inflation remaining virtually constant at 2.5 per cent. Inflation expectations from US household surveys have also been very stable of late, although their level is a bit above that of the expectations of professional forecasters. Measures of expected inflation taken from a comparison of indexed and nominal US Treasury yields have been plagued by difficulties in accounting for term premia.

One problem with surveys of inflation expectations, noted by Ranchhod (2003), is that they may reflect current and past economic conditions, rather than being truly forward-looking. In the euro area, professional forecasters' expectations for euro area inflation consistently over-forecast inflation between 1991 and 1999, while under-forecasting inflation since then.

Schuberth (Austrian National Bank, (2005)) makes a distinction between perceived and actual inflation in order to shed some light on how agents form their expectations. She finds that since the beginning of 2002, perceptions of inflation have been running above actual inflation, that is, that households think inflation is higher than it actually is. This misperception first appeared at the time of the euro cash changeover (Fluch and Stix (2005)), perhaps when stories of price increases were common, and then explained by the recent increase in oil prices, when households are very aware of a significant price increase. Interestingly, during 2002–03, the increase in perceived inflation did not feed into higher expected inflation. Of late however, the opposite has been true.

(d) Implications for Phillips curves

Across the central banks participating in the Autumn Meeting, it is almost a unanimous finding that both the location and slope of the (short-term) Phillips curve have changed over roughly the past 20 years.[8] At the same time, any attempt by policymakers to exploit this trend is seen as risky, as this may over time bring back more inflation volatility and persistence and a steeper Phillips curve. Obviously, the change in the Phillips curve comes as no surprise, given the evolution in the relationship between inflation and wages, productivity and exchange rates, as well as the changes in inflation expectations discussed above. Nonetheless, given the central place of the Phillips curve in macroeconomic analysis, it is worth separately documenting changes in the inflation process through the lens of the Phillips curve.

The findings of Benati (2005) for the United Kingdom are typical of the experience of many countries. Since the introduction of inflation targeting in 1992 and formal central bank independence in 1997, changes in unemployment have been associated with much smaller changes in the inflation rate. Not only has the Phillips curve flattened, but the distribution of unemployment/inflation outcomes around the curve has become much tighter. This result is in stark contrast to the highly unstable short-run Phillips curve observed in the United Kingdom in the four decades following World War II. Similar findings are reported for New Zealand, with a downward shift and flattening in the Phillips curve over the past 13 years. These changes are certainly consistent with the view that inflation expectations are better anchored and that large changes in output are unlikely to have much of an impact on inflation. Hodgetts (2005) notes that notwithstanding these changes, the most recent inflation forecasts by the Reserve Bank of New Zealand have been below actual inflation.

[8] Only in Chile does it appear that the Phillips curve has steepened. Instrumental variables estimation of a forward-looking Phillips curve (described in Garcia and Valdés (2005) finds an increase in slope for the latest period, relative to 2000-2001.

Kent (2005) reports on updates of the work of Debelle and Wilkinson (2002) for Australia, noting that the Phillips curve has shifted down and become flatter. Here, a reduced-form price equation, based on an open-economy Phillips curve and an equation describing the formation of inflation expectations, is estimated using rolling regressions with 10-year windows. Over time, the influence of the output gap on inflation has almost disappeared, as has the influence of the change in the output gap (commonly referred to as speed limit effects). For the output gap, there is some concern that the declining significance may be the result of a final estimation that includes only data from the expansionary phase of the business cycle.

For Canada, an expectations-augmented Phillips curve works well for the period 1973 to 1982, but when estimated over the period 1982 to the present, the output gap is insignificant (Demers (2003)). This finding is consistent with those of Beaudry and Doyle (2001) and Kichian (2001). Research by Gagnon and Khan (2001) and Guay, Luger and Zhu (2002) indicates that a more recent New Keynesian vintage of the Phillips curve (NKPC) that incorporates price rigidities does not do a good job of capturing the inflation process when labour's share of income is used as a proxy for marginal cost. However, Murchison (2004) and Amano and Murchison (2005) find that the explanatory power of the NKPC is enhanced if an open-economy definition of marginal cost is used. This suggests that findings of instability in the Phillips curve relationship may be related to measures of firms' costs.

Research at the Federal Reserve Board also notes a change in the nature of the inflation/unemployment gap relationship. In a simple regression of inflation on the unemployment gap, the coefficient on the unemployment gap is cut in half after 1984 (Roberts (2005)). This reduction may be the result of a gradual lag in the economy's adjustment to the 1979 change in monetary policy. The new relationship can also be seen in the change in the Board staff's view on the sacrifice ratio. In the late 1980s and early 1990s, it was thought that the sacrifice ratio was around 2.5, meaning that a differential of 2.5 percentage points between the unemployment rate and the natural unemployment rate would be associated with a 1 percentage point reduction in inflation. Currently, the staff view is that the sacrifice ratio is around 4, with the FRB/US macroeconomic model having a sacrifice ratio of around 6.

Work at the Bank of France (Jondeau and Le Bihan (2005)) finds some differences across countries. For continental Europe, using the output gap improves the fit of the NKPC and the inflation process is not very forward-looking. For the United States and the United Kingdom, a measure of unit labour costs is preferred and the inflation process has a large forward-looking component. Matheron (2005) finds that accounting for firm-specific labour yields estimates of nominal rigidity that are in line with the microeconomic CPI evidence.

For Switzerland, Gerlach-Kristen (2005a) finds a shift in the coefficients of an NKPC around the fourth quarter of 2000. Bashkin, Kahn and Rudolf (2005) examine the NKPC embedded in a general equilibrium model. They find that reduced-form estimates of the NKPC will fit well across many different types of firm pricing behaviour, so long as steady state inflation is low. However, they emphasise that coefficients from such a reduced-form relationship are not deep structural parameters: thus it is not surprising that these coefficients may change over time, providing theoretical support for the common finding of a shift in the NKPC.

In sum, studies of the microeconomic pricing decisions have yielded many insights into firm pricing behaviour. From these studies it is clear that market structure (ie the competitive pressure a firm faces) is an important determinant of price flexibility. At the macro level, central bank researchers have established that the evolving inflation process is, at one level, explained by a lowering of firm costs (via less expensive inputs and gains in productivity), shrinking margins, damped sensitivity to external factors and a reduction in inflation expectations. The following section of the paper turns to the question of what fundamental economic factors can explain these changes.

3. Ultimate or fundamental explanations for changes in the inflation process

Carefully documenting changes in the inflation process and its proximate determinants is necessary to begin a discussion of what is of greatest interest, the ultimate or fundamental changes that can explain why the inflation process has changed. Following the lead of Bernanke (2004), these ultimate changes can be classified into those attributable to changes in the structure of the economy, those simply

attributable to good fortune, and those attributable to changes in the conduct of monetary policy. Of course, separating the ultimate changes into these categories is a tenuous exercise, as it is difficult to disentangle the links between these various channels. In particular, it is important to keep in mind the point, recently reiterated by Bernanke (2004), that changes in structure may themselves be endogenous responses to changes in the conduct of monetary policy. This critique will be discussed in turn.

(a) Changes in the underlying economic structure

Discussions of changes in the inflation process that might have resulted from changes in the structure of the economy can be divided into changes brought about by developments in the internal or domestic economic structures and changes brought about by developments in the external or global economic structure. Structural changes in the domestic economy include labour market reform, the liberalisation of key markets (eg telecommunications), financial innovation, the move to a service-based economy and improvement in the implementation of fiscal policy.

Several central banks report on the effect on prices of deregulation in the domestic economy, although it is difficult to precisely calculate the effect of these changes on the inflation rate.[9] New Zealand embarked on a series of labour market reforms in the early 1990s that are felt to have importantly influenced the price setting process by reinforcing the trend toward a more decentralised wage bargaining system.[10]

Kite (2005b) finds large changes in the retail sector in New Zealand due to the increasing presence of large discount chains. Finally, deregulation of the telecom and air travel industries has also had a sizeable impact. Telephone charges fell 80 per cent between 1987 and 1999, dropping 0.2 percentage point off of the CPI inflation rate in each year. International airfares have fallen 30 per cent in the past three years.

The German labour market has undergone a series of structural reforms over the past decade. In just five years, the share of employees in western Germany covered by a sector-wide labour agreement has fallen from 70 per cent in the mid-1990s to 63 per cent in 2000. Ziebarth (2005) discusses evidence of increased wage flexibility. He also presents evidence from the Bundesbank's quarterly macroeconomic model of the likely implications of these changes for the inflation process. He considers the effect over the next 20 years of implementing either the labour reform proposals of the German Council of Economic Experts or those of the Institute for the German Economy. Both proposals generate, relative to baseline, a decline in inflation in the first decade and an increase in the second as the reforms eventually spur economic growth that bids up wages and prices. Thus, structural change can have important impacts on the inflation process.

Germany has also seen reforms in its network industries, especially telecommunications and energy. Ziebarth (2005) reports that where regulatory reform was most aggressive there have been sharp price reductions. For example, telecommunications prices fell 30 per cent from 1995 to 2004. Similar results hold for Switzerland since its liberalisation of the telecommunications sector in 1998. For Austria, Fluch and Stix (2005) discuss recent liberalisations of markets for telecommunications, electricity and natural gas. Telecommunication prices in late 2004 were 14 per cent below those for 1997. However, the effects of liberalisation on energy prices were blunted by tax increases and increases in global energy prices. Nonetheless, Kratena (2004) shows that electricity and natural gas prices are 40 per cent and 14 per cent lower, respectively, than would have been the case without liberalisation. Structural change in the retail food sector is thought to have influenced the inflation process for Sweden. Although three firms have come to increasingly dominate the sector, there is some evidence of economies of scale pushing prices down. The share of sales in hypermarkets is increasing and firms are switching to more private labels (Asplund and Friberg (2002)). In the United Kingdom, a fall in union membership (Nickell and Quintini (2002)), a decline in retail margins and

[9] See Cavelaars (2002) and Neiss (2001) for work in this area.

[10] In addition, more stable inflation expectations have encouraged a lengthening of wage agreements. Blackwood et al (2005) find that the share of labour contracts that extend beyond one year has increased from 65 per cent in 1996 to 76 per cent in 2005. As of 2005, only 8 per cent of wage contracts were covered by multi-employer agreements.

better inventory management are all thought to have contributed to a decline in the rate and/or volatility of inflation.

In emerging market economies, the pace of structural reforms appear to have influenced the change in the inflation process. In the case of India, Pattnaik and Samantaraya (2005) argue that over the last few years, structural reforms aimed at liberalising internal and external trade, as well as the rationalisation of the Indian tax system, helped lower inflation and inflation expectations. Furthermore, institutional reforms aimed at developing a broad-based financial market and the elimination of the process of automatic monetisation through the issue of ad hoc Treasury Bills enhanced the effectiveness of monetary policy in achieving reasonable price stability in the recent period. Pongsaparn and Mallikamas (2005) document that in Thailand the number of goods and services that are subject to governmental monitoring has more than doubled since early 2003. This may explain the recent, substantial deviation in the behaviour of the PPI and CPI. Clearly, prices that are at least partially subject to controls will behave much differently than those that are freely set.

Over the past 25 years, there have also been enormous changes in the structure of the world economic system. Not surprisingly, researchers have spent considerable effort in trying to understand the impact of the wave of globalisation on the conduct of monetary policy and on the inflation process (Rogoff (2003) is a prominent example). Precisely estimating this impact is fraught with difficulties, leaving much of the analysis on a conjectural basis. However, central banks have done important initial work in developing a means to account for the impact of global developments on the domestic inflation process.

A recent paper by Borio and Filardo (2005) compares the role of global and domestic factors in driving domestic inflation in a sample of 16 countries. Preliminary results suggest that over time the importance of global factors has increased relative to domestic factors. Holmsen and Røstøen (2005) present the findings of an effort by the Central Bank of Norway to more carefully calculate the effect of changing import patterns on domestic prices. They develop a new import price indicator which shows that the prices for imported goods in the CPI have fallen 8 per cent since 1998. The weights in the indicator shift over time to reflect the changing pattern of Norway's trade with the rest of the world. The share of imports from what are labelled as low-cost countries has increased from 5 per cent in 1990 to 13 per cent in 2004. Of this group, China's share has risen from 0.5 per cent in 1988 to 5 per cent in 2004. By product group, this switch in the pattern of trade has been largest for clothing, where the share of imports from low-cost countries has risen from 18 per cent in 1991 to 62 per cent in 2004. They conclude that these developments have clearly moderated Norwegian inflation.

Calculations for Sweden (2005) show that the switch to low-cost countries may have brought down prices for Swedish importers by roughly 2 percentage points in 2004. Similar work for the United Kingdom (Nickell (2005)) estimates that the inflation rate of UK-weighted world exports was reduced by somewhat more than 0.5 percentage point in 2004 by the switch to low-cost countries such as China. In New Zealand, the share of imports from China has risen from under 2 per cent in 1990 to around 11 per cent in 2005. The effect of such changes is clear: since 1997, the foreign currency price of imported manufactured goods has fallen on average by 2.5 per cent per year. Interestingly, Guo (2005) finds that China's entry into the World Trade Organisation has changed the characteristics of the inflation process in China, as the increased exposure to rising prices of imported goods has tended to push up inflation.

Work in progress at the Bank of England reported by Andrews (2005) suggests that improved fiscal policy might also have contributed to a structural change that altered the inflation process. In particular, fiscal policy appears to have become more countercyclical and therefore more stabilising and less volatile. During the 1990s there was a sharp drop in the stock of public debt relative to GDP. Moreover, since 1997 fiscal policy has been subject to tighter legislative constraints. These developments could have contributed to a sort of pleasant monetarist arithmetic that helped to contain inflationary pressures.

(b) Good luck

It may be the case that the decline in both the rate and variability of inflation, along with the decline in the variability of output, may just be the result of a string of favourable developments that are unrelated to either structural changes in the economy or improved monetary policy. For example, it could be that most countries have been subjected to smaller shocks in the past decade than was the

case in the 1970s and 1980s. Commentators often point to the long period of generally declining and less volatile oil prices witnessed since the mid-1980s.

Determining whether this is the case requires some sort of decomposition of economic outcomes into the pieces resulting from the three possible explanations. Several researchers have considered such decompositions, with the bulk of the applications done using data for the US economy. Stock and Watson (2003) find that good luck accounts for the bulk of the reduction in the variability of output but for little of the reduction in the variability of inflation. This conclusion is also shared with Ahmed, Levin and Wilson (2004), and Roberts (2004). Sims and Zha (2004) emphasise the importance of favourable shocks (ie good luck).

Benati and Mumtaz (2006) find that the United Kingdom would still have suffered from high inflation during the 1970s even if the presumably improved monetary policy regime of the 1990s had been in place during the 1970s. This implies that the favourable performance of the 1990s owes more to good luck than good policy.

Kent, Smith and Holloway (2005) examine the role of good luck in reducing the volatility of output across the OECD economies. They find that good luck played a relatively small role in this decline, a finding echoed by Barrell and Gottschalk (2004) and Cecchetti, Flores-Lagunes and Krause (2005) for Australia. Kent (2005) examines inflation variability for the OECD economies in a panel regression using measures of openness, financial liberalisation, an index of product market regulation and an indicator of the strictness of the monetary policy regime as explanatory variables. He concludes that good luck can account for roughly one quarter of the decline in the variability of inflation seen in most of the OECD over the past 20 years.

(c) Good monetary policy

Taken literally, the above discussion of structural change and good fortune as two of the three ultimate causes for the changing inflation process means that any remaining change in the inflation process must be the result of the third alternative, an improved monetary policy. Of course, this reductionist argument is unsatisfactory, as it begs the question of exactly what change brought about the improvement in monetary policy. Research at central banks focuses on two broad explanations for the superior performance of monetary policy. First, quite a number of central banks have changed the framework of monetary policy over the past two decades, for example, through the adoption of an explicit inflation target or the granting of central bank independence by the legislative authority. Second, central bank research has considered the possibility of an enhancement in the conduct of monetary policy, for example, through better decision-making brought about by either an improved measurement of the state of the economy or by a better understanding of macroeconomic theory (BIS (2005)). These two explanations, an improved framework or improved conduct of monetary policy are considered in turn.

Central bank researchers are spending considerable effort in ascertaining whether the adoption of a new framework for monetary policy lies behind the changing inflation process. The widespread adoption of inflation targeting frameworks over the past 15 years means that much of this research focuses on attempts to assess the impact of adopting a formal target for inflation. Often, some simple approaches are used, quite commonly the comparison of experiences across countries that were reviewed in Section 1. The logic behind such comparisons is that a similar change across several economies may mean that an improvement in one economy's inflation process may not be the result of a change in that economies' monetary policy regime Comparing the experiences of many countries that have adopted inflation targets, García and Valdés (2005) conclude that the decline in the level and persistence of inflation in Chile is consistent with the view that the move to explicit inflation targeting in Chile has borne significant fruit. A similar logic can be applied to comparisons in the inflation process across sectors. Aucremanne and Collin (2005) argue that an improvement in policymaking should be felt across all sectors of the economy, while beneficial changes in the inflation process that are due to changes in the underlying economic structure, such as deregulation of the economy or global competition, are likely to have differential impacts across sectors. Their finding that the observed changes in the inflation process touched the majority of sectors in a fairly synchronised fashion indicates that some of the Great Moderation may be the result of improvements in monetary policy regimes. This is further corroborated by the fact that the observed decrease in persistence was also found for nominal wage growth, but was far less pronounced for real wage growth.

Central banks also find evidence of the importance of changes in the monetary policy framework using statistical methods. Following the adoption by Chile of a formal inflation target in 1999, García and Valdés (2005) show that leads of inflation have become more significant in reduced-form estimates of pricing equations. They also find that adding an inflation targeting variable to an autoregressive estimate of inflation persistence eliminates the finding of a break in the persistence coefficient. For the United Kingdom, Benati (2004) finds structural breaks in both the mean and variance of inflation in the second quarter of 1992, broadly consistent with the move to inflation targeting. However, the timing of the break is subject to some uncertainty and may have been associated with the United Kingdom's ERM commitments.

Recent empirical studies have also investigated the impact of changes in the monetary policy framework on the inflation expectations process. In New Zealand, there is some evidence that the move to inflation targeting in 1989 may have lowered and stabilised inflation expectations. However, Hunter (2005) shows that backward-looking models of inflation expectations fit just as well as those in which inflation expectations are a function of the inflation target. Using financial theories and data, Gerlach-Kristen (2005b) and Büttler (2002) argue that the new policy regime adopted by Switzerland in 2000 has had important effects on inflation expectations.

Central banks have also devoted substantial resources to more theoretically grounded approaches, such as explicitly incorporating inflation targeting into a structural economic model. This allows for an explicit determination of the impact of the new monetary policy framework. Work at the Central Bank of Brazil presents a prime example of this research strategy (Alves and Areosa (2005)). These authors extend Woodford's (2003) hybrid NKPC model to embed an explicit inflation target in a small, open economy context. Estimates of the model show that the adoption of an inflation target in June 1999, following the float of the real, explains much of the change in Brazilian inflation dynamics. The coefficient on the inflation target is both economically and statistically significant. Rolling estimates of the model demonstrate that the inflation target's credibility can be restored after major shocks provided that policymakers demonstrate a firm commitment to the target. This work is consistent with the notion of Woodford (2004) that expectations about monetary policy are of prime importance. Their findings are also consistent with those of Cerisola and Gelos (2005), who link changes in surveyed inflation expectations in Brazil to macroeconomic developments, including the adoption of an inflation target.

One of the prime benefits of the adoption of an inflation target in 1998 by the Czech Republic was thought to be an anchoring of inflation expectations (Smidkova and Hrncir (2000)). Hurnik (2005) explores whether or not this was actually the case, using an identified vector autoregression model. He finds that expectations of firms are more sensitive to exchange rate shocks while households' expectations respond more to food price shocks, although the adoption of an inflation target does appear to have anchored inflation expectations for both types of agents.

Murchison and Rennison (2005) use TOTEM, the Bank of Canada's new projection and policy model (see Binette et al (2004)), to explore the role of inflation targeting in shaping the inflation process. They find that monetary policy shocks compounded the negative effects of supply shocks in the 1970s and 1980s, but that these two shocks have been uncorrelated since Canada's adoption of an inflation target in 1991. This model-based research is consistent with Longworth's (2002) demonstration that Canadian inflation expectations have become predominately forward looking.

Of course, a new monetary policy regime or framework is not a requirement for an increase in quality of monetary policymaking that leads to a change in the inflation process. Even within an unchanging policy regime, improvements in the conduct of monetary policy can also trigger changes in the inflation process. Not surprisingly, much of the research along these lines focuses on the US experience because the United States, unlike many other economies, has not had a formal change in the monetary policy regime. However, there is a fair amount of research on the experiences of the United Kingdom as well. Explanations for the change in the conduct of monetary policy focus either on improved measurement of the state of the economy and/or an improved understanding of macroeconomic theory.

Many researchers document the evolution in policymakers' understanding of macroeconomic theory over the past four decades.[11] Cogley and Sargent (2005) explore whether or not the FOMC's understanding of the inflation-output trade-off was formed by the pattern of the shocks hitting the economy. They find that changes in the belief about the trade-off and related changes in the reaction function could qualitatively replicate the evolution of US inflation seen in the data. Ellison and Yates (2004) test a similar model for the United Kingdom and find that it can replicate the profile of inflation volatility, which rose in the 1970s and fell in the 1990s.

This improved understanding might help explain the more aggressive response to inflation in the 1980s and 1990s as compared to the 1960s and 1970s. Taylor (1999) and Clarida, Gali and Gertler (2000) document the increased aggressiveness of monetary policymaking in the United States, while Nelson (2003) does the same for the United Kingdom. These studies demonstrate that there has been a shift in the coefficients of the monetary policy reaction function, with a sharper response to inflation in the recent period. Roberts (2004) shows that the increased aggressiveness of the FOMC can account for the declining slope of the Phillips curve that was discussed in Section 2(c). In China, monetary policy has also become more aggressive, with policy rates now moving more than one-for-one with inflation.

Thus, it is certainly plausible that a better understanding of macroeconomic theory brought about more effective policymaking and altered the inflation process. However, an alternative hypothesis has been advanced to explain the changes in the inflation process. Orphanides (2002) argues that the poor monetary policy outcomes for the United States in the 1960s and 1970s can be explained by faulty estimates of potential GDP rather than by timid monetary policy responses. He shows, using real-time data series that were available to policymakers in those decades, that there has not been any change in coefficients for estimated monetary policy reaction functions. Nelson and Nikolov (2001, 2002) show that mismeasurement of potential output can also contribute to explaining high inflation in the United Kingdom in the 1970s.

In a similar vein, Orphanides et al (2000) show that the supposed change in the conduct of monetary policy can also be explained by improved measurement of the output gap. As for the alternative hypothesis of increased aggressiveness, Roberts (2004) finds that the gains in the quality of policymaking based on this improved measurement could also account for the decline in the slope of the Phillips curve.

Primiceri (2004) notes that the improved measurement might just be the result of good fortune. Better measurement of the natural rate of unemployment might only be a temporary phenomenon, enhanced by the recent stability in the natural rate. If the natural rate fluctuates as much in the future as in the 1970s, then so will inflation and output. This highlights a key point to be addressed in the next section. Whether it is better understanding of macroeconomic theory or better measurement of the state of the economy that accounts for improved monetary policymaking only makes a substantive difference if these two hypotheses imply a different course for monetary policy in the coming years.

4. Summary of findings and the research agenda

A number of conclusions can be reached based on the papers presented at the autumn meeting. There is little doubt that almost every country has experienced a statistical change in the univariate inflation process.

These observed changes in the inflation process can be attributed to several proximate developments: more moderate wage behaviour coupled with impressive increases in productivity, a reduction in the pass-through of exchange rate changes and energy prices, and a decline in inflation expectations. All of these developments lie behind the near universal finding of a downward shift and flattening of the Phillips curve. Research is beginning to focus on ways to explicitly incorporate the monetary policy

[11] Prominent examples include DeLong (1997), King (1997), Hetzel (1998), Christiano and Gust (2000), Romer and Romer (2002) and Nelson (2004).

regime and international considerations into the structural models from which the reduced-form Phillips curve is derived.

More fundamentally, central banks are eager to understand the evolution in the inflation process in terms of changes in the ultimate determinants of inflation. Domestically, many countries have seen sizeable reform of the labour market and important liberalisation of key markets, especially in network industries. In addition, quite a few countries report on research that quantifies the effect on the inflation process of the increased globalisation seen over the past two or three decades. Quite a bit of effort, especially in the United States and United Kingdom, has been spent assessing whether the favourable changes in the inflation process can be attributed to a fortuitous, and perhaps temporary, decline in the size of shocks that are hitting the economy. Finally, much research points to changes in the framework or improvements in the conduct of monetary policy as factors behind the evolving inflation process.

Several directions for future research emerge from this overview of central bank research efforts. It certainly will prove extremely valuable to continue the analysis of microeconomic price setting. These studies have yielded valuable insights into firm behaviour that should advance future modelling efforts. In particular, the consistent finding of considerable heterogeneity in price setting across sectors implies that future models may need to incorporate greater sectoral detail. This line of research is relatively new and uses datasets that cover only a short time period. As these datasets are accumulated over time, central banks should gain insights into the price setting behaviour that helps explain the future evolution of the inflation process.

Changes in the nature of the Phillips curve imply that traditional measures of the real economy, such as the output gap or deviations from the natural rate of unemployment, may become even harder to infer. For example, Roberts (2005) notes that with a flatter Phillips curve, changes in the unemployment rate have less impact on inflation and therefore provide less precise estimates of the natural rate of unemployment. He argues that this implies that central banks should devote more time and attention to directly monitoring labour market developments, certainly a call for a new research direction.

Mankikar and Yates (2005) make the observation that central bank research efforts to date have tended to focus on exploring a single explanation for the change in the inflation process. This is understandable, as it simplifies the task at hand, but it makes it difficult to then judge how the individual pieces fit together – a bit like the three blind men attempting to describe an elephant. This observation is related to the Bernanke (2004) critique that research on the inflation process has failed to allow for the possibility that changes in the policymaking framework may have altered other parts of the economic structure. To date, central bank researchers have interpreted the critique in a rather narrow fashion, limiting the impact of a change in monetary policymaking to only affecting inflation expectations. However, the critique can be interpreted much more broadly, as there are good reasons to suspect that improved policymaking will have impacts throughout the economy. For example, a more credible commitment to price stability is quite likely to impact developments in the labour market. Needless to say, research that pays serious attention to the critique, either the narrow or broad version, will require increasingly sophisticated modelling strategies.

Along these lines, it is interesting to note that the research summarised at the autumn meeting made almost no mention of the role of asset prices in understanding the evolving inflation process. With regard to monetary assets, there was some discussion of the interaction between the changing inflation process and the monetary aggregates. The absence of a broader discussion of asset prices may be a bit surprising, given the recent attention to the possibility that the flattening Phillips curve means that inflationary impulses will first be observed in asset price inflation.[12] Thus, policymakers may well be confronted with a sense of macroeconomic imbalances coming from an examination of asset prices even when price inflation is completely contained. Unfortunately, as for the Bernanke critique, it may be that it will be some time before asset price developments can be explicitly incorporated in well specified economic models.

Finally, when confronted with changes in the inflation process that are not completely understood, it is natural for policymakers to consider what type of monetary policy regime or framework is best suited

[12] See Greenspan (2005) and Borio and White (2003).

to such a changing environment. Bean (2005) argues in favour of inflation targeting while Greenspan (2005) advocates a more eclectic risk management approach. Continued central bank research efforts devoted to understanding the evolution of the inflation process will provide the important by-product of shedding light on this important debate.

The contributions to the autumn meeting certainly leave the impression that favourable inflation developments have triggered an enormous research effort to identify the factors that account for these pleasant outcomes. It is hard to share the view of some analysts that the newfound stability will lead central banks to attempt to exploit the short-run trade-off between unemployment and inflation. Moreover, the impressive body of research also makes it hard to argue that central banks have become complacent and run the risk of falling asleep at the switch if the favourable inflation developments begin to reverse themselves. Although policy mistakes are certainly likely when confronted with a complex and dynamic economic structure, the contributions to the autumn meeting indicate that if mistakes are made they will not be for lack of effort.

References

Adolfson, M (1997): “Exchange rate pass-through to Swedish import prices”, *Finnish Economic Papers*, vol 10, no 2, 81-98.

——— (2004): "Exchange rate pass-through – theory, concepts, beliefs and some evidence," mimeo, Sveriges Riksbank.

Adolfson, M, S Laseén, J Lindé and M Villani (2005): “Bayesian estimation of an open economy DSGE model with incomplete pass-through”, *Sveriges Riksbank Working Paper*, no 179.

Ahmed, S, A Levin and B Wilson (2004): “Recent US macroeconomic stability: good policies, good practices, or good luck?”, *Review of Economics and Statistics*, vol 86, no 3, 824-32, August.

Altissimo, F, P Benigno and D Rodriguez-Palenzuela (2004): “Inflation differentials in a currency area: facts, explanations and policy implications”, mimeo.

Álvarez, L, P Burriel and I Hernando (2005a): “Do decreasing hazard functions for price changes make any sense?”, *ECB Working Paper* , no 461.

——— (2005b): “Price-setting behaviour in Spain: evidence from micro PPI data”, *ECB Working Paper*, no 522.

Álvarez L and I Hernando (2005): “The price setting behaviour of Spanish firms: evidence from survey data”, *ECB Working Paper*, no. 538.

Alves, S and W Areosa (2005): “Targets and inflation dynamics”, paper presented at the BIS Autumn Economists’ Meeting, 27-28 October, Basel.

Amano R and S Murchison (2005): “Factor-market structure, shifting inflation targets and the New Keynesian Phillips curve”, in *Issues in inflation targeting*, Proceedings of a Bank of Canada conference, April.

Amirault, D, C Kwan and G Wilkinson (2004): “A survey of the price-setting behaviour of Canadian companies”, *Bank of Canada Review*, Winter 2004-2005.

Andrews, P (2005): “The Great Stability in the United Kingdom: what do we know and what do we need to know?”, paper presented at the BIS Autumn Economists’ Meeting, 27-28 October, Basel.

Angeloni, I, L Aucremanne and M Ciccarelli (2005): “Price setting and inflation persistence: did EMU matter?”, mimeo, ECB and National Bank of Belgium.

Angeloni, I, L Aucremanne, M Ehrmann, J Gali, A Levin and F Smets (2004) “Inflation persistence in the euro area: preliminary summary of findings”, mimeo, ECB, December.

Asplund, M and R Friberg (2002): “Food prices and market structure in Sweden”, *Scandinavian Journal of Economics*, vol 104, no 4, 547-66.

Aucremanne, L and M Collin (2005): “Has inflation persistence changed over time? Evidence from aggregate and sectoral Belgian CPI data”, mimeo, National Bank of Belgium.

Aucremanne, L and E Dhyne (2005): “Time-dependent versus state-dependent pricing: a panel data approach to the determinants of Belgian consumer price changes”, *National Bank of Belgium Working Paper* 66.

Aucremanne, L and M Druant (2005) “Price-setting behaviour in Belgium: what can be learned from an ad hoc survey?”, *National Bank of Belgium Working Paper* 65.

Bailliu, J and E Fujii (2004): "Exchange rate pass-through and the inflation environment in industrialized countries: an empirical investigation," *Bank of Canada Working Paper*, 2004, 21.

Bank for International Settlements (2005): *75th Annual Report*, Chapter IV.

Barrell, R and S Gottschalk (2004): “The volatility of the output gap in the G7”, *National Institute Economic Review*, 188, 100-07.

Basdevant, O (2003): “Learning processes and rational expectations: an analysis using a small macroeconomic model for New Zealand”, *Reserve Bank of New Zealand Discussion Paper*, 2003/05.

Bashkin, H, H Kahn, and B Rudolf (2005): “The Phillips curve under state-dependent pricing”, *Swiss National Bank Working Papers*, no 1.

Baudry, L, H Le Bihan, P Sevestre and S Tarrieu (2004): “Price rigidity: evidence for the French CPI macro-data”, *Banque de France Working Paper* no 113.

Baumgartner, J, E Glazier, F Rumler and A Stigilbauer (2005): “How frequently do consumer prices change in Austria? Evidence from micro CPI data, *ECB Working Paper* , no 523.

Bean, C (2005): “Monetary policy in an uncertain world”, *Bank of England Quarterly Bulletin*, Spring, 80-91.

Beaudry P, and M Doyle (2001): “What happened to the Phillips curve in the 1990s in Canada?” in *Price stability and the long-run target for monetary policy*, Proceedings of a Bank of Canada conference, 51-82.

Benati, L (2004): "Evolving post-world War II UK economic performance", *Journal of Money, Credit, and Banking*, vol 36, no 4, 691-718, August.

Benati, L (2005): “The inflation targeting framework from an historical perspective”, *Bank of England Quarterly Bulletin*, Summer, 160-68.

Benati, L and H Mumtaz (2005): “The ‘Great Stability’ in the United Kingdom: good policy or good luck?”, *Bank of England Working Paper*, forthcoming.

Bernanke, B (2004): “The Great Moderation”, remarks at the meetings of the Eastern Economic Association, Washington DC, 20 February 2004.

Bilke, L (2005): “Break in the mean and persistence of inflation: a sectoral analysis of French CPI”, *Banque de France Working Paper* , no 122.

Bils, M and P Klenow (2004): “Some evidence on the importance of sticky prices”, *Journal of Political Economy*, vol 112, no 5, 947-85, October.

Binette, A, S Murchison, P Perrier and A Rennison (2004): “An introduction to TOTEM”, mimeo, Bank of Canada.

Blackwood, L, G Feinberg-Kanieli, G Lafferty and P Kiely (2005): “Employment agreements: bargaining trends and employment law update 2004–2005”, mimeo, Victoria University of Wellington, Industrial Relations Centre.

Blinder, A (1991): “Why are prices sticky? Preliminary results from an interview study”, *American Economic Review*, vol 81, no 2, 89-96, May.

Blinder, A, E Canetti, D Lebow and J Rudd (1998): *Asking about prices: a new approach to understanding price stickiness*, Russell Sage Foundation, New York.

Borio, C and B White (2003): “Whither monetary and financial stability? The implications of evolving policy regimes”, Federal Reserve Bank of Kansas City symposium entitled *Monetary Policy and Uncertainty*, August.

Borio, C and A Filardo (2005): “The evolving inflation process and monetary policy”, paper presented at the BIS Autumn Economists’ Meeting, 27-28 October, Basel.

Burriel P and I Hernando (2005): “Recent inflation developments in the Spanish economy: the role of competition in product markets”, paper presented at the BIS Autumn Economists’ Meeting, 27-28 October, Basel.

Burstein, A, M Eichenbaum and S Rebelo (2004): “Large devaluations and the real exchange rate”, *NBER Working Paper*, no 10986.

Büttler, H (2002): “The term structure of expected inflation rates”. *Economic and Financial Modelling*, vol 7, no 1, Spring.

Campa, J and L Goldberg (2004): “Exchange rate pass-through into import prices” *CEPR Discussion Paper* no 4391.

Cavelaars, P (2002): “Does competition enhancement have permanent inflation effects?”, *Netherlands Bank Staff Report*, no 92.

Cecchetti, S and G Debelle (2004): “Has the inflation process changed?”, Third BIS Annual Conference, *Understanding Low Inflation and Deflation*, Brunnen, Switzerland, 18-19 June.

Cecchetti, S, A Flores-Lagunes, and S Krause (2005): Assessing the source of changes in the volatility of real growth", *The changing nature of the business cycle*, Reserve Bank of Australia conference, Sydney, 11-12 July.

Cerisola, M and R Gelos (2005): "What drives inflation expectations in Brazil? An empirical analysis", *IMF Working Paper*, WP/05/109, June.

Chantanahom, P, C Poonpatpibul and P Vongsinsirikul (2004): "Exploring inflation in Thailand through sectoral price setting behaviour and underlying trend", Bank of Thailand Symposium.

Christiano, L and C Gust (2000): "The expectations trap hypothesis", *Federal Reserve Bank of Chicago Economic Perspectives*, 21-39.

Clarida, R, J Gali and M Gertler (2000): "Monetary policy rules and macroeconomic stability: evidence and some theory", *Quarterly Journal of Economics*, vol 115, no 1, 147-80, February.

Cogley, T and T Sargent (2001): "Evolving post-World War II US inflation dynamics"; *NBER Macroeconomics Annual*, 16, 331-73, MIT Press.

Cogley, T and T Sargent (2005): "The conquest of US inflation: learning and robustness to model uncertainty" *Review of Economic Dynamics*, vol 8, no 2, 528-63.

Coletti, D and F Demers: (2004) "Is High inflation persistence a stylized fact of the Canadian economy? A review of the evidence with an eye to the new projection model", mimeo, Bank of Canada.

Debelle, G and J Wilkinson (2002): "Inflation targeting and the inflation process: some lessons from an Australian economy", *Reserve Bank of Australia Research Discussion Paper*, no 2002-01.

DeLong, B (1997): "America's only peacetime inflation: the 1970s", in C Romer and D Romer (eds) *Reducing Inflation*, NBER Studies in Business Cycles, vol 30.

Demers, F (2003): The Canadian Phillips curve and regime shifting", *Bank of Canada Working Paper*, 2003-32.

Dhyne, E, L Alvarez, H Le Bihan, G Veronese, D Dias, J Hoffmann, N Jonker, P Lünnemann, F Rumler and J Vilmunen (2005): "Price setting in the euro area: some stylized facts from individual consumer price data", *ECB Working Paper*, no 524.

Dwyer, J and K Leong (2001): "Changes in the determinants of inflation in Australia", *Reserve Bank of Australia Research Discussion Paper*, no 2001-02.

Ellison, M and A Yates (2004): "Escaping volatile inflation", mimeo, Bank of England.

Estrada, A and D López-Salido (2004): "Understanding Spanish dual inflation", *Investigaciones Económicas* vol 28, no 1, 123-40.

Fabiani, S, M Druant, I Hernando, C Kwapil, B Landau, C Loupias, F Martins, T Mathä, R Sabbatini, H Stahl and A Stokman (2005): "The Pricing behaviour of firms in the euro area: new survey evidence", *ECB Working Paper*, no. 535.

Fluch, M and H Stix (2005): "Wahrgenommene Inflation in Österreich – Ausmaß, Erklärungen, Auswirkungen", in *Geldpolitik & Wirtschaft*, Q3/05. OeNB.

Frankel, J A, D C Parsley and S-J Wei (2005): "Slow pass-through around the world: a new import for developing countries?," *NBER Working Paper*, no 11199.

Gagnon, E and H Khan (2001): "New Phillips curve with alternate marginal cost measures for Canada, United States and the euro area", *Bank of Canada Working Paper*, 2001-25.

Gagnon, J and J Ihrig (2004): "Monetary policy and exchange rate pass-through," *International Journal of Finance and Economics*, vol 9, 315-38.

García, A (2004): "Traspaso de depreciaición a inflación en Chile, 1982-2002", unpublished Masters thesis, Departmento de Ingeniería Industrial, Universidad de Chile.

García, C and J Restrepo (2001): "Price inflation and the exchange rate pass-through in Chile", *Central Bank of Chile Working Paper*, no 128, November.

Garcia, P and R Valdés (2005): "The inflation process in Chile: changes and stability", paper presented at the BIS Autumn Economists' Meeting, 27-28 October, Basel.

Gerlach-Kristen, P (2005a): “A two-pillar Phillips curve for Switzerland”, mimeo, Swiss National Bank.

Gerlach-Kristen, P (2005b): “The impact of the new Swiss monetary policy framework on inflation expectations”, mimeo, Swiss National Bank.

Greenspan, A (2005): “Reflections on central banking”, remarks at a symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming, 26 August.

Guay, A, R Luger and Z Zhu (2002): “The new Phillips curve in Canada”, in *Price adjustment and monetary policy*, Proceedings of a Bank of Canada conference.

Guo, J (2005): “The evolving inflation process”, paper presented at the BIS Autumn Economists’ Meeting, 27-28 October, Basel.

Hall, S, M Walsh and A Yates (2000): “Are UK companies' prices sticky?”; *Oxford Economic Papers*, vol 52, no 3, 425-46, July.

Hallsten, K, Y Hedén, and A Svensson (2005): “The evolving inflation process – the case of Sweden”, paper presented at the BIS Autumn Economists’ Meeting, 27-28 October, Basel.

Hampton, T (2001a): “Do wages lead prices?”, mimeo, Reserve Bank of New Zealand.

Hampton, T (2001b): “How much do import price shocks matter for consumer prices?”, Reserve Bank of New Zealand Discussion Paper 2001/06.

Heath, A, I Roberts and T Bulman (2004): “Inflation in Australia: measurement and modelling”, in C Kent and S Guttmann (eds), *The future of inflation targeting*, proceedings of a conference, Reserve Bank of Australia, Sydney, 167-207.

Hetzel, R (1998): “Arthur Burns and inflation”, *Federal Reserve Bank of Richmond Economic Quarterly*, vol 84, no 1, 21-44.

Higo, M, K Nishizaki, Y Saita and I Takagawa (2005), “Kouri Bukka Toukei Chousa wo Mochiita Kakaku Nenchakusei no Keisoku [Measurement of price stickiness using the retail price survey]” (tentative title), mimeo.

Hodgetts, B (2005): “Changes in the inflation process in New Zealand”, paper presented at the BIS Autumn Economists’ Meeting, 27-28 October, Basel.

Holmsen A, and J Røstøen (2005): “Finding the China effect”, paper presented at the BIS Autumn Economists’ Meeting, 27-28 October, Basel.

Hooker, M (1996): “What happened to the oil price-macroeconomy relationship?”, *Journal of Monetary Economics* vol 38, 195-213.

Hunter, L (2005): “Inflation expectations: an interim report”, mimeo, Reserve Bank of New Zealand.

Hurnik, J (2005): “Anchoring role of inflation targeting: myth or reality”, paper presented at the BIS Autumn Economists’ Meeting, 27-28 October, Basel.

Jondeau, E and H Le Bihan (2005): “Testing for a new Keynesian Phillips curve: additional international evidence”, *Economic Modelling*, vol 22, 521-50.

Jonker, N, C Folkertsma and H Blijenberg (2004): “An empirical analysis of price setting behaviour in the Netherlands in the period 1998-2003 using micro data”, *DNB Working Paper*, no 19.

Kent, C (2005): “The evolving inflation process – an Australian perspective”, paper presented at the BIS Autumn Economists’ Meeting, 27-28 October, Basel.

Kent, C, K Smith and J Holloway (2005): “Declining output volatility: what role for structural change?”, *The changing nature of the business cycle*, Reserve Bank of Australia conference, Sydney, 11-12 July.

Kichian M (2001): “On the nature and stability of the Canadian Phillips curve”, *Bank of Canada Working Paper*, 2001-4.

Kim, S (2005): “Determinants of inflation in Korea”, paper presented at the BIS Autumn Economists’ Meeting, 27-28 October, Basel.

Kite, H (2005a): “A note on non-tradables inflation”, mimeo, Reserve Bank of New Zealand.

Kite, H (2005b): “Overview of the retail sector”, Reserve Bank of New Zealand *Bulletin*, 68/2, June.

King, M (1997): “Monetary stability: rhyme or reason”, *Bank of England Quarterly Bulletin*, February.

Klenow, P and O Kryvtsov (2005): “State-dependent or time-dependent pricing: does it matter for recent US inflation?”, *NBER Working Paper*, no 11043.

Kratena, K (2004): “Evaluierung der Liberalisierung des Österreichischen Energiemarktes aus Mackroökonomischer Sicht”, *WIFO-Monatsberichte* 11, 837-43.

Kwapil, C, J Baumgartner and J Scharler (2005): “Price-setting behaviour of Austrian firms: some survey evidence”, *ECB Working Paper*, no 464.

Leung, D (2003): "An empirical analysis of exchange rate pass through into consumer prices," mimeo, Bank of Canada.

Levin, A and J Piger (2004): “Is inflation persistence intrinsic in industrial economies?”, *ECB Working Paper*, no 343.

Longworth, D (2002): “Inflation and the macroeconomy: changes from the 1980s to the 1990s”, *Bank of Canada Review*, Spring.

López-Salido, D and G Pérez-Quirós (2005): “Análisis comparativo: convergencia real, sincronía cíclica y diferenciales de inflación” in “El análisis de la economía española”, *Servicio de Estudios del Banco de España*, Alianza Editorial.

López-Salido, D, F Restoy and J Vallés (2005): “Inflation differentials in EMU: the Spanish case”, *Banco de España Working Paper*, no 0514.

Loupias, C and R Ricart (2004): “Price setting in France: new evidence from survey data”, *Banque de France Working Paper*, no 120.

Maier, P (2004): “EMU enlargement, inflation and adjustment of tradable goods prices: what to expect?”, *DNB Working Paper*, no 10.

Mankikar, A and T Yates (2005): “Recent UK and US macroeconomic performance: good luck, better policy, or both?”, mimeo, Bank of England.

Matheron, J (2005): “Firm-specific labour vs firm-specific capital: implications for the euro area new Phillips curve”, mimeo, Banque de France.

McCarthy, J (2000): "Pass-through of exchange rates and import prices to domestic inflation in some industrialized economies," *FRBNY Staff Report*, no 111.

Murchison, S (2004): “Inflation determination in TOTEM”, mimeo, Bank of Canada.

Murchison, S (2005): “The changing nature of inflation in Canada: recent Bank of Canada research”, paper presented at the BIS Autumn Economists’ Meeting, 27-28 October, Basel.

Murchison, S and A Rennison (2005): “Monetary neglect and the persistence of inflation in Canada”, prepared for the IRFMP/IMF Modeling Conference, Board of Governors of the Federal Reserve System, Washington, DC, 2-3 December.

Neiss, K (2001): “The mark-up and inflation: evidence in OECD countries”, *Canadian Journal of Economics*, vol 34, no 2, 570-87.

Nelson, E (2003): “UK monetary policy, 1972-1997: a guide using Taylor rules”, in P Mizen (ed), *Central Banking, monetary theory and practice, essays in honour of Charles Goodhart*, vol 1, Edward Elgar.

Nelson, E (2004): “The Great Inflation of the seventies: what really happened?”, *Federal Reserve Bank of St. Louis Working Paper*, 2004-01.

Nelson, E and K Nikolov (2001): “UK inflation in the 1970s and 1980s: the role of output gap mismeasurement”, *Bank of England Working Paper*, 148.

Nelson, E and K Nikolov (2002): “Monetary policy and stagflation in the UK”, *Bank of England Working Paper*, 155.

Nickell, S (2005): “Why has inflation been so low since 1999?” *Bank of England Quarterly Bulletin*, Spring, 80-91.

Nickell, S and G Quintini (2002): "The recent performance of the UK labour market", *Oxford Review of Economic Policy*, vol 18, no 2, 202-20.

Noyer, C (2001): "Challenges ahead: the accession process", speech by the Vice-President of the ECB given at the Foreign and Commonwealth Office, London, 12 November.

Orphanides, A (2002): "Monetary-policy rules and the Great Inflation", *American Economic Review*, vol 92, no 2, 115-20, May.

Orphanides, A, R Porter, D Reifschneider, R Tetlow and F Finan (2000): "Errors in the measurement of the output gap and the design of monetary policy", *Journal of Economics and Business*, vol 52, no 1-2, 117-41.

Pattnaik, RK and Samantaraya, A (2005): "The evolving inflation process: review of Indian experience", paper presented at the BIS Autumn Economists' Meeting, 27-28 October, Basel.

Perron, P (1990): "Testing for a unit root in a time series with a changing mean"; *Journal of Business and Economic Statistics*, vol 8, no 2, 153-62, April.

Pongsaparn, R and R Mallikamas (2005): "Evolving inflation process: the Thai experience", paper presented at the BIS Autumn Economists' Meeting, 27-28 October, Basel.

Primiceri, G (2004): "Why inflation rose and fell: policy-makers' beliefs and US postwar stabilisation policy", mimeo, Princeton University.

Ranchhod, S (2003): "The relationship between inflation expectations survey data and inflation", *Reserve Bank of New Zealand Bulletin*, 66/4, December.

Rich, R and C Steindel (2005): "A review of core inflation and an evaluation of its measures", paper presented at the BIS Autumn Economists' Meeting, 27-28 October, Basel.

Roberts, J (2004): "Monetary policy and inflation dynamics", Board of Governors of the Federal Reserve System *FEDS Working Paper*, 2004-62, October.

Roberts, J (2005): "The evolving inflation process", paper presented at the BIS Autumn Economists' Meeting, 27-28 October, Basel.

Rogoff, K (2003): "Globalization and global disinflation", *Monetary policy and uncertainty: adapting to a changing economy*, a symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming, 28-30 August.

Romer, C and D Romer (2002): "The evolution of economic understanding and postwar stabilisation policy", in *Rethinking stabilisation policy*, Federal Reserve Bank of Kansas City.

Rotemberg, J (2005): "Customer anger at price increases, changes in the frequency of price adjustment and monetary policy", *Journal of Monetary Economics*, vol 52, no 4, 829-52.

Savioz, M and T Maag (2005): "Changes in the Swiss inflation process – stylised facts, determinants, and policy implications", paper presented at the BIS Autumn Economists' Meeting, 27-28 October, Basel.

Schuberth H (2005): "Micro price setting, liberalisation effects and perceived inflation in Austria", paper presented at the BIS Autumn Economists' Meeting, 27-28 October, Basel.

Sekine, T (2005) "Time-varying exchange rate pass-through: experience of some industrial countries", mimeo, Bank for International Settlements.

Sims, C and T Zha (2004): "Were there regime switches in US monetary policy?", *Federal Reserve Bank of Atlanta Working Paper*, 2004-14, June.

Smidkova, K and M Hrncir (2000): "Disinflating with inflation targeting: lessons from the Czech experience", in W Coats (ed) *Inflation targeting in transition economies: the case of the Czech Republic*, Prague, Czech National Bank.

Stahl, H (2005): "Time-dependent of state-dependent price setting? Micro evidence from German metal-working industries", *Deutsche Bundesbank Discussion Paper Series 1: Economic Studies*, 25/2005.

Stock, J and M Watson (2003): "Has the business cycle changed? Evidence and explanations", *Monetary policy and uncertainty*, Federal Reserve Bank of Kansas City symposium, 28-30 August.

Stulz, J (2005): “Pass-through of the exchange rate and import prices into domestic prices in Switzerland”, mimeo, Swiss National Bank.

Taylor, J (1999): “An historical analysis of monetary policy rules”, in J Taylor (ed) *Monetary policy rules*, NBER.

Woodford, M (2003): *Interest and prices*, Princeton University Press, Princeton NJ.

Woodford, M (2004): “Inflation targeting and optimal monetary policy”, *Federal Reserve Bank of St. Louis Review*, vol 86, no 4, 15-41, July/August.

Ziebarth, G (2005): “Inflation dynamics in Germany: changing patterns and trends”, paper presented at the BIS Autumn Economists’ Meeting, 27-28 October, Basel.