Theories of Inflation and their Recent Empirical Evidence in the Federal Republic of Germany

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This paper evaluates the empirical performance of different theories in explaining the recent inflation in the Federal Republic of Germany. The theories are dealt with under the headings of keynesian explanations on the one hand subdivided into cost-push, demand-pull and Phillips-type relations and neoclassical explanations on the other hand, including the quantity theory, the accelerationist hypothesis and the impulse-theoretic approach.

1. Introduction

The first sharp recession in the economic history of the Federal Republic of Germany in 1967 stopped the era of moderate inflation. Since 1968 inflation accelerated and reached a peak in 1973/74. Until 1978 the increase of the price level slowed down to an annual rate of 2.7 % and accelerated again to 5.6 % in Febr. 80. Compared to the 'sixties the average rate of inflation doubled in the 'seventies, while the variance turned out to be proximately threefold, thus impairing the predictability of the future purchasing power of money and other assets fixed in nominal terms.

The aim of this paper is to evaluate the performance of different theories in explaining the recent inflation in the Federal Republic of Germany. We will concentrate on the period 1967 - 1979 and on those theories which have been exposed to empirical observation in a reproducible manner, thus conformed to accepted standards of empirical investigations. This procedure precludes theories

(a) which have not been applied to recent empirical data of the Federal Republic of Germany;

(b) which do not conform to the above mentioned methodology.

Theories, which conform to our a priori exclusion principle are dealt with under the headings of keynesian explanations on the one hand subdivided into cost-push, demand-pull and Phillips-type relations and neoclassical explanations on the other hand, including the quantity theory, the accelerationist hypothesis and the impulse-theoretic approach.

2. The Keynesian Explanation of Inflation

2.1. Cost-Push and Demand-Pull Inflation

I will develop the core of the hypothesis and try to avoid diversions at the risk of passing over arguments which might be regarded as essential.

The basic idea of demand-pull inflation was developed by *Keynes* (1940) in his analysis of alternative methods to "pay for the war". Inflation is caused by an effective monetary demand exceeding production valued by present prices. Price changes are positively related to relative excess demand. Demand pressure can be absorbed by rising prices, rising production, delayed delivery or combination of these measures. The question, which item dominates, is rigorously answered by the simple demand-pull hypothesis: Real income and production increase until full employment is reached. Beyond full employment demand-pull results in rising prices only. This means, inflation is confined to a situation of full employment. A more sophisticated division of monetary demand into reactions of prices and output will be discussed later[1]. Inflation occurring together with less than overall full employment has been attributed by *Keynes* and his followers to bottlenecks in specific branches, i. e. to a distribution of sectoral full employment over the economy. Before overall full employment is reached, some sectors increase their prices and start an inflationary process.

The source of demand pressure is not specified because it is irrelevant for the ensuing inflationary process. So every component of demand becomes a potential source of inflation, especially "autonomous" demand: investment, exports and government demand. Consequently anti-inflationary policy has to restrict demand by various instruments, running the risk to increase unemployment, since aggregate demand on the other hand determines the level of employment. This reasoning creates the 'cruel' trade-off-dilemma between unemployment and inflation, which is apparently also embedded in the Phillips-curve, being developed about twenty years after *Keynes'* original idea[2,3].

The theoretical counterpart of demand-pull is given by cost-push on the supply side. Cost-push can be exerted by every component of costs: wage earnings, indirect taxes and subsidies, depreciation and interest payments, and imported input factors. Costs are transformed into prices by "full cost-", "target-" or "mark-up-" pricing. This means,

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[1] Cf. part 3.2. and 3.3.

[2] We will deal with the Phillips-curve in the subsequent section.

[3] Although the negative relation between inflation and unemployment had been observed by *I. Fisher* already 1926, the relation was forgotten until the work of *A. W. Phillips* (1958).

firms multiply their costs per unit of output by a constant factor $(1 + m)$ to calculate their prices. Price changes therefore depend on (a) the mark-up ratio m, (b) changes in per unit labor-costs, i. e. the difference between the growth rates of wages and productivity, and (c) the growth rate of "imported" costs and of other costs.

This hypothesis was first put forward in the form of *G. C. Means*' (1935) hypothesis of administered prices. An oligopolistic market structure facilitates mark-up pricing, because all oligopolists face roughly the same variations in costs. Consequently they are able to raise their prices synchronously in reaction to increasing costs without explicit agreement, which would violate antitrust laws.

Thus, mark-up pricing becomes under oligopolistic conditions a profit maximizing strategy, if the demand side is characterized by a low elasticity of demand, so that increased prices are only partly neutralized by decreased demand and, hence, returns increase.

The controversy about mark-up pricing is still going on. The issue focusses on the question whether price behavior is insensitive or — rigorously spoken — independent of demand conditions and only determined by costs. The latter "strong" mark-up hypothesis has been confirmed by *Godley* and *Nordhaus* (1972) for the manufacturing industry in the U. K. It is applied actually by the "Starnberg School", *Müller* et al. (1978), to explain inflation in Germany. Wages are usually regarded as the most prominent factor of cost-push. Wage increases exceeding the growth rate of labour productivity raise unit costs. Rising wages are attributed to powerful trade-unions which impose "excessive" wage increases[4] upon employers, thus satisfying the income claims of their members. Rival income claims violating the income constraint seem to be the ultimate cause of inflation[5], calling for sociologic and political analysis rather than narrowly defined economic analysis.

The hypotheses, which have been tested recently[6], integrate cost-push and demand pull elements[7].

Excess demand is not directly observable. Different proxies are used to measure the demand pressure, for example the ratio of actual GNP divided by potential GNP or an index of capacity-utilization. The above mentioned elements of cost-push are measured in general

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[4] Wage increases may only be called "excessive" with respect to a constant distribution of income.

[5] Cf. the recent critical survey by *Fautz* (1978).

[6] Cf. Table 1.

[7] The former issue of cost-push vs. demand-pull inflation has been given up in favour of cost-push combined with demand-pull.

(a) by growth rates of hourly wage earnings substracting the growth rate of labour productivity to obtain the changes in per unit labour costs;

(b) by the price index for imported input factors or by the general import price index;

(c) by capital costs;

(d) by several taxes imposed on firms.

It is very difficult to compare empirical tests even if they are intended to provide evidence for roughly the same theoretical background, because the data and econometric techniques allow a wide variety of approaches. Differences between the econometric estimations presented in Table 1 are due to differences with respect to

(a) the sample period,

(b) the transformation of theoretical terms into statistical data,

(c) the lag structure,

(d) the inclusion of expected inflation.

Reviewing the results altogether, the cost-push and demand-pull influences cannot be empirically rejected. *Dieckheuer* and *Franz* produced significant coefficients for their demand-pull proxies, whereas *Dramais* in his multi-country study did not succeed — his demand-pull coefficient remained insignificant[8]. With respect to cost-push all investigations prove a significant positive influence of wage increases and a negative influence of the growth rate of labour productivity on inflation. The contribution of rising import prices to inflation is more difficult to assess[9]. *Franz* (1978) and the *Deutsche Bundesbank* (1977) report a significant coefficient, while *Dramais* and *Carrin/Barten* do not.

In his comprehensive estimation of a price function for the Federal Republic of Germany *Dieckheuer* (1975)[10] tried 16 different proxies for excess demand together with

(a) the growth rate of hourly nominal wage earnings

(b) the growth rate of labour productivity

(c) adaptively formed expectations about inflation

and got for only two of them statistically satisfying results.

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[8] Results tentatively supporting *Dramais'* were obtained by *Cross* and *Laidler* (1976), 230. They did not get satisfactory results estimating the influence of excess demand on inflation in Germany on annual data over the period 1954 - 1970.

[9] Cf. the analysis of *Neumann* (1978), discussed below in part 3.3.

[10] *Dieckheuer* (1975), 409 ff.

Table 1: **Recent estimations of the influence of demand-pull and cost-push factors on inflation in the Federal Republic of Germany**

In brackets: t-statistics

Author	Constant Term	Excess Demand Term	Cost-push Terms		Other Terms	R^2 / DW	Sample Period
Franz[a] (1978)	− 22.21 (4.8)	22.50 Al_t (5.1)	0.85 $(\hat{w}-\hat{q})_{t-i}$ (8.9)	0.10 $\hat{p}m_{t-i}$ (3.7)	0.516 u_{t-1} (4.1)	0.97 1.78	Quarterly 1965 I - 1976 IV
Bundesbank[b] (1977)	− 4.18 (− 8.20)		0.84 $\hat{w}_{t-i}$ (7.5)	0.57 $\hat{p}m_t$ (3.09)	D_i $(i = 1, 2, 3)$	0.90 0.68	Quarterly 1964 I - 1976 IV
Dramais[c]*) (1977)	0.00 (0.008)	0.51 T_t (1.34)	0.52 C_t (4.61)			0.42 1.22	1953 - 1973
[d]*)	0.51 (10.40)		0.32 $\hat{w}_t$ (6.48)	0.17 $\hat{p}m_t$ (—)		0.35 1.29	1953 - 1973
Geschwendtner[e] (1977/78)	1.06 (3.85)		0.60 $\hat{wl}_t$ (13.92)			0.93 1.49	Annual 1961 - 74
Carrin and Barten[f]*) (1976)	0.00 (1.75)		0.9 $\hat{w}_t$ (2.67)	0.17 $\hat{p}m_t$	0.89 $\hat{p}_t^e$ (20.80)	0.91 — . —	Quarterly 1961 - 1971 IV
Dieckheuer[g] (1975)	.	0.10 BS_t (2.64)	0.52 $\hat{w}_t$ (3.99)	— 0.32 $\hat{q}_t$ (2.29)	0.59 $\hat{p}_t^e$ (7.01)	0.90 1.95	Semiannual 1963 - 73

*) Part of a multi-country study. — a) *W. Franz* (1978), 452. Explained: rate of Inflation. Regressors: Al = Level of industrial capacity utilization; $\hat{w}$ = growth rate of nominal effective wages; $\hat{q}$ = growth rate of labour productivity; $\hat{p}m$ = growth rate of prices of imported raw materials; u = error term. The coefficients of the cost-push terms are the totals of distributed Almon-lag coefficients. Franz used the Orcutt-Cochran procedure to eliminate serial correlation. — b) The equation is published in the version 18/11/77 of the econometric model of the *Deutsche Bundesbank;* block 7.1.1.; explained: logarithmic first differences of private consumption prices; a_i = Almon-lag coefficient; $\hat{w}$ = logarithmic first differences of hourly gross wage earnings; $\hat{p}_m$ = log. first differences of import price index; D_i = seasonal dummies. — c) *A. Dramais* (1977), 37 ff. Explained: Private consumption deflator — annual growth rates. T = Actual GDP divided by potential GDP; C = Growth rate of total costs (including costs of labour, capital, imported goods and services, indirect taxes and subsidies). — d) $\hat{w}$ = Growth rate of the ratio of employees compensation divided by total civil employment; $\hat{p}m$ = growth rate of the deflator of imported goods and services (the coefficient of pm is insignificant). — e) *Gschwendtner* (1977/78), 118. Explained: Growth rate of gross domestic product deflator. $\hat{wl}$ = growth rate of per unit labour costs. — f) *Carrin* and *Barten* (1976), 255. Explained: Changes of consumption prices. $\hat{w}$ = change of hourly earnings; $\hat{p}m$ = changes in import prices — the coefficient was not significant, so it was assigned to pm; $\hat{p}$ = expected percentage change of consumer prices, measured as lagged observed change. — g) *G. Dieckheuer* (1975), 409. Explained: Growth rate of GNP-deflator. BS = Difference between the growth rates of actual GNP and average real GNP; $\hat{w}$ = growth rate of nominal hourly wage earnings; $\hat{q}$ = growth rate of labour productivity; $\hat{p}$ = adaptively formed expected rate of inflation.

A similar approach is presented by *Franz* (1978)[11]. He uses the capacity utilisation of the whole industry, a distributed lag of the difference between the growth rate of wages and of labour productivity and a distributed lag of the inflation rate of imported inputs. The test statistics are satisfying, so we cannot reject the influence of demand pressure and cost-push on inflation for the period 1965 - 1976.

Dramais' (1977) results of his analysis of E. E. C. countries contradict *Dieckheuer* and *Franz*. *Dramais* did not observe a significant influence of demand-pull, measured as quotient of actual and potential GNP on the rate of inflation. Judged by the low $R^2 = 0.42$, the results by *Dramais* are not very reliable compared to *Franz* and *Dieckheuer*, reporting R^2 of about 0.90. These differences are at least partly due to the Almon-lag technique employed by *Franz* and the lagged dependent variable p used by *Dieckheuer*. The coefficient of determination responds sensitively to these techniques and generally improves.

The empirical results with respect to imported inflation via rising import prices are ambiguous. Significant effects are reported by the *Bundesbank*, *Franz* and *Boelaert;* insignificant coefficients are observed by *Dramais* and *Carrin/Barten*. We will postpone the evaluation of these results until the end of this paper.

The orthodox Keynesian view, which explained inflation by the dichotomy demand-pull and cost-push, dominated the academic and political discussion until the rise of the monetarist counterrevolution. The following central points of criticism show that the problems, embodied in the Keynesian view, are essentially theoretical problems.

(1) Cost-push and demand-pull theories of inflation put the wrong question. They cut the wheel of economic interdependence and arbitrarily choose a spoke and declare: This spoke drives the wheel. They lead to the vision of wage-price or price-wage spiral. Cost push and demand pull seem to occur autonomously and remain unexplained by the theory. "Also relevant to the interpretation of all the empirical work on price determination is the fact that actual unit cost changes fall during booms and rise in recessions. Prices move pro-cyclically but with less amplitude. There is a fundamental difficulty in identifying the separate effect of actual cost changes, 'normal' cost changes and excess demand[12]." Nominal minimum wages are determined by the interaction of employers and trade unions. Unions do not have the power to set nominal wages autonomously. Employers' reluctance to grant higher wages depend on their sales and profit expectations which, in their turn, depend on

[11] *Franz* (1978), 452.
[12] *Laidler/Parkin* (1975), 768.

demand. It follows that wage changes cannot be attributed to the supply side alone — at least on the highly aggregate macroeconomic level at which inflations is analyzed.

(2) Monetarists object that Keynesian theories of inflation neglect the monetary conditions of inflationary processes. The struggle for higher income shares, for example, leads in Keynesian theories to unlimited inflation, which is only possible,

(a) if cost-push predominates persistently and

(b) if the money supply responds perfectly elastic to money demand.

(3) The cost-push hypothesis or — more general — supply-induced inflation contradicts neoclassical price theory, in which prices are determined by market conditions, which on their turn are determined by preferences, technology and the ressource constraint. Neither the level nor changes of inflation can be explained by cost-push.

(4) The most striking argument against the demand pull theory is the empirical coincidence of decelerating real income and accelerating prices (stagflation).

(5) Expectations play an important role in the course of inflation, and they influence demand as well as supply.

Summing up, we may say that price changes, demand-pull and cost-push are the simultaneous result of the same endogenous economic process. Nobody disputes that factor costs influence prices, but changes in prices and in expectations about prices, on the other hand, influence factor costs. Consequently the main objection against the cost-push demand-pull distinction is heuristic in nature: The Keynesian approach makes it impossible to identify clearly the causes of inflation. The failure of anti-inflationary policy guided by Keynesian ideas might be attributed to the misconception of theoretical analysis.

2.2. The Phillips-Curve

Until the end of the 'sixties, the Phillips hypothesis had been considered as one of the basic theorems of macroeconomics: Full employment can only be reached by violating the goal of price stability. Less inflation is accompanied by less employment and vice versa. The theoretical basis for *Phillips'* (1958) seminal empirical analysis was provided by *Lipsey* (1960). He transmitted the neoclassical paradigm of price determination in atomistic markets to the analysis of the macroeconomic labour market: Prices, i. e. wages, change in reaction to differences between supply and demand. He then postulated a one-to-one rela-

tionship between excess demand on the labour market and unemployment. Low unemployment consequently indicates excess demand on the labour market which leads to increasing wages. Rising unemployment reduces demand pressure and slows down wage increases. This theoretical framework generates the unemployment-wage change pattern compatible with the observations of *A. W. Phillips* (1958).

The link between wage inflation and price inflation was introduced by *Samuelson* and *Solow* (1960)[13]. They argued that price increases are proportional to the difference between the growth of wages and of productivity, i. e. they assume a constant mark-up on per unit labour costs.

The Phillips-curve reached its peak of popularity and official recognition, when the *OECD*-study (1970) observed stable Phillips-relations for different countries, but its adequacy has already been questioned. Theoretical attacks by *Phelps* (1967) and *Friedman* (1968) rang the knell[14], and with respect to economic reality the empirical phenomenon of stagflation could not be reconciled with a stable long run trade off between unemployment and inflation.

Earlier investigations of the relation between unemployment and wage rate changes for the Federal Republic of Germany, confirm a dominant influence of unemployment on the rate of change of wages[15]. The analysis by *Hoffmann* (1969) contradicts these "majority"-results. He did not observe a close correlation between the two variables. Though his investigation casts doubt about the existence of a Phillips-relation for Germany, the other empirical studies confirm to it.

The estimated equations presented in Table 2 cover the period up to the fourth quarter 1976. Additional to the unemployment ratio they include the following variables:

(a) a price variable to capture the influence of expected inflation (*Franz, König, Carrin* and *Barten*);

(b) lagged unemployment and the rate of change of unemployment in order to explain the loops[16] *(König)*;

(c) the growth rate of labour productivity *(Franz)*.

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[13] *Samuelson* and *Solow* (1960), 192.

[14] For recent surveys of the Phillips-curve cf. *Santomero* and *Seater* (1978), *H. Frisch*'s discussion (1977), 1290 - 1302, *Ramser* and *Angehrn* (1977).

[15] For a survey of early empirical investigations for the Federal Republic of Germany see e. g. *Woll* et al. (1977), 27 - 34; *Woll* (1975), 114 - 117; *Zahn* (1973), 65 - 77.

[16] Cyclical loops around the Phillips-curve are due to the observation that increasing unemployment leads to wage increases below the Phillips-curve while decreasing unemployment is connected with higher than average wage increases.

Table 2: **Empirical estimations of the relation between unemployment and wage changes (price changes) in the Federal Republic of Germany**
(t-statistics in brackets)

Author	Unemployment Term		Wage Terms		Other Terms	R^2 *DW*	Data Period
Franz[a] (1978)	$0.61\ U_{t-1}^{-1}$ (2.1)		$0.30\ \hat{q}_{t-1}$ (3.9)	$0.63\ \hat{w}_{t-1}$ (7.7)	$0.27\ \hat{p}_{t-1}$ (2.4)	0.64 2.34	Quarterly 1955 I - 76 IV
	$0.18\ U_{t-1}^{-1}$ (0.4)		$0.25\ \hat{q}_{t-1}$ (2.3)	$0.81\ \hat{w}_{t-1}$ (8.6)	$0.06\ \hat{p}_{t-1}$ (0.4)	0.79 2.02	Quarterly 1965 I - 76 IV
König[b] (1978)	$-0.84\ U_{t-1}$ (4.5)	$0.88\ U_t$ (5.6)			$1.15\ \hat{p}_{t-1}$ (22.0)		Quarterly 1962 I - 70 IV
	$0.32\ U_{t-1}$ (1.4)	$-0.25\ U_t$ (1.1)			$0.96\ \hat{p}_{t-1}$ (25.0)		Quarterly 1962 I - 76 IV
Carrin and Barten[c] (1976)	$-4.59\ U_t$ (3.58)			$0.89\ \hat{w}_{t-1}$	$0.11\ \hat{p}_t$ (2.51)	0.77 —.—	Quarterly 1955 III - 71 IV

a) W. *Franz* (1978), table 1. Explained: Growth rate of nominal effective wages. U = unemployment ratio; $\hat{q}$ = growth rate of labour productivity; $\hat{w}$ = growth rate of nominal effective wages; $\hat{p}$ = rate of inflation. — b) *H. König* (1978), 94. Explained: Rate of inflation $\hat{p}$. U = vacancies — unemployed. — c) *Carrin* and *Barten* (1976), 254. Explained: Percentage change of hourly earnings in manufacturing. U = first differences between four quarters moving averages of the rate of unemployment; $\hat{p}$ = rate of inflation. They estimated structural parameters which I transformed into the corresponding regression coefficients.

The most recent empirical studies by *Franz* (1978) and *König* (1978) show the deterioration of the Phillips-curve for the 'seventies. The inclusion of the data from the fourth quarter 1971 on to the fourth quarter 1976 by *König* reverses the sign of the unemployment variables in comparison to the period 1962 I - 1970 IV and renders them insignificant. In the same fashion the results of *Franz* might be interpreted. His estimates belonging to the period 1965 I - 1976 IV show, that the influence of lagged prices and lagged unemployment has deteriorated which is proved by the insignificant coefficients for the latter period. The *t*-statistics decline from 2.4 and 2.1 to 0.4.

The investigation by *Woll* et al. (1977)[17] shows the instability of Phillips-type relations for the FRG and corroborates the interpretation of the recent results by *Franz* (1978) and *König* (1978) as indicating the instability of the Phillips-curve or — to put it more rigorously — the nonexistence of a stable long-run trade-off between unemployment and inflation.

The ordinary labour-market indicators — vacancies and unemployed- reveal only a part of the labour market situation in the Federal Republic of Germany. Large parts of the adjustment were realized by fluctuating employment of guest-workers, short-time work and overtime work. Therefore *Woll* et al. (1977) regressed the rate of inflation on the employment of foreigners and got satisfying results for the period 1969 - 74; Franz (1978) tested a proxy for labour-market tension including unemployment, "discouraged workers" — who are not in the files of labour offices, involuntary remigration of foreign workers and short-time work. Even these efforts of data mining and the use of sophisticated econometric techniques could not establish a stable Phillips-curve for the Federal Republic of Germany. Especially the economic record of the 'seventies shows the inadequacy of the Phillips-curve. The simultaneous rise in wage changes and unemployment in 1973/74 and the subsequent decrease of the two variables inverted the negative Phillips-relation into a positive one.

3. Neoclassical Explanations of Inflation

3.1. Quantity Theory

"Inflation is always and everywhere a monetary phenomenon . . .[18]." A rate of growth of money supply exceeding the rate of growth of real income is a necessary *and sufficient* condition for inflation. That is the credo of the monetary explanation of inflation. The quantity equation provides the formal frame for the monetary explanation of inflation.

[17] *Woll* et al. (1977), 53.
[18] *Friedman* (1970), 24.

The inflationary pressure is exerted by the money supply via a stable demand for money function. But even in its modern version the quantity theory does not provide an explanation for short run inflation, because at least three factors prohibit a close relation between money growth and price inflation:

(1) The demand for money is determined by the expected rate of inflation which in turn depends on the actual rate of inflation. The actual rate of inflation depends on the rate of change of money supply. This means, a shift in money supply affects money demand so that the inflationary outcome cannot be predicted by the simple quantity approach.

(2) The quantity theory requires that the real rate of growth is independent of monetary factors in the long run, i. e. it requires the validity of the classical dichotomy — real variables are determined by real factors, and money only influences the general level of prices.

(3) The expected rates of return and actual rates of return are susceptible to variations of the money supply, so that the demand for money function shifts.

(4) Hence, the reaction of the price level to monetary impulses shows a long and variable lag, which is sometimes referred to as an independent problem.

These theoretical objections show that the quantity theory of money could only survive as a theory of the demand for money, which was stressed by *Friedman* (1956). The contemporaneous version of the quantity theory can only explain nominal income. The division of changes of nominal income into changes of prices and of real growth requires theoretical extension which takes care of the interaction of monetary and real factors.

Despite theoretical deficiencies, there exist empirical studies relating price changes to changes of money. The investigations by *Willms* (1972), *Trapp* (1976) and *Woll* et al. (1977) reinforce the theoretical doubts about the ability of the quantity theory to explain inflation in the FRG.

3.2. The "Accelerationist" Hypothesis

The further development of the neoclassical tradition beyond the quantity theory resulted in models which analyze the interaction of excess demand, price level changes and exogenous impulse forces. Its basic idea can be traced back to the neoclassical critique of the Phillipscurve by *Phelps* (1967) and *Friedman* (1968). They argued that a trade-

off between unemployment and inflation rests upon the difference between actual and anticipated inflation.

It follows from their argument that only unexpected monetary impulses influence employment and the real economic activity. Expected inflation corresponding to maintained monetary impulses only shows up in rising prices.

The idea was modified by *Lucas* (1973) and condensed into a supply function and a price function. He argued that only apparent changes in *relative* prices induce firms and workers to alter their supply. For the individual firm in an atomistic market it is impossible to distinguish a rise in individual prices from incipient inflation. If no inflation or no change in the rate of inflation has been expected, price changes are perceived as changes in relative prices. When firms realize that their relative position in the market did not change, they only adjust prices but not output. *Lucas* (1973) formulated an ingenuous test for his version of the "natural rate hypothesis" and estimated his structural parameters for 18 countries — including Germany — with very different histories of inflation. Beyond his methodical invention, the empirical results are relevant in our context. The Lucas-test was reproduced by *Hamburger* and *Reisch* (1976)[19] with the sample period extended to 1953 - 1973.

The salient feature of these investigations for the evaluation of inflation in Germany lies in the variation of the structural coefficient, indicating the trade-off between unemployment and inflation. It shows that the unemployment-inflation trade-off has deteriorated to a considerable degree[20]. This empirical finding supports the notion that the Phillips-curve is unstable and that inflationary experience destroys the real expansionary effects of nominal impulses.

The results by *Lucas* and *Hamburger/Reisch* corroborate the empirical findings of *König* (1978) and *Franz* (1978), p. 453, who cannot reject the accelerationist hypothesis, because the coefficients of the expected rate of inflation are not significantly different from one.

3.3. Impulse Theory

The idea developed by *Lucas* was broadened and integrated by the "Monetarist Consortium"[21] into the *Brunner/Meltzer* aggregative framework[22]. It consists of four markets: for money, credit, output and existing

[19] *Hamburger* and *Reisch* (1976), 317.

[20] *Hamburger* and *Reisch* (1976), 317 observed an initial impact of nominal impulses on real output of 0.61 while *Lucas* (1973) observed 0.82, which lies 34 % above the former value.

[21] The following contributors published 1978 under this heading: *Brunner, Dutton, Fourçans, Fratianni, Korteweg, Meltzer* and *Neumann*, in: *Brunner* and *Meltzer* (1978).

real capital. The capital market is eliminated by Walras law. The remaining model can be described as a simultaneous equations system[23] which determines the equilibrium values of prices and quantities in the markets for credit, money and output, corresponding to a specific set of exogenously determined parameters. Different values of parameters yield different values of the endogenous variables, i. e. differences in exogenous variables correspond to differences in the equilibrium values of endogenous variables. The former changes can be interpreted as impulse forces generating systematic changes of economic aggregates.

The impulse forces are transmitted via changing relative prices. Their impact on the economies is reflected by changes of output and the general price level. As in the *Lucas* model the trend rate of output is assumed to be predetermined by factors such as the technologically determined rate of change of productivity and the growth rate of the labour force. The deviation of output from trend and the rate of inflation remain to be explained.

The impulse forces are condensed into four groups: monetary, fiscal, foreign price and foreign quantity impulses. They are splitted into anticipated and unanticipated impulses. According to the "natural rate of unemployment hypothesis":

(a) anticipated stimuli should affect only absolute prices whereas unanticipated impulses should affect output temporarily. Additional to that test the following questions are put to the empirical data:

(b) Are cyclical fluctuations in output attributable to changes in the four above mentioned impulse forces?

(c) Are expectations formed rationally?

The differentiation between anticipated and unanticipated impulses requires a hypothesis concerning the formation of expectations. The 'Consortium' applied the "rational expectations" hypothesis in their work. Rigorously formulated, rational expectations are "true mathematical expectations of the future variables in the model which are known to the public at time t"[24]. This hypothesis arose from the deficiencies of 'adaptive expectations' which had been applied insofar to macroeconomic models. Expectations are in general not consistent with the properties of the models in which they occur.

The empirical estimations by *Neumann* (1978) do not contradict the underlying theoretical reflections. Accelerations and decelerations of

[22] The theoretical concept and the empirical results are presented in *Brunner* and *Meltzer* (1978).
[23] Cf. *Schröder* (1978), 167.
[24] *Shiller* (1978), 3.

the price level seem to be uniquely determined by the rationally anticipated variations. They generate a regression coefficient of unity, whereas unexpected impulses, defined as the difference between actual and anticipated impulses do not show a significant influence. These results are partly imposed by the statistical procedure. *McCallum* (1978), 283 showed, that the unity coefficient of anticipated acceleration is imposed rather than estimated.

The results obtained by *Neumann* (1978) improved, when he introduces asymmetrical weights[25]. The weights are based on the idea, that starting from low capacity utilization, a supplier will react to increasing demand in the first instance by increasing production. He will turn to price changes, when the increase in demand is maintained and higher rates of capacity utilization are reached. A subsequent downswing in demand will be seen at first as temporally and answered by suppliers with decreased production. It follows that the impact of impulse forces should be different depending on the state of capacity utilization and the direction of change. The impulse forces are weighted accordingly, resulting in considerably improved goodness of fit for all equations estimated, including the output equations.

These results can be interpreted as showing the impact of unanticipated impulses on output fluctuations. A statistical interrelation cannot be rejected between output fluctuations on the one hand and unanticipated changes in the growth rate of the money stock, of import prices and of quantities of export on the other hand. It is remarkable that fiscal impulses seem to have only significant influences on output if leading one period.

The output measure tested by *Neumann* (1978) excludes real exports. This measure shows a powerful impact of changes in real exports which must be interpreted in favour of the Keynesian multiplier.

Concerning inflation, the impulse-theoretic approach tries to establish that a small number of exogenoues variables can be made responsible for changes of the rate of inflation. Changes in the growth rate of the money stock and in the growth rate of real exports occur simultaneously with accelerations of inflation; the fiscal impulse measure does not show such a high parallelity. Neither anticipated nor unanticipated accelerations of import prices influence domestic prices at a statistical significant level.

Possible conclusions with regard to the trade-off between accelerations of output and of prices are not as clear-cut as in *Lucas'* (1973) test.

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[25] Cf. *Schröder* (1978), 135, for the theoretical formulation of asymmetrical price setting behaviour depending on capacity utilization in the *Brunner/Meltzer* (1972, 1976) framework.

He tested structural parameters, while the "Consortium" does not generate structural parameters[26]. Hence it cannot be inferred

(a) any reliable conclusion about the impact of anticipated impulse forces,

(b) any reliable conclusion about the predominance of rational expectations, because we don't have separate informations about the formation of expectations.

The overall performance of the impulse-theoretic hypothesis with respect to output accelerations improves, when the sample period 1956 - 1973 is extended up to '75, then including two years of economic crisis, the first two years of floating exchange rates and of the new monetary policy of the Deutsche Bundesbank, intending to achieve a preannounced growth target of central bank money. Although the coefficients do not change, their level of significance improves. The goodness of fit of the output function judged by the values of R^2 is only satisfying when asymmetrical weights are applied to the data.

The empirical improvement due to the extended sample period may be tentatively rationalized as pointing to enforced influences during crises of the impulse forces taken into account. The variables taken as exogenous in the econometric sense, seem to be more powerful during economic crises. The institutional shift to flexible exchange rates and to the "new monetary policy" did not impair the empirical performance of the impulse theoretical approach.

The results by *Neumann* (1978) stand in contrast to the results by *König* (1978) and *Franz* (1978). The latter show a deterioration of explanatory power during the last years whereas *Neumann's* (1978) price equations do not react to the inclusion of '74 and '75 into the sample period and the performance of his output equation has improved.

4. Concluding Remarks

Different attempts to explain recent inflation in the Federal Republic of Germany have been reviewed in this paper. We have selected theories conforming to the criterion of empirical application with regard to accepted methodical standards.

The demand-pull cum cost-push approach is confirmed by *Franz* (1978) and *Dieckheuer* (1975); it is not supported by *Dramais* (1977). His demand-pull proxy has no significant coefficient and the $R^2 = 0.417$ shows, that only 41,7 % of the variance of the rate of inflation can be attributed to cost-push and demand-pull. This failure may be explained

[26] Cf. the comment by *McCallum* (1978), 281 f.

by the wrong proxy for excess demand chosen by *Dramais*. *Dieckheuer*'s results show that the estimations are very sensitive to the choice of the excess demand proxy. Only two of 16 proxies tried by *Dieckheuer* generated satisfying results.

Less ambiguous are the results with respect to cost-push. Changes of wages and of productivity show a reliable interrelation with rates of inflation. Only the results by *Zahn* (1973) for the 'sixties do not conform to that picture. He shows that wage changes hardly had a significant influence on inflation.

Still more ambiguous are empirical results with respect to import prices. They apparently do not constitute a stable channel of the international transmission of inflation.

The investigation of the Phillipscurve yields an interesting result: the relation between unemployment and wage changes deteriorates the more the sample period approaches the present time. A stable long-run trade off between unemployment and inflation must be rejected, but the alternative "accelerationst" hypothesis can neither be sufficiently confirmed by German data nor rejected.

The extended accelerationist approach as applied by the monetarist "Consortium" to different countries with Germany among them, faces the same difficulties as the other approaches: the empirical performance is too good to reject the hypothesis but too bad to rule out other explanations of inflation.

Although the alternative theories are not compatible, i. e. they combine different economic variables to explain inflation, we are not able to discriminate between "true" and "false" hypotheses on the basis of the empirical evidence under review. The underlying methodology — advanced by *Popper* (1935) and his school — only succeeded with respect to the long-run Phillips-curve.

The coexistence of partly contradictory theories is possible because empirical evidence can only be gained in the light of theories. Empirical data do not exist per se but are observed from the point of view of preformulated theories. The basis for coexisting and furthermore covalid theories is given by their non-commensurability[27].

The phenomenon of lacking commensurability is due to the high reduction of *complexity* by economic reasoning and by macroeconomic reasoning in particular. On the other hand, economic processes *appear* complex because we do not dispose of a coherent general economic theory. Consequently the state of the art is represented by different

[27] The concept of non-commensurability was advanced by *Kuhn* (1970).

theories and empirical evidence cast in the light of those theories. This situation leads politicians and their economic advisers, who are supposed to fight inflation, to retreat to eclecticism[28].

Summary

The demand-pull cum cost-push approach is empirically supported but theoretical reflections show its inadequacy. Import prices apparently do not constitute a stable channel of the international transmission of inflation. The Phillips-curve relation deteriorates the more the sample period approaches the present time. A stable long-run trade-off between unemployment and inflation must be rejected, but the alternative "accelerationist" hypothesis can neither be sufficiently confirmed by German Data nor rejected. The extended accelerationist approach, named "impulse theory" faces the same difficulties as the other approaches: The empirical performance is too good to reject the hypothesis but too bad to rule out other explanations of inflation. The quantity theory fails.

Zusammenfassung

Die empirischen Untersuchungen ergeben folgendes:

Der Nachfragesog cum Kostendruck-Ansatz wird zwar empirisch bestätigt, dennoch zeigen theoretische Reflektionen seine Unangemessenheit. Die Importpreise bilden offensichtlich keinen stabilen Kanal der internationalen Inflationsübertragung. Die Phillips-Kurve wird instabiler, je näher die Beobachtungsperiode an die Gegenwart heranrückt. Ein stabiler langfristiger ‚trade-off' zwischen Inflation und Arbeitslosigkeit existiert nicht. Die alternative „akzelerationistische" Hypothese wird durch die bundesdeutschen Daten dennoch weder hinreichend bestätigt noch widerlegt. Der erweiterte „akzelerationistische" Ansatz, die „Impulstheorie", sieht sich den gleichen Schwierigkeiten wie die anderen Ansätze gegenüber: Ihre empirischen Ergebnisse sind einerseits zu gut, als daß die Hypothese zurückgewiesen werden könnte, andererseits aber nicht ausreichend, um andere Inflationserklärungen zu verdrängen. Die Quantitätstheorie scheitert empirisch.

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[28] Cf. the criticism by *Lindbeck* (1977) of *Fels* (1977), who presented an eclectical view of inflation, proximately identical to the view of the German Council of Economic Advisers.

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The empirical investigations give the follwing results: