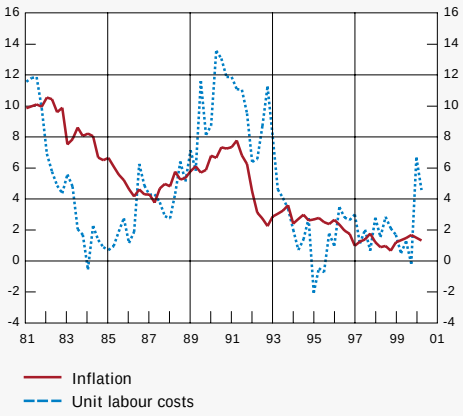
INFLATION AND COSTS

Figure B15. Inflation and unit labour costs. Percentage annual change and scaled log levels



Note. Inflation represented by UND1X. Real unit labour costs calculated by adjusting nominal unit labour costs with the UND1X price index. The costs series, transformed into logarithms and seasonally adjusted, has been scaled so that its mean value is the same as that for inflation.

Sources: Statistics Sweden and the Riksbank.

A number of fairly dramatic changes occurred in the Swedish economy in the 1990s. They include a realignment of economic policy, globalisation, increased competition and reforms of public systems and institutional frameworks. Among other things, these changes have broken earlier patterns where problems with costs were resolved with devaluations. Cost pressure in the Swedish economy has decreased appreciably and remained low throughout the 1990s. This applies in particular to labour costs, which have also been affected by a successive improvement in productivity growth and lower nominal wage increases.

It is hardly controversial to state that the development of costs has a bearing on the rate of inflation in an economy. A common approach to predicting future inflation envisages that prices are determined by a mark-up on the firm's costs. The accuracy of this approach in practice accordingly depends on the extent to which costs do co-vary with inflation; in simple terms, the higher the co-variation, the more accurate the forecasts will be.

The paths of inflation[45] and (real) unit labour costs in Sweden are shown in Fig. B15. The co-variation between the two time series is clearly good but far from perfect. In general terms, inflation seems to function as a kind of trend for costs. Inflation often fluctuates in the same direction as costs but costs fluctuate considerably more than inflation. This suggests that the actual development of costs is a good starting point when assessing inflation but that a simple mark-up calculation will often be rather misleading. A better understanding of the cost-inflation interaction would no doubt be of value not only for forecasting but also in a more general analytical context, for instance as a step in mapping and analysing the pricing behaviour of firms. A simple but comparatively modern macro model is presented here that can throw light on some of these issues.

45 Inflation is represented here by UND1X. For reasons given further on, the analysis is based on quarterly data for the period 1979 Q3 to 2000 Q2. The conclusions concerning the time series in Fig. B15 still hold when data from the beginning of the 1970s are included.

The analysis is guided by what is known in the literature as neo-Keynesian Phillips curve theory.[46] The starting point for this theory is that firms set prices to maximise profits but that monopolistic competition holds in the economy and price adjustment is subject to restrictions. More specifically, it is assumed that, for reasons given exogeneously, prices can be adjusted in any one period by only a proportion of firms. A crucial difference from large parts of the traditional Phillips curve theory is that the relationships is derived explicitly from firms' optimisation problem instead of having to base arbitrary assumptions on purely empirical observations. Aggregation over all firms then yields a relationship between the general price level and real unit labour costs:

$$\pi_t = \beta E_t(\pi_{t+1}) + \lambda RULC_t, \qquad (1)$$

where π_t is inflation (change in the general price level), $E_t(\pi_{t+1})$ the expected rate of inflation in period $t+1$, given the information available in period t, and $RULC_t$ stands for real unit labour costs.[47] The firm's discounting factor is represented by β and λ is partly a function of the proportion of firms that it is assumed can adjust costs in any one period. Higher price flexibility is associated with a larger proportion of the current price pressure being mirrored directly in price setting. Substituting recursively for expected inflation, equation (1) can be rewritten:

$$\pi_t = \lambda \sum_{k=0}^{\infty} \beta^k E_t(RULC_{t+k}). \quad (2)$$

Equation (2) implies that the current development of inflation is determined by business expectations of the future development of costs. According to this theory, inflation can then be said to serve as an 'indicator' of

46 Some useful references are: Calvo, G. (1983), Staggered prices in a utility maximizing framework, *Journal of Monetary Economics* 12; Sbordone, A. (manuscript, 1999), Prices and Unit Labour Costs: A New Test of Price Stickiness, Rutgers University; and Galí, J. & Gertler, M. (1999), Inflation dynamics: a structural econometric analysis, *Journal of Monetary Economics* 44.

47 In the theory, p_t and $RULC_t$ are both measured as the percentage deviation from steady state. In the following empirical analysis this is caught by including a constant in the estimations.

the future cost pressure expected by firms.[48] Expectations that costs will rise or fall can depend in turn on expected changes in productivity as well as on an altered rate of wage increases.

It is worth noting that the forward-looking element in price setting can be considered to explain why a comparatively stable development of prices can go hand in hand with more marked fluctuations in costs. The basic mechanism can be explained most simply with an example. Take the period at the end of the 1980s in Fig. B15. At that time, unit labour costs in Sweden rose comparatively rapidly without there being any sizeable acceleration of inflation. Cost pressure then fell rapidly in the early 1990s and remained low for a number of years. The explanation for this put forward by the theory in equation (2) is that in the late 1980s and early 1990s firms had already realised that the costs trend was not sustainable in the longer run. Expectations of lower pressure from costs in the 1990s may have been affecting prices already in the late 1980s.[49]

Another way of trying to throw light on the theory's mechanisms involves estimating the relationships in equations (1) and (2) on the basis of empirical data. The estimates can then be used in calculations that aim to describe the model's characteristics. An estimation with Swedish quarterly data from 1979 Q3 to 2000 Q2 yields the following result:[50]

$$\pi_t = \underset{(18,0)}{0,99} E_t(\pi_{t+1}) + \underset{(2,9)}{0,10} RULC_t + e_t, \qquad (3)$$

where e_t is a residual and the numbers in parentheses are values of t (a value above 2 or below –2 is assumed to show that the parameter estimate is statistically significant at the 5 per cent level of uncertainty).[51] The explanatory power of the equation is good, about 87 per cent, and the values of the parameters are

48 The relationships in equations (1) and (2) are, of course, partial and do not say anything about what drives costs. A complete analysis of the paths and interactions of prices and costs (as well as of the part played by monetary policy) requires a general equilibrium model.

49 It must be recognised, of course, that the theory considered here points to only one of a number of conceivable mechanisms that can affect the path of inflation. The analysis should therefore be regarded as mainly an intriguing complement to other, more traditional mechanisms.

50 Data on expected inflation are not available before 1979 Q3. The series used here come from Statistics Sweden's surveys of households' purchasing plans (HIP). The inflation series measure the price change from the same quarter a year earlier.

51 The constant in equation (3) has been suppressed.

reasonable.[52] The estimation indicates that an increase in costs has an immediate impact on inflation that is clear but limited: when costs rise 1 per cent, the rate of inflation is expected to move up only 0.1 percentage point.[53]

Equipped with estimations of the key parameters β and λ, equation (2) can be used to illustrate how price setting takes expectations of the future into account. More precisely, one can study how effects of expected future changes in costs - due to changes in productivity or wages - already find expression today in prices.

The following interpretation of the experiments is suggested. Rising productivity (or lower wages) is assumed to lead initially to a fall in the firm's real unit labour costs (a decline in the wage share of value added). In the longer run the wage share must return to its initial level. This implies that expectations are formed about adjustments to productivity and real wages. The longer the adjustment takes, the greater - according to the relationship in equation (2) - will be the downward pressure on inflation. This is because current price setting, besides allowing for the actual development of costs in each period, to some extent also weighs in the expected picture of future costs. The effects on inflation are calculated subject to two different assumptions about adjustment times. One assumption envisages that costs are adjusted gradually (linearly) over a period of 4 quarters and the other that the adjustment is likewise linear but takes somewhat longer, 12 quarters. In both cases the initial fall in the level of costs is assumed to be 1 percentage point.[54]

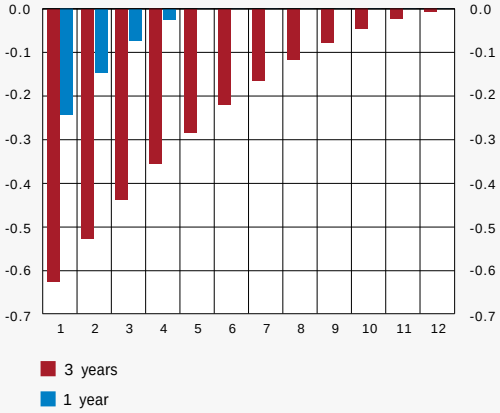
The results in Fig. B16 show that with the more protracted adjustment (12 quarters instead of 4), the effect on inflation is considerably greater in all periods. Given the estimations in equation (3), the effect on

52 It is worth noting that the estimation in equation (3) is not entirely straightforward. The approach adopted here is very simple. There are other, more complicated approaches but as the results are primarily intended to serve as an example, it seems reasonable to use a simple method.

53 It is conceivable that the monetary policy realignment in the early 1990s has affected the relationship in equation (3). It is not unreasonable to hypothesise, for instance, that the move to a low-inflation regime has increased the degree of price rigidity. Tests indicate, however, that the relationship in the equation is stable.

54 It may seem remarkable that the adjustment time for *real* costs is discussed as though it were independent of inflation, which of course it is not. In the present experiments, however, implicit paths for the adjustment of nominal wages and productivity can always be chosen so that the adjustment of real costs follows the desired course. It is the adjustment of *total* real costs that is identified in the model and the experiments, not the adjustment of cost components.

Figure B16. Effects on inflation of changes in unit labour costs. Percentage points



Note. The blue and red bars represent the effects on inflation when the level of real unit labour costs is reduced 1 percentage point initially and then moves back linearly to baseline in the course of one year and three years, respectively.

Source: The Riksbank.

inflation is almost 3 times greater in the first quarter but almost 15 times greater in the fourth.

The analysis presented here shows that there are good grounds - empirical as well as theoretical - for believing that the development of costs in an economy is a central variable for the path of inflation. If firms are forward-looking in their pricing behaviour, it is probably above all the future development of costs that has a bearing on current inflation. One implication of this is that low (high) inflation today may be an 'indicator' of higher (lower) productivity growth or lower (higher) wage increases in the future. The conclusions from this as regards the current development of the Swedish economy are not self-evident but at least it can be noted that on a number of occasions in recent years inflation, particularly domestic price pressure, has been unexpectedly low. At the same time, most forecasters, including the Riksbank, have found it necessary to revise their productivity growth assumptions successively upwards. Against this background it seems that the neo-Keynesian Phillips curve theory may provide an interesting perspective, even though conditions in reality are, of course, very much more complex than the theory assumes. A test with Swedish data does show reasonable estimations and considerable differences in effects on inflation, depending on the duration of the expected adjustments in productivity, prices and wages.