

Franz, Wolfgang; Hofmann, Thomas

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Unemployment and stability of inflation: The concept of the NAIRU in an international perspective and an estimation for Germany using business survey data

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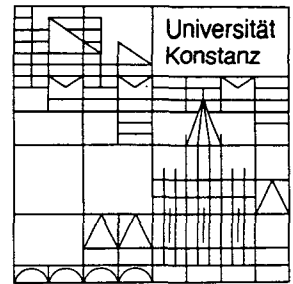
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**Sonderforschungsbereich 178**  
**„Internationalisierung der Wirtschaft“**

Diskussionsbeiträge

Juristische  
Fakultät

Fakultät für Wirtschafts-  
wissenschaften und Statistik

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Wolfgang Franz  
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**UNEMPLOYMENT AND STABILITY OF INFLATION: THE CONCEPT OF  
THE NAIRU IN AN INTERNATIONAL PERSPECTIVE AND  
AN ESTIMATION FOR GERMANY USING BUSINESS SURVEY DATA**

**Wolfgang Franz**  
**Thomas Hofmann**

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### **Abstract**

A common method of evaluating the scope for demand expansion is to try to estimate a threshold rate of unemployment above which policies of demand stimulus are non-inflationary. However, this non-accelerating inflation rate of unemployment (NAIRU) seems to have been anything but stable over the past decade. In the absence of major shocks it is an increasingly popular argument that the NAIRU itself depends on the time-path of previous actual unemployment. This effect has been christened "hysteresis" and various channels through which hysteresis may work are discussed in this paper. Moreover, we estimate the NAIRU for the Federal Republic of Germany using categorical business survey data for inflationary expectations.

Unemployment and Stability of Inflation: The Concept of the NAIRU  
in an International Perspective and an Estimation for Germany  
Using Business Survey Data<sup>1)</sup>

by WOLFGANG FRANZ  
University of Konstanz  
Federal Republic of Germany  
and THOMAS HOFMANN  
University of Stuttgart  
Federal Republic of Germany

1. Introduction and Overview

In the past fifteen years macroeconomic thinking about unemployment and inflation has focused on the "Non-Accelerating Inflation Rate of Unemployment" (NAIRU). In principle, the NAIRU constitutes a certain level of the unemployment rate which limits the sustainable level of economic activity. If actual unemployment falls short of the NAIRU, then inflation tends to accelerate. The importance of this concept for policy makers is obvious. High and often accelerating inflation and unemployment rates in the past called for a strategy which could achieve lower rates for both targets. However, reducing unemployment below a certain level by expansive demand policy may imply a non-tolerable accelerating inflation rate. For the policy maker knowledge of the unemployment rate which is consistent with stable inflation may therefore be useful. The label "natural" rate of unemployment, however, has been frequently misunderstood (especially outside the economics profession), since there is nothing "natural" with this rate. The level of unemployment indicated by the NAIRU is subject either to a better designed demand strategy or to other policy measures.

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1) Preliminary version; do not quote without the authors' permission. Paper to be presented at the CIRET-Conference at Osaka (Japan), October 1989

**Table 1: NAIRU Estimates and Actual Unemployment Rates**

Country	Time period	Average unemployment-rate	NAIRU
Austria	1973-1975	1.4	1
	1976-1980	1.9	1.5
	1981-1983 I	3.3	2
Canada	1968-1970	4.8	6
	1971-1975	6.0	6.5
	1976-1980	7.7	7.5
	1981-1983 I	9.9	7.5
Federal Republic of Germany	1967-1970	1.0	3
	1971-1975	1.8	2
	1976-1980	3.6	3.5
	1981-1983 I	6.3	5
France	1967-1970	1.8	6.5
	1971-1975	2.7	2.5
	1976-1980	5.2	3
	1981-1983 I	8.3	4
Italy	1967-1970	5.4	7.5
	1971-1975	5.8	5.5
	1976-1980	7.1	6
	1981-1983 I	8.9	5.5
Japan	1971-1975	1.4	1
	1976-1980	2.1	1.5
	1981-1983 I	2.3	2
Netherlands	1970-1975	3.6	3
	1976-1980	5.7	5.5
	1981-1983 I	11.4	8.5
United Kingdom	1967-1970	2.3	5.5
	1971-1975	3.0	3.5
	1976-1980	5.4	7
	1981-1983 I	10.5	8
United States	1967-1970	4.0	4.5
	1971-1975	6.0	5.5
	1976-1980	6.8	6
	1981-1983 I	8.8	6

Source: Coe (1985), p. 113.

In order to furnish insight into the limitations of demand management, it is necessary to estimate this threshold unemployment rate. While the details of the estimation procedure are relegated to the next section, table 1 displays some estimated NAIRUs across countries and time. Four points stand out from these estimates:<sup>2)</sup>

- (i) The level of unemployment necessary to keep inflation constant is lower in the US and Japan than in some European countries (Austria and the Netherlands are exceptions). This may reflect, in part, some dimensions of flexibility in the labor market.
- (ii) There is a tendency for the NAIRU to rise over time. Does this mean that labor markets have become less flexible?
- (iii) Movements in the estimated NAIRUs are strongly associated with movements in actual unemployment.
- (IV) In some countries current levels of the unemployment rate are way above the estimated NAIRUs. Does this imply that in these countries expansionary policy measures can be undertaken without spurring inflation?

Many economists such as Solow (1986) have reacted to these findings by expressing skepticism towards these estimates. Not only do they believe that these NAIRU's are too high, but they also question the estimated procedures. To put it in Solow's words: "A natural rate that hops around from one triennium to another under the influence of unspecified forces, including past unemployment rates, is not 'natural' at all. 'Epiphenomenal' would be a better adjective; look it up."<sup>3)</sup> Indeed, while empirical research seems to indicate that the rise in the NAIRU in the seventies can be attributed to various supply shocks such as OPEC and a (resulting) productivity slowdown,<sup>4)</sup> these determinants are less promising candidates for the ongoing increase of the NAIRU in the eighties. In the absence of major shocks it is an increasingly popular argument that the NAIRU itself depends on the time path of previous actual unemployment. This effect has been christened "hysteresis".

2) See Metcalf (1987).

3) Solow (1986, p. S33). For the sake of convenience, Webster's New Collegiate Dictionary (1979) defines an epiphenomenon as a "secondary phenomenon accompanying another and caused by it".

4) The standard reference is Bruno and Sachs (1985) and Bruno (1986).

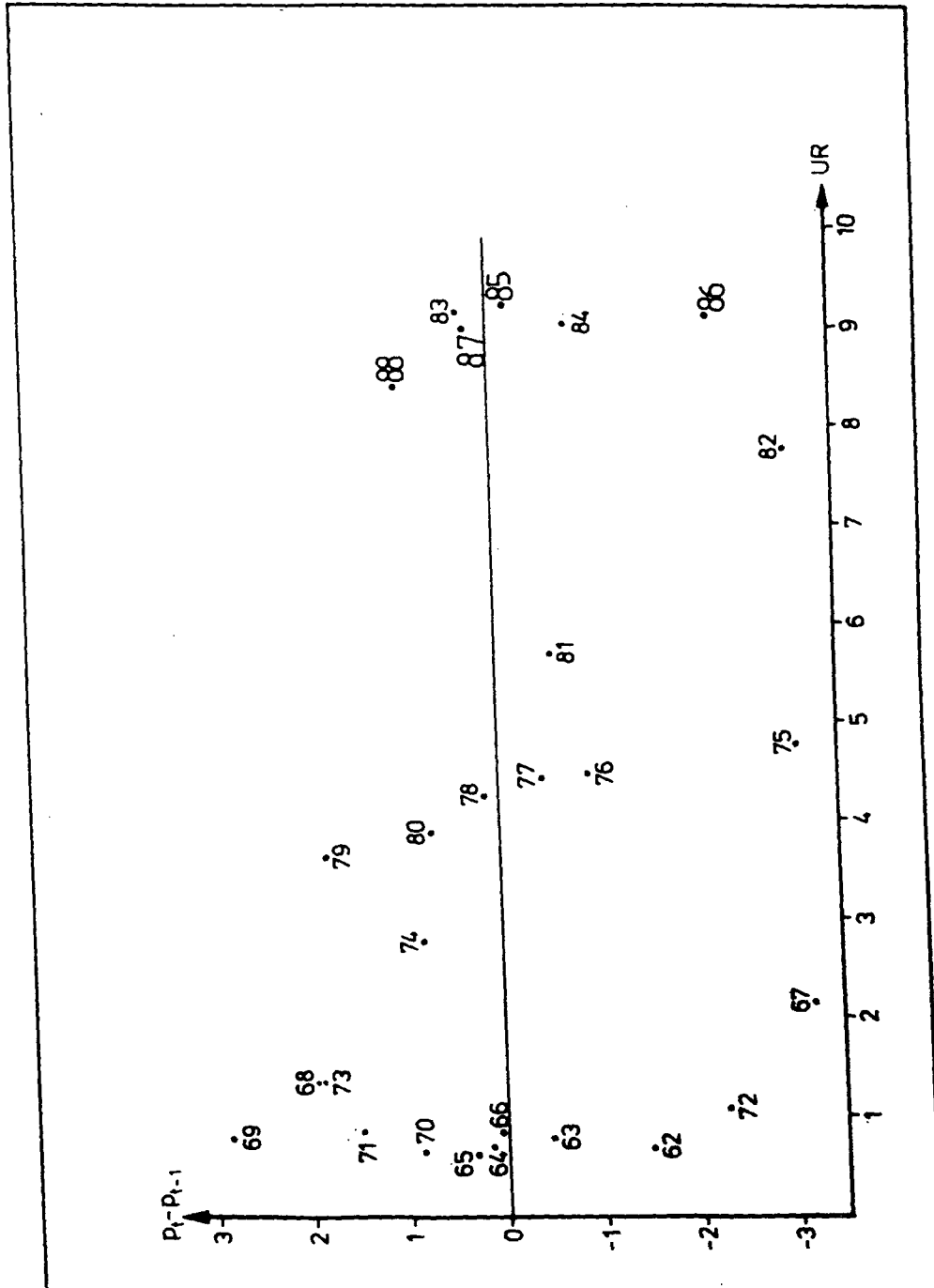
This paper attempts to give an overview on these subjects and to provide some new estimates using business survey data. The remainder of the paper is organized as follows. Section 2 provides a description of the basic concept of the NAIRU. An analysis of possible shifts of the NAIRU due to supply shocks is discussed in section 3. Recent developments in studying the hysteresis phenomenon are contained in section 4. The following section 5 is devoted to our own estimate of the NAIRU using the standard Phillips curve approach and business survey data. The paper ends with a conclusion.

## 2. Basic Concept of the NAIRU

This section is devoted to a largely non-technical explanation of the basic concept of the NAIRU. As has been mentioned the NAIRU is a benchmark unemployment rate which determines the amount of unemployment which is consistent with stable inflation rates, i.e., inflation rates which do not differ from one year to another. As long as actual unemployment is above the NAIRU, there is room for expansionary demand policy without spurring inflation. If, however, actual unemployment is below the NAIRU, the economy suffers from accelerating inflation.

Unfortunately, the NAIRU cannot be observed directly but must be calculated. At first glance, such a calculation should not be very complicated. All what is required seems to be time series of inflation and unemployment rates for a given economy. Then, for each year, the first difference between the inflation rates are calculated. These differences together with the unemployment rate are, for each year, plotted into a diagram. Figure 1 is an example where the numbers refer to the Federal Republic of Germany 1962-1988. Stable inflation means that two subsequent inflation rates do not differ. In this case the difference between two subsequent inflation rates must lie on the zero axis of figure 1 such as in 1968. Hence, in this year we have experienced stable inflation. Actually, the respective unemployment rate in this year amounts to 1.5 per cent. This is the NAIRU because this unemployment rate is consistent with stable inflation, at least for this year.

**Figure 1: Unemployment and Changes in Inflation for the Federal Republic of Germany 1962-1988**



While this might be a convenient procedure for the sixties, the data are less cooperative in the following decades. As can be seen from figure 1, for the mid-seventies a NAIRU of, say, 4.5 per cent might be a reliable figure. More dramatically, the eighties seem to be characterized by a NAIRU as high as 9.5 per cent which is close to actual unemployment. If so, there are at least two major shifts of the NAIRU to the right indicating that we have to face higher unemployment rates in order to stabilize inflation. Why?

In order to understand what happened we have to look behind the simple inspection of figure 1 and to set up a theory which explains the NAIRU and its possible shifts. There are several theoretical approaches but most of them are based on two relationships: One of them explains the determination of wages, the other analyzes the formation of prices. Combining these two relationships gives us a theoretical foundation of the NAIRU. In what follows, this approach is described.<sup>5)</sup>

To begin with the determination of wages, at least the following two aspects play an important role in the wage bargaining process. First, trade unions attempt to avoid a decline of the real wage rate due to inflation. Put differently, they claim a wage change according to the expected inflation rate. Since wage bargaining covers the period ahead, expected rather than actual inflation is the relevant variable. However, the prediction of the inflation rate may be based on the inflation rate of the previous period. If so, we conclude that lagged inflation rate determines the growth rate of nominal wages. If the unions are successful in maintaining the level of the real wage rate despite inflation, then there should be a one to one-correspondence between these two variables.

The second point relates to the power of the unions. In the presence of high unemployment their position will not be very strong in the bargaining process. To simplify matters, we assume that the higher the unemployment rate the lower the growth rate of wages. We shall qualify this argument later.

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5) See Franz (1987, 1983) for a more detailed theoretical analysis.

More formally, the wage equation is:

$$(1) \hat{w}_t = a_0 + a_1 \hat{p}_t^* + a_2 \hat{\pi}_t - a_3 UR_t \quad a_i > 0 \quad i = 1, 2, 3$$

where  $\hat{w}$  = growth rate of the nominal wage rate

$\hat{p}^*$  = expected inflation rate

$\hat{\pi}$  = labor productivity growth

UR = unemployment rate.

If inflationary expectations are formed by an adaptive expectations mechanism, we can replace  $\hat{p}_t^*$  by the lagged value of actual inflation:

$$(1b) \hat{w}_t = a_0 + a_1 \hat{p}_{t-1} + a_2 \hat{\pi}_t - a_3 UR_t.$$

Moreover, note that the coefficient  $a_1$  equals unity if expected inflation is fully translated into a corresponding wage growth.

Turning to the second relationship, the hypothesis concerning price formation, most important is the development of unit labor costs, i.e., the difference between wage growth and labor productivity growth. Moreover, the change of other variables such as taxes, user costs of capital, import prices and the like may contribute to an explanation of inflation. This gives us the following relationship:

$$(2) \hat{p}_t = b_0 + b_1 (\hat{w} - \hat{\pi})_t + c_4 \hat{m}_t + c_5 \hat{uc}_t$$

where  $\hat{p}$  = actual inflation rate

$\hat{m}$  = growth rate of import prices

$\hat{uc}$  = growth rate of user costs of capital.

Note that the coefficients associated with the cost components represent the share of labor income among total income. For example;  $b_1$  is the share of labor income; hence,  $b_1 < 1$ . For a constant returns assumption of production the sum of  $b_1$ ,  $c_4$  and  $c_5$  equals unity. Theoretically, the price equation may be based on mark-up pricing rules on various cost components. The mark-up factor may, however, not be constant [as assumed in eq. (2)] but may depend on, say, demand conditions on the goods market. If so, variables such as the capacity utilization rate or the growth rate of real GDP might be appropriate proxies.

We are now in a position to calculate the NAIRU in a very simplified way. Inserting eq. (1a) into eq. (2) and rearranging terms gives:

$$(3) \hat{p}_t - c_1 \hat{p}_{t-1} = c_0 - c_2 \hat{\pi}_t - c_3 UR_t + c_4 \hat{m}_t + c_5 \hat{u}c_t$$

where

$$\begin{aligned} c_0 &= b_0 + b_1 a_0 \\ c_1 &= a_1 b_1 > 0 \\ c_2 &= b_1 (1 - a_2) > 0 \\ c_3 &= a_3 b_1 > 0. \end{aligned}$$

Alternatively, eq. (2) may be formulated in the following way, where the explanatory variables are expressed in real terms and where use is made of the constant returns assumption mentioned above, i. e.,  $1 = b_1 + c_4 + c_5$ :

$$(2a) \hat{p}_t = b_0/b_1 + (\hat{w} - \hat{\pi}_t) + c_4/b_1 (\hat{m} - \hat{p})_t + c_5/b_1 (\hat{u}c - \hat{p})_t.$$

This formulation helps to clarify the condition that price changes respond with unit elasticity to the change of unit labor costs. Inserting eq. (1) into eq. (2a) yields:

$$(3a) \hat{p}_t - a_1 \hat{p}_{t-1} = d_0 - d_2 \hat{\pi}_t - d_3 UR_t + d_4 (\hat{m} - \hat{p})_t + d_5 (\hat{u}c - \hat{p})_t$$

where

$$\begin{aligned} d_0 &= (b_0 + b_1 a_0)/b_1 \\ d_2 &= 1 - a_2 > 0 \\ d_3 &= a_3 > 0 \\ d_4 &= c_4/b_1 > 0 \\ d_5 &= c_5/b_1 > 0. \end{aligned}$$

Expressing the materials cost and the user cost variables in real terms (as in eqs. 2a and 3a) rather than in nominal terms (as in eqs. 2 and 3) highlights the necessary condition for the NAIRU to be independent of  $p$  is that  $a_1$  equals unity, i.e., that expected inflation is fully incorporated into wage changes. To see this, recall that the NAIRU is defined for stable inflation rates, i.e., for  $\hat{p}_t = \hat{p}_{t-1}$ . Using eq. (3a), setting the difference between inflation rates equal to zero, and solving for  $UR$  yields an unemployment rate, the NAIRU, which depends, in our analysis, on the growth rates of real cost components and productivity growth. It is by now clear why NAIRUs calculated in this way may differ between various countries. Broadly speaking, this may be due to

different procedures and institutional regulations concerning the wage bargaining process and/or the way in which prices are determined. For example, if wages react promptly and to a substantial amount to higher unemployment, then the NAIRU will be lower (other things equal) compared with a situation where the unions do not care about unemployment. Or, if an economy experiences higher productivity growth - due to, say, higher technical progress brought about by higher expenditures for research and development - , then the NAIRU may be lower: A wage growth will be compensated by productivity growth to a larger extent and, hence, will affect inflation to a lesser amount. This, in turn, requires less unemployment.

But the simple piece of arithmetic outlined above tells us more than why NAIRUs may differ between countries. It also points to several reasons why the NAIRU may have increased as observed in the past fifteen years. This point is developed in more detail in the next section.

### 3. Supply Shocks and the Rise of the NAIRU

What went wrong with the NAIRU in the seventies? As is well known several supply shocks hit most if not all industrial countries albeit to a different extent. By supply shocks we mean causes of inflation which have their origin on the supply side of the market.

The most important adverse supply shock in the seventies were the spurts in raw material prices such as the boost in oil prices engineered by the OPEC cartel. Oil supplies from Arab countries were embargoed during the Arab-Israeli War which began in October 1973 and then oil prices were quadrupled from about \$ 3 per barrel in early 1973 to about \$ 12 in March 1974. The second oil price shock took place in 1979. Oil production in Iran dropped due to the revolution in Iran. This induced a pressure on oil prices which was aggravated by panic stockpiling of crude oil. Over the subsequent year the price of Saudi Arabian crude oil more than

doubled, from \$ 13.30 to \$ 28, and most other members of OPEC were charging between \$ 30 and \$ 34 per barrel.<sup>6)</sup>

Not only raw material prices but also food prices experienced a temporary shock.

Due to crop failures and droughts in some countries farm prices boosted in 1972/73. In 1978/79 especially the USA were faced with a jump in food prices caused by higher prices for beef.

The development of (labor) productivity caused supply inflation, too. Some countries such as the Federal Republic of Germany and the USA were confronted with a productivity slowdown in the seventies. The reason for this development is not entirely clear. For the Federal Republic of Germany there is empirical evidence that the decline in capital formation had some impact on the productivity slowdown.<sup>7)</sup> This country experienced several reductions in investment. Moreover, the oil price shocks had their effects in that they rendered parts of the capital stock obsolete. Finally, the degree of modernity of the capital stock declined from its high level prevailing during the reconstruction phase after World War II. To some extent this decline was inevitable as a part of the process of normalization after the reconstruction phase. On the other hand, it was strengthened by the aforementioned slowdown in investment.

Another type of supply shocks may be labelled as "self-inflicted wounds". This name points to the possibility that government policies could initiate higher inflation stemming from the supply side. This is most obvious for higher indirect tax rates. Since firms pass them over to customers (at least partly) this measure leads to a temporary increase of inflation. The same argument holds for social security, payroll taxes and cost-raising regulations.

From the preceding analysis the channel through which these supply shocks affect the NAIRU should be clear. The influence of OPEC I

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6) See Gordon (1987a) for a more detailed description and analysis in a macroeconomic framework.

7) See Franz (1983) for a more detailed theoretical and empirical analysis.

and II on inflation is measured by  $c_4$  which depends, for example, on how much oil has been imported rather than produced by the country itself. If stable inflation rates are still required, the unemployment rate consistent with stable inflation rates is higher in the presence of these adverse supply shocks. This stems from the argument that higher unemployment is necessary to reduce wage growth thus offsetting the impact of the supply shock.

Two important points are worth to be noted. First, the shocks described so far imply temporary rather than permanent higher inflation rates. Consider the boost in oil prices: The increase from \$ 3 to \$ 12 means, of course, a higher inflation rate in this time period. If, however, oil prices remain on that higher level of, say, \$ 12, then the inflation rate of oil prices becomes zero and the aggregate inflation rate - such as the inflation rate of consumer prices - approaches zero when all prices in the economy have adjusted to the higher oil prices. Therefore, the NAIRU should shift back after the adjustment process unless new shocks prevent the NAIRU from doing so such as the permanent productivity slowdown discussed above.

The second point directs attention to the aforementioned phrase that higher unemployment (i.e., a higher NAIRU) is required to offset the inflationary impact of supply shocks. The relevant question is whether each supply shocks should be offset fully by higher unemployment. This is most debatable for a supply shock due to higher value added tax rates. One might argue that inflation spurred by these measures should not be ironed out by higher unemployment. A similar argument holds for supply shocks which are partly exogenous to the domestic economy such as OPEC I and II. While parts of the increase of oil prices are concomitant developments of home-made inflation (and may be offset by higher unemployment), another probably larger part is exogenous and may be tolerated rather than reduced by restrictive policies generating unemployment. The rationale for this argument is that this inflation far from being a welfare for the economy, is not a national catastrophe especially if higher inflation approaches zero after an adjustment process, indeed. It might be an option worthwhile to be considered by the policymaker to tolerate this

exogenous and temporarily higher inflation rather than to fight against it using restrictive policies which create unemployment.

Whatever option the more favorable, they highlight a major problem with the NAIRU. If parts of supply inflation should be disregarded in the amount of the NAIRU one has to calculate a so-called "no-shock NAIRU" as in Gordon (1982) or in Franz (1987, 1983). Since different views may prevail on the range concerning the inclusion of supply shocks, the calculated no-shock NAIRUs reflect these beliefs and are anything but a neutral guideline upon which everyone can agree. Put differently, in the presence of adverse supply shocks it is a necessary pre-requisite for the evaluation of the NAIRU (but not for the estimation of the relationships for wage and price inflation) to declare to what extent supply shocks should be offset by higher unemployment.

We have outlined that supply shocks such as OPEC I and II and the productivity slowdown may contribute substantially to an explanation of the rise of the NAIRU in the seventies. However, there remains the puzzle how to interpret the shift of the NAIRU in the eighties as evidenced by table 1 and figure 1. In the eighties we did not experience major supply shocks. In contrast to the seventies raw material prices decreased partly and in some countries productivity grew faster.

In order to understand what might had happened with the NAIRU in the very recent years we have to introduce the hysteresis hypothesis. As we shall see in the next section, now the relationship concerning wage growth neglected in this section comes into play.

#### **4. Hysteresis: Concept and Applications**

The concept of hysteresis is that the NAIRU tends to follow the actual unemployment rate. The argument is that sustained high levels of unemployment result in changes in the structural features of the economy such that the NAIRU will raise. These

structural changes include variations in the human and physical capital stock and the methods of wage determination.<sup>8)</sup>

In more general terms, a variable exhibits hysteresis if its current value depends on its past values with the coefficients summing to one or - in a broader view - with the coefficients indicating a very high degree of a causal relationship running from previous values to the current one.<sup>9)</sup> Focussing on unemployment the presence of hysteresis indicates strong path - dependent effects on current unemployment stemming from previous experiences with unemployment.

There are three major types of explanations as to why unemployment may exhibit hysteresis.<sup>10)</sup>

#### (i) Search Process

The search process is to be seen from both the employer's and the unemployed persons's viewpoints. Beginning with the first, in a screening process the firm has to identify the unknown productivity of the applicant for a job. If firms use unemployment experience itself as a screening device, then unemployed persons with a long duration of unemployment are viewed as the less promising candidates. This criterion is the more likely to be applied the easier it is for firms to fill job openings.

A similar argument is that employers have erroneous prior beliefs about the availability of the unemployed with respect to their qualifications. When firms expect members of a "superior" group to be readily available due to, say, adverse labor market conditions, then their expected search time and costs of finding qualified persons are lower and the tendency to reject the less qualified

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8) See OECD (1987), p. 178 for a non-technical description of hysteresis.

9) The latter case is sometimes called persistence, see Franz (1987) and the subsequent discussion of that paper by C. Wyplosz. The term hysteresis is taken from the physical sciences where it refers to situations where equilibrium is path-dependent. An example is electrical engineering where the degree of magnetism after a transitory increase of the magnetic impulse is path-dependent.

10) The following discussion is an extended version of section II of Franz (1987)

applicants becomes greater. Although this misperception will tend to fade after a recognition lag, those unemployed not considered for the job in question will already have been relegated to the pool of long-term unemployment thus creating hysteresis.

Turning to the other side of the search process long-term unemployed may reduce their search intensity due to their discouragement as a consequence of being so often rejected by employers. If they run out of unemployment benefits they may drop out of the labor market entirely. This effect of discouragement can be very longlasting. Therefore, the decision to reduce labor supply can turn out to irreversible if skills are depreciated at a high rate.

Finally, if skills are acquired not only through on-the-job-training but also through changing jobs, then high unemployment supports a deterioration in skills because it reduces job mobility. Thus, once workers become unemployed they are faced with greater difficulties in finding a job.<sup>11)</sup>

## (ii) Capital Shortage

A second approach to explaining hysteresis effects stresses the role of the capital stock. The basic idea [Sachs (1986)] is that the NAIRU depends on the capital stock and that a decline in the capital stock can be treated analytically as a supply shock. Since investment depends on factor prices as well as on the state of demand in the economy, running the economy at unemployment rates higher than the NAIRU will reduce investment. That will, in turn, eventually increase the NAIRU.

At first glance, the capital shortage argument is supported by an inspection of capacity utilization rates. In some countries utilization rates of the capital stock nearly reach a degree of normal utilization despite a high underutilization of labor. Does this observation indicate that the expansion is hampered by a capital shortage? To some extent the answer depends on the nature of the production function. The greater the possibilities for

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11) See Hargraves Heap (1980), p. 614 for this point.

substituting labor for capital, ex-ante and ex-post, the more unlikely it is that the capital stock is really a boundary. When product demand increases and firms find it profitable to increase capacities, they can, in the short run, employ more labor with the existing capital stock by measures such as an extension of shift work. They can also expand investment and thus create still more work places. Unless there is a high degree of inflexibility in the production process and there are limits on expanding the capital stock (such as environmental restrictions or high user costs of capital), the problem of a possible capital shortage will not be significant during periods of higher aggregate demand. It is, of course, possible that a strong increase of aggregate demand may be necessary if expanding capacities needs building new factories rather than enlarging present plants or re-opening old factories. It is well known that in the 1930's and during World War II, a considerable disinvestment and reduction in the size of the civilian capital stock took place. It did not prevent many economies from attaining full employment shortly afterwards [Blanchard and Summers (1986)]. More recently, automobile industries - often cited as using short-run fixed factor production processes - may serve as an example. Despite a substantial reduction of investment and employment in the seventies, significant hiring and capital accumulation followed the increase of demand for automobiles some time later.

### (iii) Wage Bargaining

A third mechanism which can possibly generate hysteresis stems from the role of the unemployed in the wage bargaining process. More specifically, past unemployment may raise today's unemployment level because the unemployed exert small influence on wage setting. This argument rests basically on two premises:

- Unions care less about the unemployed "outsiders" than about the welfare of their employed members, the "insiders".
- Unemployed workers cannot find jobs at lower wages outside the unionized sector either because firms do not accept underbidding or because there is no sector that is not covered by collective bargaining.

In what follows, both arguments are developed in more detail. One question put forward by Lindbeck and Snower (1986) is why

unemployment is not eliminated through underbidding. Besides bowing to social norms according to which underbidding is viewed as an improper form of social behavior, employers may refuse to accept such bids for other reasons as well. The argument put forward by these authors is that the costs of hiring underbidders rise due to the hiring, training, and firing process and due to the possibility that the remaining jobholders withhold cooperation from these entrants, thus lowering their productivity.

While Lindbeck and Snower concentrate on the firm's decision as to whether to replace some of its workers with unemployed "outsiders", the paper by Solow (1985) focusses on whether the firm is willing to make an addition to the size of its labor pool. The Solow-paper highlights the possibility that in the face of an increase of aggregate demand, the job holders (the "insiders") are able and willing to convert higher demand for labor into higher wages for themselves rather than into an enlargement of employment by providing access to jobs for outsiders. Their motive is the fear of the consequences of making outsiders to insiders: the risk of becoming unemployed would increase with the number of employed persons (union members) and/or a setting of lower future wages would be necessary in order to circumvent such a loss of jobs. Another theoretical foundation of the insider/outsider-approach has been made by Blanchard and Summers (1986). Union membership rules play a central role in determining the path of employment - and, hence, the path of unemployment if labor supply is constant - in the aftermath of shocks. To the extent that union membership is connected with employment, persistence of (un-)employment movements is likely to appear. An intuitively plausible explanation for this result is that if union membership can be held only by employed persons a laid off union member decreases his chances of recovering employment with the firm. Therefore, he will be more cautious and presumably accept a lower wage rate compared with the case where being laid off does not affect his future employability.

As has been pointed out, persistence in employment is a likely result in the model by Blanchard and Summers if unions forget quickly those who have lost their jobs. In contrast, employment is much less persistent if membership does not change or changes very

little when employment changes. As the authors argue this result basically carries over if an economy without unions is considered. The reason is that a firm cannot credibly threaten to replace all of its workers, nor even individual employees, with lower wage workers. In the first case, high costs would occur due to the loss of the specialized expertise of the formerly employed, in the second case, the still employed workers may not be willing to cooperate with new entrants. Here the analysis joins the arguments put forward by Lindbeck and Snower (1986).

It is difficult to judge the empirical relevance of the hysteresis phenomenon stemming from the insider-outsider argument and the effects from the search process.

Both hypotheses share the common view that increased unemployment has not disinflationary impacts after the initial rise. Neither do the long-term unemployed exhibit much pressure on wages, nor do unions set wages so that the outsiders - to which group the long-term unemployed are quite likely belonging - find a job. This line of reasoning suggests a possible empirical test of both hypotheses. Recall from section 2 that an important variable in the formulation of the wage bargaining process is the unemployment rate. According to the aforementioned hysteresis argument, however, it is not the total unemployment rate which is important, but rather its composition between short-term and long-term unemployment. Therefore, the test consists of an econometric investigation on whether there is a difference between the impact of short-term versus long-term unemployment on wage growth. More precisely, the influence of long-term unemployment should be zero if the hypotheses are correct. Such a study has been carried out by the OECD for six countries.<sup>12)</sup> As a result, with the exception of France for all countries the hypothesis of such a zero influence stemming from long-term unemployment cannot be rejected. But the test is not very conclusive since in all but two countries the impact of short-term unemployment on wage growth was not significantly different from zero either. On the other hand, there is a generally significant influence of total unemployment on wage

12) See OECD (1987), p. 213-216. The countries under consideration in this study are: Austria, Federal Republic of Germany, France, Netherlands, United Kingdom, United States of America.

growth which contradicts with the previous results. The reason for this pitfall is that due to a rather close comovement of both variables, the short-term and the long-term unemployment rate, the test cannot distinguish properly between the influences of both rates.

Using a different framework, Gordon (1987) also could not find much evidence for the hysteresis phenomenon. The fact that in his study the hysteresis hypothesis is validated only for small European countries having both high unemployment (Belgium) and low unemployment (Austria, Sweden, Switzerland) seems to remove much of the credibility of this argument as an explanation of high European unemployment, particularly in the large countries. These results are in contrast with the study by Blanchard and Summers (1986) who claim support for the hysteresis phenomenon in their work on the Federal Republic of Germany, France, and the United Kingdom. For the Federal Republic of Germany, Gordon's and the OECD's findings differ from those recently found by Franz (1987), too. Also employing a different theoretical and empirical framework this study could not reject the hypothesis that the NAIRU depends on the share of long-term unemployment. Moreover, it was shown that the second shift of the NAIRU for this country in the eighties (see figure 1) can to a considerable extent be explained by the dramatic increase of that share. Since long-term unemployment will tend to disappear in a strong recovery, a NAIRU dependent on a high long-term unemployment is a rather misleading figure. The reason for this verdict is that a NAIRU for a given high long-term unemployment share is not a threshold rate of unemployment below which inflation accelerates. If expansionary demand policy reduces actual unemployment, then, after some time, long-term unemployment will decrease and so does the NAIRU. A more "reliable" figure for the NAIRU is to calculate it for a normal level of long-term unemployment prevailing at full employment.

##### **5. Estimation of the NAIRU for the FRG Using Business Survey Data**

In order to tribute to the scope of the CIRET conference this section is devoted to a reestimation of the NAIRU for the Federal Republic of Germany using business survey data collected by the Ifo-Institute of Economic Research in Munich. While the technical

details are relegated to an appendix, it suffices here to give a brief outline of the procedure and a short discussion of our results.

Among other questions in the business test, firms in the manufacturing sector are asked to give information on their prices charged from their domestic customers within the next three months. Possible answers are that prices will (i) increase, (ii) remain approximately constant, (iii) decrease. Hence, these data are categorical in nature. In our estimation we use the difference between percentages of responses (i) and percentages of responses (iii) as an indicator for price expectations ("balance-approach"). It is obvious that this proxy suffers from various deficiencies. Most importantly, these "expectations" are a mixture of plans and expectations and, moreover, responses of type (ii) are suppressed.<sup>13)</sup>

In order to obtain non-categorical data, these data are used as explanatory variables in a regression with the one-quarter-ahead actual inflation rate as the dependent variable.<sup>14)</sup> This regression covers the time period 1962II-1970I (i.e., 32 observations). Our calculations are based on two different actual price series namely prices for consumer goods and prices for investment goods (machinery and equipment). In a second step, the estimated regression is then employed to form one-period-ahead forecasts of the inflation rate of period 1970II-1988II. More specifically, the first forecast (for 1970II) is obtained by using the above regression and inserting the "balance of expectations" for 1970I. Then a new regression is estimated of the same type which, however, covers the time period 1962III-1970II. Inserting the balance of expectations of 1970II into this regression yields the inflation forecast for 1970III. This method is continued until the sample covers the time period until 1988II with the number of observations remaining unchanged (=32). This procedure is carried out for consumer prices as well as for prices for investment

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13) To remove the latter flaw knowledge of each of the categories (i) and (ii) is required. This information is not published, however. If it were, other econometric methods such as outlined by Carlson and Parkin (1975) could be used. See König, Nerlove, Oudiz (1981) and Wolters (1984) for analyses using the same data.

14) See, for example, Kirchgässner (1982) and Pesaran (1987) for this procedure.

goods. The Phillips curve estimates are then based on the weighted sum of these two expectations series with the weights being the ratio of real private consumption and production of investment goods, respectively, to the sum of these two components of aggregate demand.

In what follows we present the estimates of the Phillips curve based on the theoretical considerations outlined in section 3. The estimates differ in the treatment of inflationary expectations. In one version  $p^*$  is modelled by an adaptive expectations mechanism, i.e.,  $p^*$  is replaced by a distributed lag of actual inflation rates. The alternative version uses inflationary expectations based on business survey data as described above. Since these expectations are endogenous, they have been instrumented by exogenous variables when estimating the Phillips curve. Moreover, the estimates differ slightly from eq. (3) in that we also include possible effects of changes of indirect taxes and employers' contributions to social security. Finally, a dummy for the effects of the autonomous (?) wage push in 1970 is introduced. As has been mentioned, the estimation covers the time period 1970II-1988II. While the choice of this period is dictated by the data, it has the advantage that in contrast to previous studies the time period of the sixties is suppressed where the unemployment rate in the Federal Republic of Germany virtually remained constant at extremely low levels of about 1 p. c. (with the exception of the 1967-recession where it increased to 2.1 p. c.).

Table 2 displays the estimates. While all coefficients exhibit the sign theoretically expected, the tax and the social security variables prove to be largely insignificant. The Durbin-Watson statistic may be biased in col. (1) due to the presence of the lagged endogenous variables, but indicates the absence of significant autocorrelation in col. (2). As can be seen from the square of the correlation coefficient (corrected for degrees of freedom), nearly twenty percent of the variance remains unexplained by the estimates. The most disturbing fact of the estimates displayed in col. (1) is the extremely low level of the coefficient associated with adaptive inflationary expectations. Experiments with other autoregressive schemes yielded similar results, however. This coefficient doubles nearly in col. (2)

**Table 2:** Phillips curve estimates for the FRG 1970/II-1988/II<sup>a)</sup>  
 Dependent variable: Actual inflation rate<sup>b)</sup>

Explanatory variables	Adaptive expectations	Expectations based on business data
	(1)	(2)
Inflationary expectations	0.4535 <sup>c)</sup> (4,3)	0.8216 (5,5)
Productivity growth	-0.1449 (2,0)	-0.1458 (2,0)
Growth rate of import prices	0.1050 (5,8)	0.0877 <sup>f)</sup> (4,5)
Unemployment rate (t-1)	-0.0604 (3,4)	-0.0363 (2,0)
Indirect taxes <sup>d)</sup>	0.1163 (1,2)	0.1235 (1,2)
Social security contributions <sup>e)</sup>	0.2025 (1,1)	0.0830 (0,4)
Dummy for wage push	0.9289 (2,7)	1.2417 (3,3)
$R^2$	0.8352	0.8149
Standard error of estimates	0.3112	0.3297
Durbin-Watson statistic	2.1022	1.9495

a) see text for explanations; t-values in brackets; estimates in col. (2) are IV-estimates; constant and seasonal dummies are not reported;

b) implicit deflator of consumer and investment goods;

c) sum of lag coefficients;

d) defined as the rate of change on the expression  $1+v^{ind}$ , where  $v^{ind}$  denotes the indirect tax rate;

e) defined as the rate of change of the expression  $1+v^S$ , where  $v^S$  is the ratio of employers' contributions to social security to gross labor income;

f) growth rate of relative import prices.

when inflationary expectations are based on business survey data. The latter coefficient is, by and large, in accordance with the results of previous studies<sup>15)</sup> and seems to be the more reliable figure compared with col. (1). Note also that the effect of the unemployment rate on inflation in col. (2) is lower not only compared with col. (1) but also relatively to previous estimates. The estimates in col. (2) use relative import prices, i.e., the growth rate of import prices minus the inflation rate (see section 2 for a justification). This procedure applied to col. (1) yielded implausible results.

As has been shown in section 2, these estimates can be used to calculate the NAIRU. Since the coefficient associated with the inflationary expectations variable is below unity, we have to assume a "tolerable" inflation rate in order to evaluate the NAIRU. We view a 3 p. c. annual value as an agreeable figure. Moreover, the NAIRU depends on productivity growth which is set on its yearly average value. "Self inflicted wounds" are not included, hence the effect of indirect taxes and social security contributions is suppressed. Finally, the NAIRU is calculated as a "no shock"-version, i. e., inflation of import prices above aggregate inflation is also not taken into account. Despite many attempts we have been unsuccessful to include variables which may capture a possible hysteresis phenomenon such as the share of long-term unemployment and the like.

The upshot of these calculations is a NAIRU for 1987 of 6.2 p. c. [col. (1)] and 5.5 p. c. [col. (2)]. Not only is such a 6. p. c. figure in the very near of previous own estimates, but it also joins results by Schultze (1987) and Coe (1985). As it stands, this figure means that unemployment can be reduced in the FRG down to a level of about 6. p. c. without spurring inflation. Recall, however, that several caveats have been made in the previous sections which render the NAIRU a less straightforward and reliable guide for economic policy.

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15) See Franz (1983, 1987)

## 6. Conclusion

A common method of evaluating the scope for demand expansion is to try to estimate a threshold rate of unemployment above which policies of demand stimulus are non-inflationary. This has been done in a number of studies. However, this non-accelerating inflation of unemployment (NAIRU) seems to have been anything but stable over the past decade. More ironically, it appears to follow the actual unemployment rate rather closely, so that, by and large, actual unemployment is always natural. If so, the chances that a rapid recovery will reduce unemployment substantially may be quite limited.

While empirical research seems to indicate that the rise in the NAIRU in the 1970s can be attributed to various supply shocks, such as OPEC and a (resulting) productivity slowdown, these determinants are less promising candidates as explanations for the development in the 1980s. In the absence of major shocks it is an increasingly popular argument that the NAIRU itself depends on the time-path of previous actual unemployment. This effect has been christened "hysteresis" and various channels through which hysteresis may work are discussed in this paper with a special reference to the insider-outsider theory. However, no conclusive answer emerged from reviewing empirical studies on whether hysteresis is empirically relevant in fact.

Despite these caveats against the NAIRU we reestimate the NAIRU for the Federal Republic of Germany using categorical business survey data for inflationary expectations. The data are collected by the Ifo-Institute of Economic Research, Munich. As a result of our calculations we obtain a NAIRU of about 6 p. c. for 1987. While this figure is in close agreement with the outcome of other studies, we are still skeptical about the NAIRU being a straightforward guide for economic policy.

## Appendix

This appendix is devoted to a more technical presentation of the method of quantification of categorical expectations data. It reproduces the regressions equations employed and comments on the specification, followed by a discussion of the forecasting procedure and the forecasting performance of the inflationary expectations series obtained.

The regression equations are specified as follows (coefficients  $a_i$  and  $b_i$  should not be confounded with those in the text):

$$(A1) \hat{pc}_t = a_1 + a_2 \hat{pc}^*_{ifo, t-1} + a_3 \hat{pc}_{t-4} + \text{seasonal dummies} + u_{1t}$$

$$(A2) \hat{pi}_t = b_1 + b_2 \hat{pi}^*_{ifo, t-1} + \text{seasonal dummies} + u_{2t}$$

$$t=1, \dots, 32$$

where a hat denotes the quarterly rate of change of the variable and where

$pc$  = implicit deflator of private consumption

$pc^*_{ifo}$  = expectations of prices of consumer goods, "balance statistic" of the Ifo business test (beginning-of-quarter value)

$pi$  = implicit deflator of investment goods (machinery and equipment)

$pi^*_{ifo}$  = expectations of prices of investment goods, "balance statistic" of the Ifo business test, (end-of-quarter value)

$u_{it}$  = error terms,  $i = 1, 2$ .

The regression of the actual inflation rates on the expectations data enables us to convert qualitative survey data into quantitative measures. The underlying assumption is that actual inflation rates consist of two components, namely one part which has been anticipated previously and another part which was unanticipated and which is captured by the error term. Besides

prices of consumer goods we study those of investment goods separately in order to receive expectations data which include a substantial part of the expectations of the deflator of final domestic demand which serves as the dependent variable in the Phillips curve (in growth rates).

Fortunately, the Ifo Institute classifies the survey results by the use of produced goods, so that the above mentioned categories should be in close relationship to the respective components of the deflator of final demand. Hence, our Phillips curve estimates do not explain price movements of the other components of final domestic demand, i.e., public consumption, investment in construction and inventory changes.

To some extent the seasonal dummies included might be viewed to capture remaining differences between manufacturers' prices and retail selling prices due to sampling differences, for example. Absence of the seasonal dummies did not affect the significance of the expectations variables.

Moreover, for consumer goods prices it was found that the value of price expectations in the first month of a quarter could better explain actual price changes in the following quarter rather than end-of-quarter values can. The opposite was true, however, for investment prices.

Finally, as to equation (A1), the four quarter lagged endogenous variable takes into account possible trend movements of the series which are not captured by the Ifo-data.

The equations were estimated using OLS. In order to receive ex post forecasts, 73 regressions for each equation had to be estimated. Thus, for each forecast period (beginning in 1970.2) a separate forecasting equation is used. Since it is impossible to give a full account of all 146 regression results, some major findings are summarized in table A1. This table reports the regression coefficients  $a_2$  and  $b_2$ , respectively. The coefficient relating price expectations for consumer goods to the actual inflation rate ( $a_2$ ) varies between +0.0153 and +0.0596 and is (with one exception)

Table A1: Regression Results<sup>a)</sup>

		$a_2$	$\bar{R}^2$	$b_2$	$\bar{R}^2$
1970:	2	.168836E-01	.504396	.582292E-01	.516436
1970:	3	.152910E-01	.499894	.551734E-01	.542676
1970:	4	.158418E-01	.482351	.505492E-01	.478145
1971:	1	.157025E-01	.484895	.542458E-01	.566853
1971:	2	.180912E-01	.509511	.559354E-01	.599442
1971:	3	.188948E-01	.541398	.572999E-01	.633341
1971:	4	.192083E-01	.495026	.581761E-01	.638709
1972:	1	.202927E-01	.534138	.587393E-01	.636901
1972:	2	.198374E-01	.616178	.546697E-01	.624381
1972:	3	.194165E-01	.629074	.542230E-01	.609551
1972:	4	.195955E-01	.582059	.536123E-01	.618506
1973:	1	.196738E-01	.582619	.526379E-01	.612485
1973:	2	.200144E-01	.654835	.501298E-01	.641972
1973:	3	.193682E-01	.686636	.501588E-01	.628676
1973:	4	.184814E-01	.677535	.496073E-01	.628877
1974:	1	.185063E-01	.682188	.494455E-01	.608743
1974:	2	.190093E-01	.737256	.522243E-01	.651638
1974:	3	.209016E-01	.738203	.569137E-01	.655646
1974:	4	.201338E-01	.770127	.584971E-01	.650030
1975:	1	.201444E-01	.769270	.587809E-01	.646789
1975:	2	.188176E-01	.830515	.719577E-01	.744522
1975:	3	.197482E-01	.833418	.723964E-01	.719194
1975:	4	.211885E-01	.821386	.754493E-01	.735807
1976:	1	.182029E-01	.798108	.744050E-01	.724880
1976:	2	.239063E-01	.785274	.617889E-01	.739342
1976:	3	.258417E-01	.767593	.584761E-01	.725106
1976:	4	.274733E-01	.746791	.614477E-01	.748783
1977:	1	.266942E-01	.731044	.594026E-01	.756805
1977:	2	.234804E-01	.749636	.561655E-01	.768281
1977:	3	.237012E-01	.746310	.546896E-01	.773196
1977:	4	.245265E-01	.753674	.546542E-01	.780801
1978:	1	.255737E-01	.752252	.518814E-01	.779283
1978:	2	.273989E-01	.734921	.521164E-01	.768991
1978:	3	.269998E-01	.739086	.511185E-01	.750637
1978:	4	.291559E-01	.750298	.532123E-01	.751116
1979:	1	.290038E-01	.755018	.496809E-01	.742356
1979:	2	.264531E-01	.744356	.600824E-01	.735997
1979:	3	.259632E-01	.742975	.608762E-01	.730501
1979:	4	.283245E-01	.696755	.604844E-01	.717784
1980:	1	.289053E-01	.691344	.721889E-01	.744566
1980:	2	.293086E-01	.694639	.627365E-01	.732563
1980:	3	.297432E-01	.685295	.670576E-01	.734505
1980:	4	.319834E-01	.745120	.717253E-01	.735504
1981:	1	.320442E-01	.747236	.716751E-01	.732415
1981:	2	.305903E-01	.744253	.767455E-01	.714274
1981:	3	.327922E-01	.749728	.769369E-01	.687209
1981:	4	.337645E-01	.721694	.782079E-01	.694357
1982:	1	.337588E-01	.723360	.779018E-01	.672376
1982:	2	.307740E-01	.647539	.603418E-01	.548471
1982:	3	.265296E-01	.607704	.525928E-01	.514915
1982:	4	.262141E-01	.562553	.417892E-01	.563756
1983:	1	.339922E-01	.585489	.399924E-01	.555476
1983:	2	.319530E-01	.537878	.454937E-01	.502512
1983:	3	.353395E-01	.530090	.488660E-01	.514260
1983:	4	.356324E-01	.511792	.492046E-01	.519717
1984:	1	.396602E-01	.593610	.492479E-01	.524676
1984:	2	.375624E-01	.585008	.543032E-01	.464263
1984:	3	.370306E-01	.592980	.576074E-01	.436852
1984:	4	.404378E-01	.583014	.584993E-01	.387633
1985:	1	.392609E-01	.590398	.630139E-01	.414816
1985:	2	.411315E-01	.606132	.588984E-01	.389023
1985:	3	.419145E-01	.604594	.569832E-01	.380087
1985:	4	.436020E-01	.615731	.552480E-01	.351717
1986:	1	.461514E-01	.645277	.576338E-01	.328048
1986:	2	.530650E-01	.589336	.570408E-01	.294875
1986:	3	.595703E-01	.583149	.575656E-01	.355236
1986:	4	.570443E-01	.576697	.583068E-01	.376756
1987:	1	.587256E-01	.619536	.590124E-01	.360853
1987:	2	.567198E-01	.607299	.636172E-01	.390289
1987:	3	.547242E-01	.541694	.628613E-01	.407090
1987:	4	.496948E-01	.566153	.597187E-01	.372564
1988:	1	.453598E-01	.607651	.642936E-01	.384686
1988:	2	.420362E-01	.571556	.592115E-01	.336161

a) See text for details

significant at the 5 p.c. level. The corrected  $R^2$  ranges between 0.48 and 0.83. With respect to investment goods price expectations the coefficient ( $b_2$ ) winds up with values between +0.0400 and +0.0782 and is significant at the 5 p.c. level (with three exceptions). The corrected  $R^2$  ranges between 0.30 and 0.78. The final expectations series which serves as one of the explanatory variables in the Phillips curve estimation is the weighted sum of the two series with the weights being the share of both components among final demand. The summary statistics presented in table A2 give information on how closely the inflation expectations are related to actual inflation.

Table A2: Summary statistics of expected and actual inflation rates

	$\hat{p}_t^*$	$\hat{p}$
Correlation coefficient	0 . 8 2 6 1	
Mean	0 . 9 8 0 4	0 . 9 6 4 7
Standard deviation	0 . 6 5 4 8	0 . 7 6 6 4

The correlation coefficient shows a high degree of comovement between the two series. A comparison of the means indicates that, on average, our calculated inflation expectation tend to over-estimate the actual inflation rate slightly. On the other hand, the expectations series shows less variability than the inflation rate. Figure A1 shows the time pattern of both series.

Figure A1: Time pattern of actual and expected inflation rates

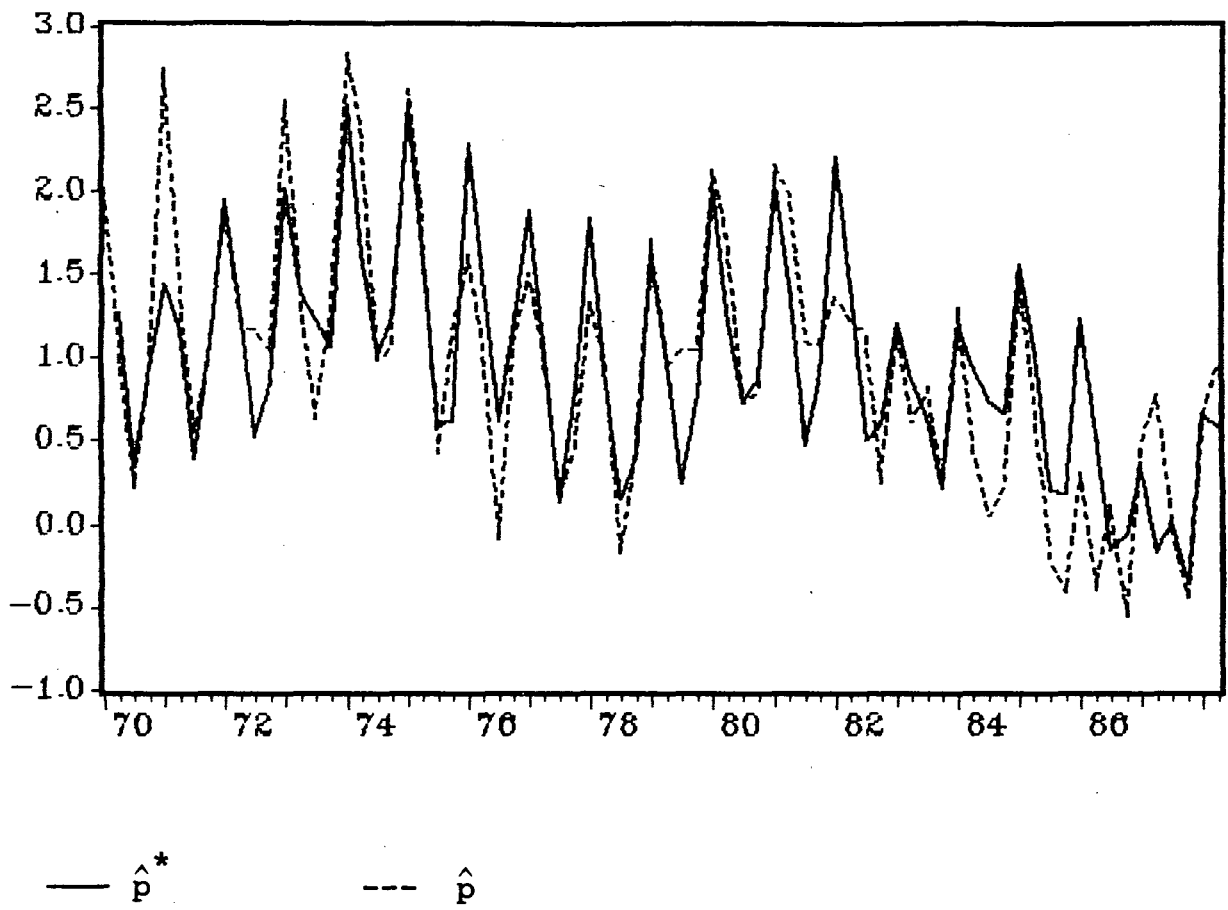


Table A3: Sources of data

p, m, v <sup>ind</sup> , v <sup>s</sup> pc, pi	Deutsches Institut für Wirtschaftsforschung (DIW), Vierteljährliche Volkswirtschaftliche Gesamtrechnung für die Bundesrepublik Deutschland, Berlin, 1988.
productivity	same and: Statistisches Bundesamt, Volkswirtschaftliche Gesamtrechnungen, Fachserie 18, Reihe 1.3, Konten und Standardtabellen, Hauptbericht 1987, Wiesbaden.
UR	Amtliche Nachrichten der Bundesanstalt für Arbeit (ANBA).
pc* <sub>ifo</sub> , pi* <sub>ifo</sub>	Wirtschaftskonjunktur, Monatsberichte des Ifo-Instituts für Wirtschaftsforschung, München, various issues.

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