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# DETERMINING FACTORS OF INDUSTRIAL PRICING - THE CASE OF THE FEDERAL REPUBLIC OF GERMANY

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## Zusammenfassung

Die Beschleunigung der Inflation in der Mitte der sechziger Jahre hat eine Vielzahl ökonometrischer Untersuchungen zur gesamtwirtschaftlichen und sektoralen Preisentwicklung veranlaßt. Sektoral disaggregierte Studien der Preisentwicklung weisen einen höheren Erklärungsgehalt als gesamtwirtschaftliche Studien auf, z.B. in bezug auf den Einfluß von Marktstrukturfaktoren und den Zusammenhang von absoluten und relativen Preisen im verarbeitenden Gewerbe. Im Vordergrund der Analyse steht die Frage nach der direkten Nachfrageabhängigkeit der Preisentwicklung. Die Untersuchung der Determinanten der industriellen Preisentwicklung ist eine notwendige mikroökonomische Voraussetzung zur Erklärung des Inflationsprozesses.

## Abstract

The acceleration of inflation in the mid sixties has caused a multitude of econometric examinations of both overall economic and industrial price development. Sectorally disaggregated studies of price formation are supposed to provide a more comprehensive explanation compared to a highly aggregated economic analysis, e.g. with regard to the influence of market structural indicators and the interdependence between absolute and relative prices in the manufacturing sector. Among others, the question of the direct demand determination of price formation is discussed. The investigation of the determinants of industrial pricing is regarded as the prior microeconomic condition to explain an inflationary process.

# Determining Factors of Industrial Pricing - The Case of the Federal Republic of Germany

By Fritz Rahmeyer and Rolf Grönberg

## 1. Introduction

The acceleration of inflation which originated in the United States in the mid sixties, in the Federal Republic of Germany at the beginning of the seventies, temporarily accompanied by a slowdown in output growth and an increase in the rate of unemployment, has caused a multitude of theoretically guided econometric examinations of both overall economic and industrial price development. The question of the direct demand determination of price changes is in the fore. Its answer should give some indication about recommendable antiinflationary strategies and their presumed costs with regard to output losses. Sectorally disaggregated studies of price formation are supposed to provide a more comprehensive explanation compared to a highly aggregated economic analysis:

- The determinants of final output prices and their relative influence will differ across branches of the industrial sector. To stick to the assumption of a uniform industrial price behaviour is inadvisable, global and aggregated studies of price formation and inflation will hide sectoral differences concerning price and cost changes and their determining factors (see Sawyer 1983, p. 97 f.).
- A disaggregated study permits a more detailed analysis of market structural indicators, e.g. market concentration, dependency on foreign trade with respect to the development of prices.
- The sectoral study of price development gives information about the interdependence between relative and absolute manufacturing prices[1].

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[1] For motivating the necessity of a disaggregated, sectoral analysis of the inflationary process see i.e. Wied-Nebbeling 1986, pp. 1.

In connection with the periodical reporting on structural changes in the Federal Republic, the collection of disaggregated data for the manufacturing sector compatible with national income accounting has improved significantly. Consequently, in comparison with the comprehensive study of one of the authors (Rahmeyer 1983) an extended theoretical and empirical analysis of the determining factors of industrial pricing is advisable, extended with regard to the influence of market structure and the interdependence of inflation and relative price variability.

The investigation of the determinants of industrial pricing is the indispensable microeconomic preliminary step to explain the inflationary process (for a discussion, see Riese 1986, p. 85). "Macroeconomics has never had a good theory of inflation, and micro underpinnings might help provide one" (Perry 1984, p. 402; also Dean 1980, p. 4). Inflation is the result of the market process substantiating the continuity of price development. The wage-price mechanism established by the decisions of the market participants, i.e. the price behaviour of firms and wage setting of wage-earners or unions, respectively, is the fundamental microeconomic element of a (keynesian oriented) explanation of inflation, while monetary factors are mainly of only secondary importance (monetary accommodation of cost push and supply shocks). Interpreting inflation as the outcome of a market process, it can be dealt with only in the framework of a macroeconomic model of income determination, whilst the wage-price mechanism is a first approximation within a submodel representing the supply side. Concerning this latter case, in particularly the level of overall economic demand indicated by capacity utilization and the rate of unemployment, is given exogenously and thereby the influence of monetary and fiscal policy. The center of a wage-price model is the estimation of price and wage equations to explain sectoral price changes but not a continuous rise of the overall economic or manufacturing price level, respectively.

In the following, first of all a short survey of the basic elements of alternative theories of inflation is given focus-

ing on cost-based pricing as a microeconomic foundation of cost-push theories and on a structure-oriented approach to inflation (2.). Next, the results of the calculations of the industrial price and wage determining factors are presented (3.). The final section deals with the impact of market concentration onto industrial price development thereby using different analytical methods (4.).

## 2. Fundamental principles of alternative theories of inflation

### 2.1. Definition and conception

Inflation is defined as an increase of the overall economic price level (see Lipsey 1979, p. 284 ff.). A "general" theoretical explanation of inflation does not exist, on the contrary there are competing approaches. Since inflation is predominantly seen as an overall economic phenomenon, its different ideas are embedded within the framework of macroeconomic theories, such as the keynesian and monetarist or postkeynesian neoclassical theory. The theories of inflation are an integral part of the existing macroeconomic theories.

The macroeconomic view must be supplemented by a microeconomic foundation of price formation, such as the rules of marginal or average cost pricing, enriched by considerations on the impact of the market structure. Some importance has to be given to the explanation of wage-rate changes on the labour market. While price theory strives for the explanation of individual prices and their structure, inflation theory will explain the development of the price level.

The growth of the overall price level is the result of the weighted price developments in the sectors of the economy. The causes of price changes in the different sectors will probably not be uniform. The overall economic rate of inflation is in part the consequence of the interplay of sectoral price and wage developments. The focus of interest is the manufacturing industry, the center of a market economy, that is least of all sectors subject to government regulations.

The social and institutional conditions of an economy are inherent to the inflationary process (see Streißler et al. 1976, p. 42 f.; Parkin 1978, pp. 43). Especially the hypothesis of a struggle between the different groups of the society for increased income shares gives a non-economic explanation of triggering off an inflationary process. "The fundamental cause of inflation in a socioeconomic context is the fact that overall nominal income expectations rise higher than productive power because of the rivalries and illusions of social groups. It is significant in this connection that for individuals or groups, price stability can be considered a 'collective good', which everyone benefits from whether he has made sacrifices or not. ... The rate of decline in the value of money ultimately depends on the claims society makes on the national product" (Kloten, Ketterer, Vollmer 1985, p. 353 f.). The 'struggle for income shares'-hypothesis strives for an explanation both of price and wage development and the causes of demand and cost changes. This non-economic approach will not be viewed here extensively.

## 2.2. Demand-pull and cost-push theories of inflation

Traditional classification yields demand-pull and cost-push or market-force and non-market force theories of inflation (see Lipsey 1979, p. 287) (for a critique see Laidler, Parkin 1975, p. 742 f.; Addison, Burton 1980, p. 189). In the demand-pull version a distinction between a keynesian and a monetarist approach is common (see Gordon 1976, p. 186 f.). The keynesian theory does not comprise an independent theory of inflation. But within the scope of its theory of output and employment, the question of price adjustment (or semi-inflation) is treated as well. Assuming full employment and full capacity utilization, the keynesian theory can be generalized to a theory of (true) inflation. Just as unemployment is the result of a deflationary gap, global price changes are in a symmetrical manner the outcome of an inflationary gap. In the case of money illusion of wage-earners or less than proportionally rising wages, a permanent price increase can only result by means of

an enduring excess demand situation exogenously occuring in the output market. However, a complete adjustment of wages to rising prices or, as a result of a simultaneous excess demand in the labour market, endogenously causes a lasting increase in prices under the assumption that no negative feedback on the level of real demand exists. The wage-price spiral controlled by market forces is the dynamic, persistent element in a keynesian theory of inflation. The monetary sector is of no explicit importance in the inflationary process, implicitly an always sufficient, accomodating money supply is assumed.

The monetarist inflation theory which is based upon a market oriented explanation, as distinguished from so-called sociological or institutional and ecclectic theories (see Brunner 1974, pp. 181; Laidler 1976, p. 252), criticizes both alternative approaches mainly with respect to the assumptions of the mere accomodating effect of monetary factors in explaining inflation and of money illusion (or lagged wage adjustment) on the side of wage earners. Inflation is entirely regarded as a market phenomenon endogenously determining the actual and expected rates of inflation and the degree of excess demand. (Adaptive) price expectations represent the dynamic element in a monetarist model of inflation. The long-term growth of the price level is always the result of exogenous disturbances, e.g. a monetary expansion in excess of real output growth, but not of endogenous disturbances of the market system as in the case of a monetary accomodation of an autononous wage or price push.

The criticism of the demand oriented theory of inflation points toward the assumption of the exclusiveness of market determined factors in price and wage formation and towards marginal analysis as the heart of the neoclassical theory of the firm (for the latter see Koutsoyiannis 1976, pp. 256). Regarding the cost-push or supply oriented theory of inflation the primary reason for triggering off and disseminating an increase in the overall price level is the active behaviour of firms and trade unions who, as a result of their market power in imperfect markets, dispose of a more or less ample scope for discretionary price and wage

setting. To begin with, contrary to the assumption of marginal price theory, firms make decisions about prices and quantities in view of incomplete information about their economic environment, e.g. the current and future development of demand and supply. They are unable to get adequate knowledge for determining their marginal revenue and cost curves in view of an environment of continuous change (see R.A. Gordon 1948, p. 277). The degree of economic uncertainty is supposed to be higher for future demand (regarding the distinction between relative and absolute and transitory and permanent demand changes) than for future production costs, thus higher for marginal than for average costs. To escape this uncertainty the firms will adjust their prices as far as possible to known or even unsure business indicators. Since increasing labour and/or material costs will affect all enterprises to the same extent (modified by their structure of production costs) and trigger off a price-raising tendency, they reduce the uncertainty of the firms concerning the reactions of their competitors. Additionally, cost changes (e.g. contract-based wages) are regarded as lasting longer than demand changes, so prices will adjust to the former more rapidly and to a higher degree. To sum up, the result is a preference in price formation for cost-based pricing as a more often applied rule compared to competitive pricing (see among others Silberston 1973, p. 79; Wied-Nebbeling 1975, p. 149; Okun 1981, p. 153). Referring to the behavioural theory of the firm, the overwhelming majority of firm decisions concerning the adjustment to changes in its environment results from simple rules and the application of established methods (see Winter 1971, p. 240 f.). Routine behaviour, including, among others, the rules of price formation, takes the place of maximization behaviour as a decision rule. According to the version of the normal (or standard) cost-hypothesis, price setting results in a mark-up onto normal or standard costs. It is independent of short run demand and actual cost fluctuations (see Coutts, Godley, Nordhaus 1978, p. 60). If the cost curve runs horizontally within the relevant range of production, short run demand fluctuations cause - given the mark up - variations

in sales and profits, but not in prices. Additionally, the level of output can be stabilized by demand-buffering strategies such as variations in inventories and the level of orders or delivering periods, resp. (see Hay, Morris 1979, p. 136). Furthermore, in a world of dynamic competition, prices are only one instrument among others in management strategies and probably not of first importance.

Moreover, existing costs of price adjustment lead to the result that sticky, inflexible prices also serve as an instrument to reduce buyers' costs of price information in the market. Sticky prices avoid or reduce search costs concerning the price level and the availability of output, fostering at the same time continuity and reliability in customer's relationships. Price changes destroy the available knowledge about ruling market prices. Stable prices are seen as a service to the customer. They are of use for promoting the actual and long-run business relations (implicit contract view; see Okun 1981, pp. 138). Price increases are justified by cost increases, not by taking advantage of sales possibilities. The orientation to the development of average costs is considered as a fair pricing rule (see Okun 1975, p. 363). Concerning the sellers, cost-based pricing helps to avoid potential price-wars in oligopolistic markets and costs of price changes, e.g. as a result of reactions of competitors. To this an inelastic demand with respect to price changes in mature and stagnating markets may contribute as well (see Wied-Nebbeling 1986, p. 230, 239). After all, a delayed and partial price adjustment in the case of demand fluctuations promotes the stability and functioning of an enterprice economy, since quantity and price adjustments cushion their effects on the course of the business cycle mutally (see Streißler 1980, p. 41; Perry 1984, p. 406). So from this point of view price (and also nominal wage) stickiness may be seen as the result of optimizing behaviour in markets characterized by nonnegligible costs of information and transaction (Okun 1980, p. 824)[1].

1 For a summary discussion whether full cost pricing ist consistent with marginalism, see Lee 1984a, pp. 1118.

The interrelation between changes of wages, productivity and prices is the center of the cost-push theory of inflation (empirical mainline model of inflation; among others see Tobin 1972a, Perry 1978). In open economies the prices of imports have to be taken into account as well. The wage equation represents the importance of the labour market. The wage setting process may be characterized as being composed of a cyclical component, usually explained by a version of the Phillips curve, and a wage norm, only loosely related to current unemployment, as a result of past wage changes and permanent, contractual employment relations between workers and employers (see Perry 1980, p. 209; Hall 1980, p. 91; Schultze 1985, p. 2). The length of time of wage contracts determines the degree of nominal and real wage stickiness. In addition to contractual relations the observable (relative) stability of inter-industry wage structure (relative wage stickiness) brings about aggregate nominal wage stickiness and inertia inflation (see Lipsey 1981, p. 452 f.; Schultze 1985, pp. 1).

The price equation, based on a variant of the cost-based pricing hypotheses, represents the product market. It describes the direct relation between prices of final output, different kinds of factor costs and demand, in case differentiated by indicators of market structure. Neither the labour nor the output market is in accordance with the model of an instantaneous market clearing. Prices are not mainly set to clear markets and to allocate ressources optimally, but rather in view of a feasible, long-run profit or financial objective, e.g. maintaining the ability to invest and to cover production costs, in that way enabling firms to survive and grow in business (see R.A. Gordon 1948, p. 284; Wiles 1973, p. 386, Lee 1984b, p. 158). Thus, wages and prices respond with a delay to cyclical demand fluctuations if at all (predominance of quantity adjustments)[1]. However, changes in demand when perceived as permanent, will cause changes in wages and prices. The development of pro-

1 For a further discussion of inertia in price and wage adjustment see R.J. Gordon 1981, pp. 493; 1982a, pp. 1087; 1982b, p. 13; for a critique and modification of Okun's model concerning wage and price setting in an international comparison, see Gordon 1982b, p. 40 f.

ductivity is of use as a basis to calculate normal costs. The degree of normalization depends on the time horizon of firms.

An inflationary process once released, either by the way of an excess demand or an autonomous wage or price push, provoces a permanent wage-price spiral relatively independent of the state of demand and supply, given a price- and fairness oriented wage increase and a cost-oriented price increase. Money supply is regarded as a more or less endogenous variable, determined mainly by means of the wage-price spiral, establishing a core rate of inflation, and real supply shocks. The consequences of cost-push factors for output, employment and inflation depend on the degree of their monetary accomodation and the extent and lenght of wage indexation as admitted by cost-push proponents (for an analysis of policy responses to supply shocks, see Gordon 1984, pp. 38). The behaviour of the monetary authorities with respect to the accomodation of the existing rate of inflation on the one hand and the wage-earners and firms in the wage-bargaining process allowing for real wage fluctuations on the other hand will not be constant in the run of time but may depend on the level and variability of the rate of inflation, also - in the case of the market participants - on the experience concerning the practised stabilization policy of the past.

## 2.3. Structural oriented approach to inflation

Structure-oriented hypotheses intend to analyze the importance of the structure both of labour and output markets and of overall economic aggregates for the development of the price level. This still incomplete approach is appropriate for the explanation of a creeping inflation and an inflationary basis, whilst not for runaway, double-digit and accelerating inflations. It is grounded on the following observations (see Frisch 1980, p. 137):

- Different rates of productivity growth in the sectors of the economy along with a relatively stable inter-industry wage structure,

- Asymmetrical wage and price flexibility in the case of demand fluctuations (in detail Scitovsky 1978, pp. 221),
- Inter-industrial dispersion of excess demand and supply in labour and output markets ("dispersion is inflationary"; Tobin 1972b, p. 10),
- Differences in market structure, foreign trade structure, cost structure of the industry branches.

The basic pattern of manufacturing prices across industries is the result of the wage and productivity development (supply side explanation). The wage structure in the manufacturing sector is relatively constant, the consequence of an approximately equal wage growth in all its branches. The dispersion of productivity growth exceeds the wage dispersion (see Rahmeyer 1986). Accordingly, the growth of unit labour costs as a central determinant of price growth is different in all manufacturing branches. Prices on average change inversely to productivity but not proportionally, especially if alterations of the demand structure face rigidities in the pricing process and the production facilities.

In the course of economic growth and structural change, the overall economic price level will increase if firms or industries with an above average productivity growth will not (relatively) reduce their prices proportionally, but instead use it in part to allow additional wage or profit increases, whereas sectors with below average productivity growth are forced to (relatively) raise their prices (alternatively to reduce sales, output and employment), because wages increase to about the same extent in all economic sectors ("productivity inflation", Frisch 1973, p. 14). In the case of asymmetric wage and price flexibility the allocation of goods and productive factors takes place by different wage and price increases, an accomodating money supply is implicitly assumed.

Besides differences in inter-industry productivity growth and the asymmetry of wage and price flexibility, the breakdown of the national economy into a sector with mainly competitive

or administered pricing is well to the fore of a structural theory of inflation (see Nordhaus 1976, p. 59; Guger 1978, pp. 124; Okun 1981, pp. 134). Competitive markets are characterized by instantaneous price adjustment in the case of demand fluctuations, which always lead to market clearing, and additionally by (nearly) homogeneous products and free market entry. Administered markets show the existence of large-scale enterprises, a high or medium degree of market concentration, barriers to entry and are thus characterized by market power of firms. Accordingly, they dispose of a certain scope concerning market conduct, e.g. referring to the rule of price calculation, as cost-based pricing, that may also be taken as an instrument of oligopolistic coordination thus fostering price stickiness. The industrial process of price formation and inflation may therefore be portrayed as the simultaneous existence of marginal and cost-based pricing.

## 3. Empirical calculation of industrial price and wage formation

### 3.1. Problems of specification

The theoretical and empirical analysis of the price and wage determining factors provides the foundation of the long-term price development or inflationary process, respectively. A detailed microeconomic underpinning referring to an extended model is not conducted deliberately. Actually, the theoretical foundation of price equations is based on neoclassical price theory and the assumed maximization principle only to a limited degree thus automatically receiving unfavourable criticism (see Fischer 1986, p. 9 f., 31). However, a well established macroeconomic theory of price dynamics does not exist (see Nordhaus 1972, p. 27). The theoretical basis of applied econometric price equations is not uniform and accordingly regarded as comparatively unsatisfying[1] (among others Eckstein, Fromm 1968, p. 1159; Earl 1975, p. 84). Instead of neoclassical price equations as an alternative hypothesis a behavioural approach dealing with the observable process of decision making of

1 "... a lack of integration of theory with econometric practice in the recent literature" (v.z. Mühlen 1972, p. 125).

firms in incomplete markets is focused on, describing the actual behaviour in view of given capabilities. The majority of applied price equations is specified according to fairly general assumptions concerning the practised behaviour of firms and the presumable pricing determinants (see the papers in Eckstein 1972). A variant of the average cost pricing-hypotheses is well to the fore, supplemented by indicators of market demand, in case enriched by considerations on the impact of market structure on the behaviour of prices. In the case of average (variable) cost pricing, the mark up includes all other elements of production costs together with the profit margin. The intermediate output (out of domestic as well as imported production) carries the most important weight in the structure of costs, with a rising share of the latter in the past. The so determined price generally is not the actual price. The latter also depends (among others) on the threat of potential market entry. Given the mark up (that may be demand dependent) industrial price formation depends on the development of wages, productivity or unit labour costs, respectively, and unit material costs, thus the (variable) costs of production. In accordance with the lack of a unified theoretical framework, a homogeneous econometric approach for the explanation of price-setting is not existent (see Earl 1975, p. 83).

Analogously to price equations, the econometric research of wage formation is short of a theoretical foundation, too. The employed wage equations are all an extension of the Phillips curve and mostly not derived from a model of the labour market. "There ist no ... valid general theory ... that defines a set of forces governing wage inflation; there is no equilibrium rate of increase in wage rates" (Godley 1977, p. 467). Changes in the relationship between the rate of wage inflation and unemployment point out the fact, that an estimated wage equation covering a certain period of time may represent more an average of short-run, cyclical Phillips curves.

Specifying the price and wage equation, it is assumed, that industrial price formation depends only on industry specific

cost and demand factors, whereas wage-setting also depends on overall economic factors, e.g. the rate of unemployment and inflation. The latter will effect a dampening down of the variability of relative wage growth. Thus, in an interdependent wage-price model, industrial pricing is governed by both industry specific and overall economic variables, the latter influencing prices via wages.

The explanation of industrial pricing may be roughly sketched as follows: "The study of inflation in most past research has been based on a two-equation approach, one for wages and one for prices... The wage equation was generally taken to represent the outcome of events in the labour market, with the influence of aggregate demand channeled through labour market tightness variables like the unemployment rate, while the price equation was generally taken to reflect events in the commodity market, with the influence of aggregate demand channeled through proxy variables..." (Frye, Gordon 1980, p. 7. See also Perry 1978, pp. 261; Brown 1985, p. 305)[1].

The following questions concerning industrial pricing will be analyzed (see partly Laidler, Parkin 1975, p. 766):

- Do indicators of demand besides those of production costs influence the development of prices directly or indirectly through production costs, in particular wages? A clear answer with regard to the expected effect of demand on prices is not available.
- Does the variability of relative prices exercise influence on the rate of inflation, according to the hypothesis that dispersion of relative prices results in additional inflation?
- What are the differences in the pricing factors in a sectoral comparison?
- Does the degree of market concentration exercise influence on industrial pricing?

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1 For a subsequent critique of the two equation-approach, see Gordon 1982c, pp. 95).

The present analysis is based on a 29 component breakdown of two-digit industry branches of the manufacturing sector in the Federal Republic of Germany. The annual data cover the period 1961-1980. The price indicators used (gross and net output) are not true product prices but are only an approximation based on industrial producer prices (for a critique see Helmstädter 1982, p. 61), the former being a closer one than the latter.

A wage-price model of the origin and dissemination of an inflationary process is incomplete in so far as it takes as exogenously given the level or rate of change of demand in the output and labour market. To explain fluctuations in aggregate and sectoral demand, it must be extended to a macroeconomic model of inflation (see Laidler, Parkin 1975, p. 774; Parkin 1978, pp. 36). A partial analysis may only be able to explain relative or sectoral prices, but not a continuously rising aggregate price level (confusion between relative prices and the general price level).

### 3.2. Calculation of sectoral price equations

In accordance with the preceding theoretical considerations, especially on cost-based industrial pricing as a basis for estimating single price equations of the manufacturing sector, the first specification to be employed is:

$$(1)\quad PGP = A\emptyset + A1 \cdot ULC + A2 \cdot UMC + A3 \cdot POT,$$

with PGP = Prices of gross output, annual rate of growth,
ULC = Unit labour costs, annual rate of growth (gross income from wages and salaries divided by gross output at 1976 survey prices),
UMC = Unit material costs, annual rate of growth,
POT = Capacity utilization, annual rate of growth or level, resp.

It represents a composition of demand and cost factors (flexible cost-plus pricing). A differentiation concerning market structure is not yet carried out, rather every industrial market is assumed to be characterized by a certain degree of sellers's concentration (see Qualls 1979, p. 310).

Applying time series analysis the problems both of inertia and the elasticity of price adjustment in the case of demand and cost changes will be dealt with additionally. In addition to an indicator of delay in the price adjustment process, with that of price flexibility, the lagged dependent variable will also be interpreted as a measure of adaptive expectation formation (see Gordon 1982c, p. 102; 1985, p. 272). The higher the regression coefficient, the less is the speed of price adjustment.

The prices of gross output are calculated on the basis of industrial producer prices (categories of goods). For this purpose a matrix of production is used (published by the Bureau of Statistics) comprising the linkage between categories of goods and branches of industries. So a constant linkage between goods and industries is assumed by this procedure. Producer prices are characterized as transaction instead of posted prices and as such describing the price development exclusively (Laspeyres-index). The industrial capacity utilization, either the level (in a linear way) or the rate of change, serves as demand indicator in the output market (demand variable in real terms). The test of the demand determination of prices is complicated by the fact that the demand hypothesis is related to the price formation of homogeneous goods but not to industries with heterogeneous goods. The effect of a permanent alteration of capacity utilization depends on the shape of the hitherto existing average (variable or full) cost curve, also its likely shift as a result of variations in one or all of the cost components including the profit margin. The change of the degree of capacity utilization as such may cause an extra effect on prices or its rate of growth, respectively. Thus, a definite answer concerning the expected impact of demand on prices is not available. Moreover, the importance of demand may vary subject to the stage of production of goods.

The simplest solution of the normalization of unit labour costs is the use of annual data (see Sylos-Labini 1979, p. 155). In quarterly data frequently the fluctuations of productivity

growth, but not that of wages and prices of intermediate output, are adjusted for cyclical demand variations. Firms react instantaneously to changes in wages and costs of materials, more than to changes in productivity.

Table 1 shows the results of estimated price equations for the processing industry and four subsectors of industries. Space limitations prevent the presentation of the regression equations for all individual branches. Both, unit labour and material costs control prices immediately as has been expected. In the primary and producer goods industry and the capital investment goods industry unit material costs are negatively resp. positively significant in period t-1 as well. The sum of adjustment coefficients ranges from 0.80 to 0.85. The higher number in the general and luxury foods industry may be the consequence of the higher than average share of indirect taxes in the costs of production. With the exception of the capital investment goods industry output prices adjust without delay (annual data!).

Table 1: Determinants of price development in the manufacturing sector of the Federal Republic of Germany, 1962-1980
Specification: PGP=AØ+A1·ULC+A2·ULC'1+A3·UMC+A4·UMC'1

| Coefficients / Sectors | AØ | A1 | A2 | A3 | A4 | $R^2$ | DW |
|---|---|---|---|---|---|---|---|
| Processing industry | 0,31<br>(1,82) | 0,19<br>(5,34) | · | 0,63<br>(18,17) | · | 0,98 | 2,00 |
| Primary and producer goods industry | 0,10<br>(0,36) | 0,11<br>(2,27) | · | 0,71<br>(21,26) | · | 0,97 | 1,74 |
| Capital investment goods industry | 0,50<br>(4,20) | 0,17<br>(7,24) | · | 0,45<br>(14,91) | 0,21<br>(7,49) | 0,99 | 2,28 |
| Consumption goods industry | 0,34<br>(1,78) | 0,21<br>(5,12) | · | 0,64<br>(17,07) | · | 0,97 | 2,39 |
| General and luxury foods industry | -0,25<br>(-0,73) | 0,26<br>(3,75) | · | 0,66<br>(7,19) | · | 0,88 | 2,02 |

PGP = Price index of gross output, annual rate of growth
ULC = Unit labour costs, annual rate of growth
UMC = Unit material costs, annual rate of growth
In parentheses: t-statistics

$$PGP = \underset{(1,32)}{0,24} + \underset{(5,03)}{0,23}\ PGP'1 + \underset{(5,87)}{0,19}\ ULC + \underset{(12,15)}{0,48}\ UMC \quad (1962\text{-}1980)$$

$$R^2 = 0,97 \qquad DW = 2,61$$

Demand indicators are not statistically significant, neither the level nor the rate of change of capacity utilization. Its variability in the passage of time is considerably higher than that of gross (and net) output prices. The estimates for the individual industries do not yield a discernible regular pattern of demand determination of prices.

By dividing the branches of industries into a group of five strong and eight slow growing ones (in output and productivity) (see Rahmeyer 1986 for details) the following result appears: In the first group, unit labour costs are significant only in one branch with the size of the coefficient below average, while in the second they are significant in all industries, with no regular pattern of the regression coefficients. Unit material costs are significant in all branches except one (tobacco industry).

Running a single regression between output prices or unit labour costs, respectively, and both demand indicators, we discovered a direct demand determination of both variables, which is much stronger in the case of unit labour costs (we used the lagged level of capacity utilization). Thus, demand may influence prices indirectly through unit labour costs (less through unit material costs) or its single components wages and productivity.

Alternatively, taking net output prices[1] as the dependent variable, the following equation was estimated (compare table 2):

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1 For the regression between both price indicators in the processing industry we get (1961-80)

$$PGP = \underset{(-0,62)}{-0,71} + \underset{(3,73)}{1,09}\ PNP;\ R^2 = 0,44;$$

it is the strongest in the primary and producer goods industry:

$$PGP = \underset{(0,33)}{0,29} + \underset{(5,35)}{1,11}\ PNP;\ R^2 = 0,61$$

Table 2: Determinants of price development in the manufacturing sector, 1962-1980
Specification: PNP=AØ+A1·ULC+A2·ULC'1+A3·PIM+A4·PIM'1

| Sectors \ Coefficients | AØ | A1 | A2 | A3 | A4 | $R^2$ | DW |
|---|---|---|---|---|---|---|---|
| Processing industry | 1,45<br>(3,87) | 0,43<br>(6,31) | · | 0,03<br>(0,90) | · | 0,74 | 1,56 |
| Primary and producer goods industry | 0,62<br>(0,93) | 0,40<br>(2,94) | · | 0,29<br>(3,77) | -0,18<br>(-2,12) | 0,67 | 1,52 |
| Capital investment goods industry | 1,60<br>(3,22) | 0,37<br>(4,98) | 0,19<br>(2,57) | -0,12<br>(-3,60) | 0,09<br>(2,51) | 0,80 | 2,30 |
| Consumption goods industry | 1,47<br>(3,78) | 0,46<br>(6,28) | · | 0,07<br>(2,11) | · | 0,77 | 2,35 |
| General and luxury foods industry | 0,47<br>(0,38) | 0,64<br>(3,22) | · | -0,07<br>(-0,91) | · | 0,42 | 2,00 |

In parentheses: t-statistics

$$(2)\quad PNP = A\emptyset + A1 \cdot ULC + A2 \cdot PIM + A3 \cdot POT,$$

with PNP = Prices of net output, annual rate of growth,
ULC = Unit labour costs, annual rate of growth (gross income from wages and salaries divided by net value added at 1976 survey prices),
PIM = Import price index of industrial products (input-index), annual rate of growth.

Two results should be mentioned. Firstly, no direct demand determination of prices could be detected in this regression equation as well. Secondly, industries showing a significant import price determination of their prices can have an above-average or a below-average import quota. Consequently, the share of imports is not decisive for the influence of import prices onto fluctuations of net output prices[1]. Import prices are the result of changes in world market prices and the exchange rate.

1 For an analogous result in an international instead of an interindustry comparison, see OECD 1982, p. 16.

In the third step unit labour costs are decomposed into the wage and the productivity component, which yields equation

$$(3)\quad PNP = A\emptyset + A1 \cdot LS + A2 \cdot YBR + A3 \cdot PIM,$$

with LS = Gross wage rate, annual rate of growth (corresponding by definition to average yearly earnings),
YBR = Labour productivity, annual rate of growth

As was expected, there exists a positive effect for wages and a negative one for productivity, their regression coefficients differ from each other considerably. The coefficient of wages is less than one. Thus, wages are only to a certain extent shifted onto prices (see Table 3).

Table 3: Determinants of price development in the manufacturing sector, 1962-1980
Specification: PNP=AØ+A1·LS+A2·YBR+A3·PIM

| Coefficients / Sectors | AØ | A1 | A2 | A3 | $R^2$ | DW |
|---|---|---|---|---|---|---|
| Processing industry | 1,42<br>(1,81) | 0,45<br>(4,93) | -0,44<br>(-5,08) | 0,03<br>(0,77) | 0,75 | 1,65 |
| Primary and producer goods industry | -1,90<br>(-1,17) | 0,52<br>(2,67) | -0,17<br>(-1,16) | 0,26<br>(3,23) | 0,63 | 1,62 |
| Capital investment goods industry | 2,77<br>(2,56) | 0,41<br>(3,23) | -0,48<br>(-4,22) | -0,11<br>(-2,46) | 0,61 | 1,51 |
| Consumption goods industry | 0,75<br>(0,84) | 0,54<br>(5,12) | -0,41<br>(-4,57) | 0,07<br>(1,92) | 0,77 | 2,46 |
| General and luxury foods industry | 3,68<br>(1,74) | 0,38<br>(1,52) | -0,95<br>(-3,30) | -0,08<br>(-0,97) | 0,50 | 2,05 |

In parentheses: t-statistics

In accordance with the hypothesis of an alleged interrelation between mean and dispersion of a variable in a further step

equation (1) is extended by the argument of relative price variability.

$$(4) \quad GPGP = A\emptyset + A1 \cdot GULC + A2 \cdot GUMC + A3 \cdot SPGP$$

G = Annual rate of growth
S = Standard deviation, weighted

Fischer (1981, pp. 383; 1982, pp. 176) discusses six different approaches concerning the connection and chain of causation between the rate of inflation and relative price variablitiy, in which one group assumes either inflation or the variability of relative prices as given exogenously, while the second one analyses the simultaneous influence of "third" factors onto mean and dispersion of prices. In the scope of the structure oriented approach to inflation, the "asymmetric price response model" (Marquez, Vining 1984, p. 19; Tobin 1972b, p. 10 f.) is of basic importance. According to this model prices are more flexible in the case of an excess demand than in the case of an excess supply (non-linearity of price changes). The causality in this model runs from the variability of relative prices which is assumed as given exogenously towards the rate of inflation. "As to the association between the overall rate of inflation and the variability of relative prices, many of the regression results can be traced to the causal link between relative price shocks and the inflation rate, rather than to a causal link from inflation to relative price variability" (Fischer 1985, p. 124)[1].

The direct connection between the mean and variability of prices shows statistically significant results for both price indicators, which is considerably stronger in the case of gross (PGP) contrasted to net output prices (PNP) (period 1961-80).

$$GPGP = -1{,}90 + \underset{(5{,}82)}{1{,}85}\ SPGP; \quad R^2 = 0{,}65 \quad DW = 2{,}34$$

$$GPNP = 0{,}80 + \underset{(2{,}20)}{0{,}70}\ SPNP; \quad R^2 = 0{,}21 \quad DW = 1{,}37$$

1 For a summary review of the possible directions of causation, see Marquez, Vining 1984, p. 48.

The estimation of equation (4) shows the following result (period 1962-80):

$$GPGP = -0{,}13 + \underset{(5{,}38)}{0{,}18}\ GULC + \underset{(12{,}93)}{0{,}57}\ GUMC + \underset{(1{,}85)}{0{,}24}\ SPGP$$

$$R^2 = 0{,}98 \qquad DW = 1{,}81$$

$$GPNP = 0{,}16 + \underset{(5{,}40)}{0{,}41}\ GULC + \underset{(0{,}04)}{0{,}00}\ GPIM + \underset{(1{,}91)}{0{,}39}\ SPNP$$

$$R^2 = 0{,}79 \qquad DW = 1{,}54$$

Even after allowing for the influence of unit labour and material costs there still exists a positive connection between the mean and dispersion of manufacturing prices: The variability of relative prices affects the rate of inflation in a positive way. Thus the rate of inflation is not neutral with respect to the variability of relative prices.

The previously implemented time series analysis deals with repeated observations of the same industries at different points of time. Subject of a cross section analysis is the observation of different industries at the same point[1] or period of time, respectively. In this way average alterations between periods of time across industries may be detected, additionally the branches of industries can be broken down with respect to characteristic features, e.g. stage of production, market concentration, dependence on foreign trade. Two results of the cross section regression equations will be emphasized:

- Demand influences price formation statistically significant only in the primary and producer goods industry, a stage of production far off final demand.
- Unit material costs control prices in all periods and subsectors of the manufacturing sector as well, whilst not unit labour costs. Generally, the statistical results of the estimations, e.g. the $R^2$'s are better in 1972-80 compared to 1962-71, especially brought about by unit labour costs.

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1 For a more detailed sequence of cross sections of year-to-year rates of change see Wilder, Williams, Singh 1977 and DeRosa, Goldstein 1982.

## 3.3. Calculation of sectoral wage equations

The following specification underlies the estimated wage equation:

$$(5)\quad LS = A\emptyset + A1 \cdot (1/AQ) + A2 \cdot CPI + A3 \cdot YBR,$$

with LS = Gross wage rate, annual rate of growth (gross income from wages and salaries divided by the number of wage and salary earners),
AQ = Rate of unemployment, in percentage, as demand indicator in the labour market (assuming a non-linear relationship),
CPI = Consumer price index, annual rate of growth.

Nominal wage increases tend to protect the current real wage and furthermore to participate the wage-earners in the growth of real income. The influence of prices and productivity is modified by the rate of unemployment. Price expectations are disregarded in the wage equation implying the assumption of a backward - instead of a foreward - looking view of inflation. The expected rate of inflation is as unoberservable directly as the natural rate of unemployment or its deviation from the actual rate which would be a potential demand indicator in the labour market, is. Additionally, as a result of a hardly ever accelerating rate of inflation in the Federal Republic of Germany there is no evident reason for assuming a lasting influence of inflationary expectations onto the process of wage formation (see Brown 1985, p. 250 f.; Coe 1985, p. 99 f.; Coe, Gagliardi 1985, pp. 15). The simultaneous equation bias between wages and prices in the same period is mitigated, firstly by employing an industry-specific net output price as the dependent variable whereas an overall economic consumer price index in the wage equation as an independent variable who differ from each other considerably. Secondly, wages determine prices in equation (1) by means of unit labour costs, whereas directly in equation (3) only.

A further characteristic feature of the selected wage equation is the omission of sociological factors like union power or

strike activity[1] as probable wage determining factors. There exist different problems in specifying the equations-derivation of the price equation from the production account of a firm or industry, while the wage equation ist restricted to variables given by the price-quantity link. Due to these restriction substantially less satisfactory estimates are to be expected in the case of the wage equation.

Table 4 shows the estimated results of equation (5).

Table 4: Determinants of wage development in the manufacturing sector, 1962-1980
Specification: $LS=A\emptyset+A1\cdot(1/AQ)+A2\cdot CPI+A3\cdot CPI'1+A4\cdot YBR+A5\cdot YBR'1$

| Coefficients / Sectors | AØ | A1 | A2 | A3 | A4 | A5 | $R^2$ | DW |
|---|---|---|---|---|---|---|---|---|
| Processing industry | 1,44<br>(0,65) | 2,34<br>(2,04) | 0,99<br>(2,64) | · | 0,32<br>(1,60) | · | 0,42 | 1,78 |
| Primary and producer goods industry | 0,84<br>(0,29) | 2,17<br>(1,53) | 1,07<br>(2,12) | · | 0,32<br>(1,68) | · | 0,32 | 1,81 |
| Capital investment goods industry | 0,56<br>(0,28) | 1,84<br>(1,68) | 1,00<br>(3,00) | · | 0,38<br>(2,38) | 0,33<br>(1,98) | 0,58 | 1,97 |
| Consumption goods industry | 2,34<br>(1,19) | 2,05<br>(1,87) | 0,84<br>(2,45) | · | 0,26<br>(1,42) | · | 0,40 | 2,04 |
| General and luxury foods industry | 1,90<br>(1,41) | 3,26<br>(4,13) | 0,88<br>(3,64) | · | -0,14<br>(-0,76) | · | 0,62 | 2,46 |

LS = Wage rate, gross, annual rate of growth
AQ = Rate of unemployment, in per cent
CPI = Consumer price index, annual rate of growth
YBR = Labour productivity, annual rate of growth

In parentheses: t-statistics

1 For a discussion of some social conventions, principles of appropriate behaviour and institutional factors in the labour market resulting in nominal wage stickiness in the case of excess supply, see Solow 1980, pp. 1.

Remarkably, the (inverse of the) unemployment rate as demand indicator in the labour market is positive and statistically significant in the processing industry and general and luxury foods industry. If average hourly instead of yearly earnings are used as independent variable this result also holds in the capital investment goods and consumption goods industry. Prices are completely shifted onto wages in the same period, a result of the annual wage bargaining process pointing at real wage stickiness[1]. So opposite to prices demand influences wages directly and thereby indirectly prices as well (see also Sylos-Labini 1979, p. 163; Eckstein 1984, p. 217), by this way making production costs an endogenous variable in a price equation. Both lagged prices and unemployment are insignificant (with the exception of the general and luxury foods industry). Productivity growth is dominantly not significant, the t-values are higher in the case of average yearly compared to average hourly wages.

### 3.4. Simultaneous estimation of price and wage equations

The most important objection raised against the econometric analysis of price and wage development by means of estimating single equations is the fact that the right-hand variables in price and wage equations are not truly exogenous, in particular neither wages in a price equation nor prices in a wage equation. Rather wages and prices (and also demand conditions) are part of an interdependent macroeconometric model in which the wage-price mechanism may be regarded as a central component. Only (trend) productivity and import prices might be taken as given exogenously. Single price and wage equations estimated as structural equations thus representing the causal relation of the included variables only comprise the direct impact of the exogenous variables but not potential feedbacks with the endogenous ones (see Koutsoyiannis 1977, p. 336). If wages and prices are determined reciprocally (as will probably be the case

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1 "... centralized, synchronized, and short-term contracts allow for the rapid response of nominal wages to shifts in demand..." Bruno, Sachs 1985, p. 234).

within the period of a year) the application of the so far used OLS-procedure will cause biased estimates in single equations. The selected specification of the price and wage equation (sectoral net output prices, consumer price index) certainly has mitigated the presumed simultaneous equation bias.

As an alternative way to estimate parameters of single equations the indirect least-square estimation method (ILS) is employed. It provides consistent parameter estimates in the case of exactly identified structural equations (see Pindyck, Rubinfeld 1976, p. 138; Koutsoyiannis 1977, p. 369; Maddala 1977, p. 221, 231 f.). It is characterized by three steps. Firstly, the structural price and wage equations are transformed into their reduced form thus avoiding a mutual causation of prices and wages. Secondly, the parameters of the reduced-form equations are estimated using OLS. Finally, the numerical results for the structural equations are calculated.

Starting point for simultaneously estimating prices and wages are the structural equations

$$(3)\quad PNP = A\emptyset + A1 \cdot LS + A2 \cdot YBR + A3 \cdot PIM,$$

$$(5)\quad LS = B\emptyset + B1 \cdot (1/AQ) + B2 \cdot CPI + B3 \cdot YBR.$$

By transformation into the reduced form we obtain

$$(7)\quad PNP = C\emptyset + C1 \cdot (1/AQ) + C2 \cdot YBR + C3 \cdot PIM,$$

$$(8)\quad LS = D\emptyset + D1 \cdot (1/AQ) + D2 \cdot YBR + D3 \cdot PIM,$$

with
$$C\emptyset = \frac{A\emptyset + A1 \cdot B\emptyset}{1 - A1 \cdot B2} \quad ; \quad D\emptyset = \frac{A\emptyset \cdot B2 + B\emptyset}{1 - A1 \cdot B2}$$

$$C1 = \frac{A1 \cdot B1}{1 - A1 \cdot B2} \quad ; \quad D1 = \frac{B1}{1 - A1 \cdot B2}$$

$$C2 = \frac{A1 \cdot B3 + A2}{1 - A1 \cdot B2} \quad ; \quad D2 = \frac{A2 \cdot B2 + B3}{1 - A1 \cdot B2}$$

$$C3 = \frac{A3}{1 - A1 \cdot B2} \quad ; \quad D3 = \frac{A3 \cdot B2}{1 - A1 \cdot B2}$$

Solving the system of coefficients' relation for the parameters of the structural equations, we get the following results:

$$A\emptyset = C\emptyset - C1\frac{D\emptyset}{D1} \quad ; \qquad B\emptyset = D\emptyset - D3\frac{C\emptyset}{C3}$$

$$A1 = \frac{C1}{D1} \quad ; \qquad B1 = D1 - \frac{C1}{C3}$$

$$A2 = C2 - C1\frac{C2}{D1} \quad ; \qquad B2 = \frac{D3}{C3}$$

$$A3 = C3 - C1\frac{D3}{D1} \quad ; \qquad B3 = D2 - D3\frac{C2}{C3} \quad .$$

The estimated reduced-form price and wage equations throughout show less satisfactory results than the structural equations. The rate of unemployment is statistically insignificant whereas productivity is significant in the majority of cases. The results of the wage equation are unsatisfactory all together. Using the ILS-method the overall effect of wages onto prices (A1) is less than the direct one (in the case of the OLS technique), with the exception of the consumption goods industry. The results of the respective wage equation are in part not plausible (negative sign of B2). Multiplying A1 and B2, the coefficients of wages and prices in equation (3) and (5), the result is clearly less than one (0,42; in the overall economy, including agriculture and services, 0,67) thus pointing at a stable trade off between the rate of unemployment and inflation, with that at a non-acceleration of inflation.

## 4. Market structure and industrial price development

Horizontal market concentration belongs to the most important characteristic features of industrial market structure. As a theoretical guidance serve the interrelations between market structure, conduct (e.g. competitive or oligopolistic price behaviour) and market performance, measured by means of the price-cost margin or the development of prices.

Referring to the relation between market structure and pricing behaviour in particular two questions are under debate (see Dalton, Qualls 1979, p. 22; Domberger, Smith 1982, pp. 192):

- The influence of market structure on cyclical price and quantity adjustments (hypothesis of administered pricing);
- The influence of market structure on the long-term price development, perhaps triggering off a positive single price level or a permanent inflationary effect (administered inflation).

An econometric test of the administered inflation hypothesis will be conducted in various manners. Assuming a discontinuous relationship to the growth of prices, on the one hand two groups of industry branches marked by high and low degree of business concentration are distinguished and afterwards price equations across the selected industries are estimated. On the other hand, by aggregating the respective branches to a single sector of industries, time series for both a high (CR3>0.25) and a low (CR3<0.10)[1] concentrated sector of manufacturing are constructed, afterwards again price equations for both sectors employing a time series analysis are estimated. In both cases, the demand variables do not exercise direct influence on prices, on the contrary costs of production control prices here as well (for further details see Rahmeyer 1985, pp. 315). So no difference between a high and a low concentrated industry sector with regard to the direct demand determination of prices could be detected. As a remarkable by-product, a below-average growth of output prices and an above-average growth of productivity in the high compared to the low concentrated sector of industries was discovered.

The third method implies a continuous relation between market concentration and price development. The concentration measure is explicitly taken into account as an additional variable besides demand and costs.

$$(6)\quad PNP = A\emptyset + A1 \cdot ULC + A2 \cdot UMC + A3 \cdot HERF$$

HERF = Herfindahl concentration index (1976).

[1] Cumulative share of industry sales accounted for by the three largest firms.

The econometric test is again conducted as a cross section analysis since indicators of market structure only produce small variations in time (and also no time series is available) (compare Feldmann 1984, p. 78). This approach assumes - among others - a uniform reaction of prices to market concentration across industries, independent of the price elasticity of demand (see Domberger, Smith 1982, pp. 198). Across the manufacturing sector as a whole no statistically significant impact of HERF could be detected, among the subsectors only in the case of the primary and producer goods industry was there a positive influence in the subperiod 1972-1980.

$$\underset{}{PNP} = \underset{(0,53)}{0,31} + \underset{(1,14)}{0,11}\ ULC + \underset{(10,19)}{0,64}\ UMC + \underset{(2,66)}{0,01198}\ HERF; \quad R^2 = 0.98$$

Surprisingly, in the highly concentrated sector, HERF does not exert a significant influence across industries whilst in the low concentrated sector it does, pointing at a non-linear relationship across the manufacturing sector.

$$\underset{}{PNP} = \underset{(-0,39)}{-0,18} + \underset{(2,59)}{0,29}\ ULC + \underset{(4,90)}{0,64}\ UMC + \underset{(2,40)}{0,01760}\ HERF; \quad R^2=0,88 \quad (1962\text{-}1980)$$

$$\underset{}{PNP} = \underset{(-0,25)}{-0,07} + \underset{(1,34)}{0,11}\ ULC + \underset{(6,28)}{0,90}\ UMC + \underset{(1,77)}{0,01427}\ HERF; \quad R^2=0,89 \quad (1962\text{-}1971)$$

$$\underset{}{PNP} = \underset{(-0,77)}{-0,41} + \underset{(3,52)}{0,40}\ ULC + \underset{(6,93)}{0,56}\ UMC + \underset{(2,55)}{0,01767}\ HERF; \quad R^2=0,93 \quad (1972\text{-}1980)$$

Just like the state of demand, the structure of markets too, is not given exogenously in the long run but should be viewed as endogenous (compare for this point the discussion of Schumpeterian competition). Another issue raised is that of the original importance of market concentration for market performance compared to firm or market share effects (see Schmalensee 1985, pp. 341; Scherer 1985, pp. 4). We do not go further into both questions in this place.

## 5. Concluding remarks

The theoretical and empirical analysis of industrial price and wage formation has arrived at the conclusion that output prices of industrial sectors are not directly demand determined but cost determined (unit labour and material costs). By the way of wage increases, changes in demand will on the other hand affect prices indirectly. Only the far- reaching economic recession in the early eighties has curbed the persistent wage and price inflation supported by a decline in raw material prices thus implying costs of disinflation.

Among the subsectors, the degree of market concentration affects prices additionally to production costs only in the primary and producer goods industry but not across the manufacturing sector as a whole, likeweise in the low concentrated sector of manufacturing (non- linear relationship). The positive correlation between the variability of relative output prices and the rate of inflation lends support to the hypothesis of a structure- oriented explanation of inflation. To endogenize capacity utilization and unemployment (as demand indicators) in a further step the wage- price model has to be extended to a complete macroeconometric model. Especially the importance of the money supply concerning industrial pricing needs a further explanation in a structural model of the manufacturing sector.

Bibliography

Addison, J., Burton, J. (1980), The demise of "demand pull" and "cost push" in inflation theory. Banca Nazionale del Lavoro Quarterly, No. 133, pp. 187.

Brown, A. J. (1985), World inflation since 1950. An international comparative study. Cambridge et al.

Brunner, K. (1974), Monetary management, domestic inflation, and imported inflation. In: R.Aliber (ed.), National monetary policies and the international financial system. Chikago, London, pp. 179.

Bruno, M., Sachs, J. (1985), Economics of worldwide stagflation. Oxford.

Coe, D. (1985), Nominal wages, the NAIRU and wage flexibility. OECD Economic Studies, No. 5. Paris, pp. 88.

Coe, D., Gagliardi, F. (1985), Nominal wage determination in ten OECD economies. OECD Working Papers, No. 19. Paris.

Dalton, J., Qualls, P. (1979), Market structure and inflation. The Antitrust Bulletin, Vol. 24, pp. 17.

Dean, J. (1980), Inflation: Where conventional theory falters. Columbia University and Simon Fraser University (mimeo).

DeRosa, D., Goldstein, M. (1982), The cross-sectional price equation: Comment. The American Economic Review, Vol. 72, pp. 876.

Domberger, S., Smith, G. (1982), Pricing behaviour - A survey. In: M.Artis et al. (eds.), Demand management, supply constraints and inflation. New York, pp. 192.

Earl, P.H. (ed.), Analysis of inflation, Lexington (Mass.).

Eckstein, O. (ed.) (1972), The econometrics of price determination. Washington D.C.

Eckstein, O. (1984), Foundations of aggregate supply price. The American Economic Review, Papers and Proceedings, Vol. 74, pp. 216.

Eckstein, O., Fromm, G. (1968), The price equation. The American Economic Review, Vol. 58, pp. 1159.

Feldmann, B. (1984), Unternehmenskonzentration, Marktmacht und Lohnniveau. Eine empirische Analyse für die Bundesrepublik Deutschland. Göttingen.

Fischer, St. (1981), Relative shocks, relative price variability and inflation. Brookings Papers on Economic Activity, Vol. 12, pp. 381.

Fischer, St. (1982), Relative price variability and inflation in the US and Germany. European Economic Review, Vol. 18, pp. 171.

Fischer, St. (1985), The problem of disinflation. Zeitschrift für Wirtschafts- und Sozialwissenschaften, 105. Jg., pp. 123.

Fischer, St. (1986), 1944, 1963 and 1985: Modiglianiesque macro models. NBER, Working Paper Series, No. 1797. Cambridge (Mass.

Frisch, H. (1973), Die Inflation der Gegenwart und ihre Ursachen. Wien.

Frisch, H. (1980), Die neue Inflationstheorie. Göttingen.

Frye, J., Gordon, R.J. (1980), The variance and acceleration of inflation in the 1970's: Alternative explanatory models and methods. NBER, Working Paper Series No. 551. Cambridge (Mass.)

Gordon, R.A. (1948), Short-period price determination in theory and practice. The American Economic Review, Vol. 38, pp. 265.

Gordon, R.J. (1976), Recent developments in the theory of inflation and unemployment. Journal of Monetary Economics, Vol. 2, pp. 185.

Gordon, R.J. (1981), Output fluctuations and gradual price adjustment. The Journal of Economic Literature, Vol. 19, pp. 493

Gordon, R.J. (1982), Price inertia and policy ineffectiveness in the United States, 1890-1980. Journal of Political Economy, Vol. 90, pp. 1087 (1982a).

Gordon, R.J. (1982), Why U.S. wage and employment behaviour differs from that in Britain and Japan. The Economic Journal, Vol. 92, pp. 13 (1982b).

Gordon R.J. (1982), Inflation, flexible exchange rates, and the natural rate of unemployment. In: M. Baily (ed.), Workers, jobs, and inflation. Washington D.C., pp. 89 (1982c).

Gordon, R.J. (1984), Supply shocks and monetary policy revisited. The American Economic Review, Papers and Proceedings, Vol. 74, pp. 38.

Gordon, R.J. (1985), Understanding inflation in the 1980s. Brookings Papers on Economic Activity, Vol. 16, pp. 263.

Guger, A. (1978), Der Inflationsprozeß bei administrierter Preisbildung und das Problem der Vollbeschäftigungspolitik. In: H. Frisch, H. Otruba (eds.), Neuere Ergebnisse der Inflationstheorie. Stuttgart, New York, pp. 124.

Hall, R. (1980), Employment fluctuations and wage rigidity. Brookings Papers on Economic Activity, Vol. 11, pp. 91.

Hay, D., Morris, D. (1979), Industrial economics. Theory and evidence. Oxford.

Helmstädter, E. (1982), Ordnungspolitische Probleme der Strukturberichterstattung. In: B. Gahlen (ed.), Strukturberichterstattung der Wirtschaftsforschungsinstitute. Tübingen, pp. 52.

Kloten, N., Ketterer, K.-H., Vollmer, R. (1985), West Germany's stabilization performance. In: L.Lindberg, Ch. Maier (eds.), The politics of inflation and economic stagnation. Washington D.C., pp. 353.

Koutsoyiannis, A. (1975), Modern microeconomics. London, Basingstoke.

Koutsoyiannis, A. (1977), Theory of econometrics, 2nd ed. London and Basingstoke.

Laidler, D. (1976), Inflation - Alternative explanations and policies: Tests on data drawn from six countries. In: K. Brunner, A. Meltzer (eds.), Institutions, policies and economic performance. Carnegie-Rochester Conference Series on Public Policy, Vol. 4. Amsterdam, New York, Oxford, pp. 251.

Laidler, D., Parkin, J. (1975), Inflation - A survey. The Economic Journal, Vol. 85, pp. 741.

Lee, F. (1984), The marginalist controversy and the demise of full cost pricing. Journal of Economic Issues, Vol. 18, pp. 1107 (1984a).

Lee, F. (1984), Full cost pricing: A new wine in a new bottle. Australian Economic Papers, Vol. 23, pp. 151 (1984b).

Lipsey, R. (1979), World inflation. The Economic Record, Vol. 55, pp. 283.

Maddala, G. (1977), Econometrics. New York et al.

Marquez, J., Vining, D. (1984), Inflation and relative price behaviour : A survey of the literature. Economic Perspectives, Vol. 3, pp. 1.

Muehlen, P. v.z. (1972), Discussion. In: O. Eckstein (ed.), The econometrics of price determination. Washington, D.C., pp. 125.

Nordhaus, W. (1972), Recent developments in price dynamics. In: O. Eckstein (ed.), The econometrics of price determination. Washington D.C., pp. 16.

Nordhaus, W. (1976), Inflation theory and policy. The American Economic Review, Papers and Proceedings, Vol. 66, pp. 59.

Okun, A.M. (1975), Inflation: Its mechanics and welfare costs. Brookings Papers on Economic Activity, Vol. 6, pp. 351.

Okun, A.M. (1980), Rational-expectations-with-misperceptions as a theory of the business cycle. Journal of Money, Credit and Banking, Vol. 12, Part 2, pp. 817.

Okun, A.M. (1981), Prices and quantities. A macroeconomic analysis. Oxford.

OECD (1982), International aspects of inflation. OECD Economic Outlook. Occasional Studies, pp. 5.

Perry, G. (1978), Slowing the wage-price spiral. The macroeconomic view. Brookings Papers on Economic Activity, Vol. 9, pp. 259 ff.

Perry, G. (1980), Inflation in theory and practice. Brookings Papers on Economic Activity, Vol. 11, pp. 207.

Perry,G. (1984), Reflections on macroeconomics. The American Economic Review, Papers and Proceedings, Vol. 74, pp. 401.

Pindyck, R., Rubinfeld, D. (1976), Econometric models and economic forecasts. New York et al.

Qualls, P. (1979), Market structure and the cyclical flexibility of price-cost margins. The Journal of Business, Vol. 52, pp. 305.

Rahmeyer, F. (1983), Sektorale Preisentwicklung in der Bundesrepublik Deutschland 1951-1977. Tübingen.

Rahmeyer, F. (1985), Marktstruktur und industrielle Preisentwicklung. IFO-Studien, 31.Jg., pp. 295.

Rahmeyer, F. (1986), Der Zusammenhang zwischen Lohn-, Produktivitäts- und Preisstruktur. Zeitschrift für Wirtschafts- und Sozialwissenschaften, 106. Jahr (on press).

Riese, H. (1986), Theorie der Inflation. Tübingen.

Sawyer, M. (1983), Business pricing and inflation. London, Basingstoke.

Scherer, F.M. (1985), Stand und Perspektiven der Industrieökonomik. In: G. Bombach, B. Gahlen, A.E. Ott (Hrsg.), Industrieökonomik: Theorie und Empirie, Tübingen, S. 3 ff.

Schmalensee, R. (1985), Do markets differ much? The American Economic Review, Vol. 75, pp. 341.

Schultze, Ch. (1985), Microeconomic efficiency and nominal wage stickiness. The American Economic Review, Vol. 75, pp. 1.

Scitovsky, T. (1978), Market power and inflation. Economica, Vol. 45, pp. 221.

Silberston, A. (1973), Price behaviour of firms. In: The Royal Economic Society, The Social Science Research Council (eds.), Surveys of applied economics, Vol. 1, London, pp. 45.

Solow, R. (1980), On theories of unemployment. The American Economic Review, Vol. 70, pp. 1.

Streissler, E. et al. (1976), Die Relativierung des Zieles der Geldwertstabilität. Göttingen.

Streissler, E. (1980), Kritik des neoklassischen Gleichgewichtsansatzes als Rechtfertigung marktwirtschaftlicher Ordnungen. In: E. Streissler, C. Watrin (eds.), Zur Theorie marktwirtschaftlicher Ordnungen. Tübingen.

Sylos-Labini, P. (1979), Review Article: Industrial pricing in the United Kingdom. Cambridge Journal of Economics. Vol. 3, pp. 153.

Tobin, J. (1972), The wage-price mechanism: Overview of the conference. In: O. Eckstein (ed.), The econometrics of price determination. Washington, D.C., pp. 5 (1972a).

Tobin, J. (1972), Inflation and unemployment. The American Economic Review, Vol. 52, pp. 1 (1972b).

Wied-Nebbeling, S. (1975), Industrielle Preissetzung. Tübingen.

Wied-Nebbeling, S. (1986), Sektorale Preisbildung und gesamtwirtschaftliche Preisstabilität. Tübingen.

Wilder, R., Williams, C., Singh, D. (1977), The price-equation: A cross-sectional approach. The American Economic Review, Vol. 67, pp. 732.

Wiles, P. (1973), Cost inflation and the state of economic theory. The Economic Journal, Vol. 83, pp. 377.

Winter, S.G. (1971), Satisficing, selection and the innovating remnant. The Quarterly Journal of Economics, Vol. 85, pp. 237.

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