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No. 27, 1980

CRISES, INFLATION AND RELATIVE PRICES IN SWEDISH INDUSTRY 1913-1977

by

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and
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October 1980

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Crises, inflation and relative prices in Sweden 1913-1977

In a market economy price signals guide decisions concerning the allocation of resources. During the 70'ies the price signalling function in Sweden has been subject to Government interference (price controls, industry subsidies etc). This has led to concern about how robust the price system of a market economy in fact is. Is there, at the end of the road, a point where the price system no longer works as an information system and the economy resorts to other information channels, with disastrous effects on efficiency.

This paper adresses the problem of price structure stability in Sweden in a long-term perspective.[1] After the seemingly trivial observation that movements in the general price level conceal a wide spectrum of diverging price movements, we briefly discuss the determinants of relative prices, defined as industry prices related to the general price level, in a dynamic transformation process, characterized by a movement from one set of disequilibria to another.

The rest of the paper concentrates on an empirical investigation of three problems:

1. How stable has the structure of industry prices been in Sweden 1913-1977?
2. Has there been any connection between changes in the general price level and the stability of the price structure?
3. What has been the behaviour of the price structure in periods of extreme imbalances or crises in the Swedish economy?

In an appendix the basic data and methods of measurement are presented.

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[1] In another paper "Priser och omvandling i svensk industri"! ("Prices and Transformation in Swedish Industry"), we have focussed on the relationship between relative price change and structural change over the period 1913-77.

Like most industrialized countries Sweden has experienced a shift upwards in the rate of inflation during the seventies. Since 1972 the increase in the general price level has exceeded 8 percent. This is not only the highest rate of inflation Sweden has experienced since the Korean boom in 1951, but also the longest peacetime inflationary period Sweden has experienced since the industrialization process started.

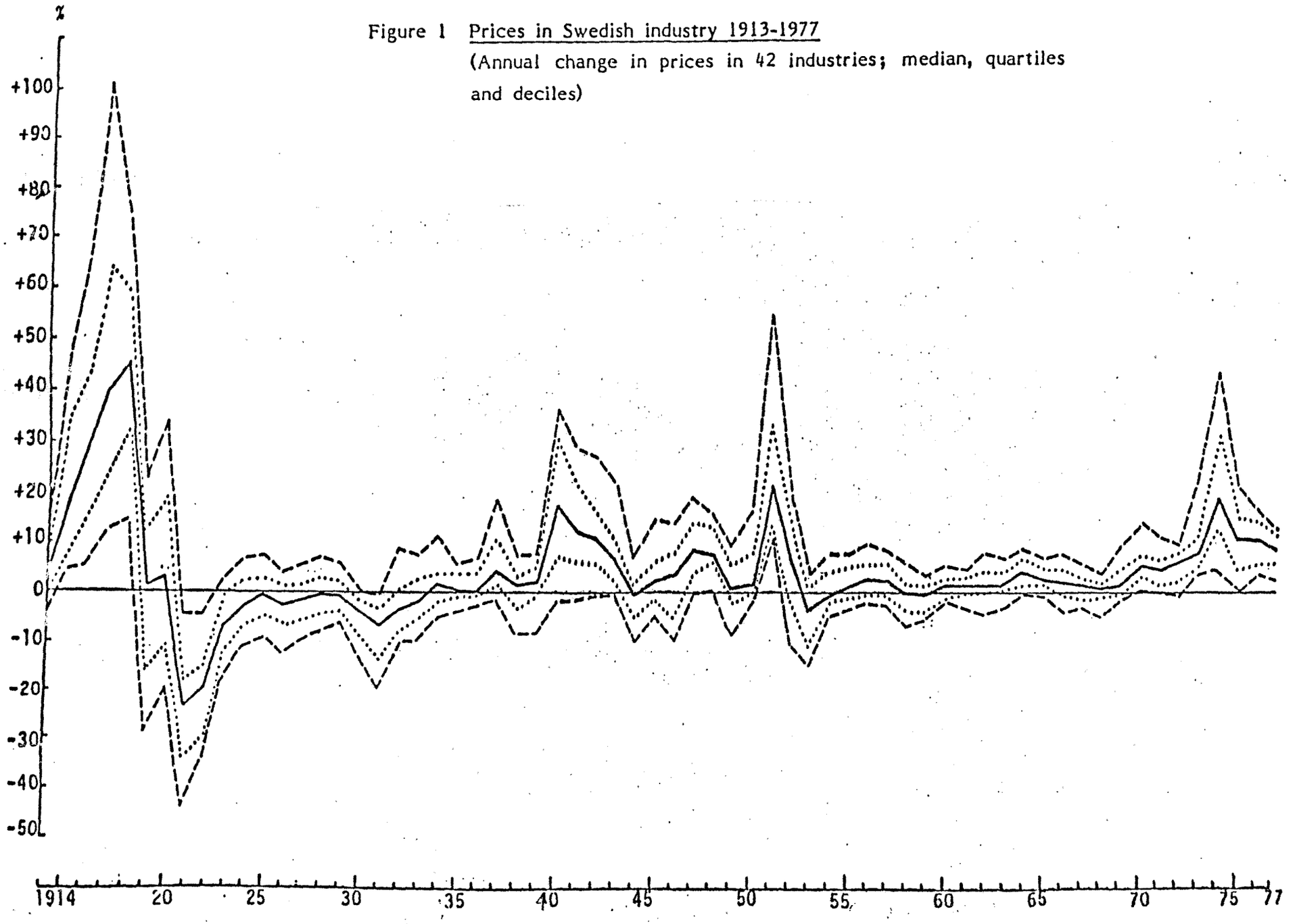
The price indices are, however, only rudimentary representations of what has happened to prices in the Swedish economy. The superficial impression that all prices have gone up by more or less the same percentage is clearly wrong. Price movements between 1970 and 1977 illustrate this. Industry prices went up 90 percent on average. In some industries prices went up much more, like for instance in the oil industry (+ 175 pc), the cement industry (+ 161 pc), the glass industry (+ 138 pc), the saw mills (+ 132 pc) or the candy industry (+ 130 pc). On the other hand prices in the mining industry only rose 47 pc, in the steel industry 54 pc, in the dairy industry 40 pc and in the milling industry 44 pc.

The seventies are of course not unique in this respect. On the contrary the whole period treated in this paper is characterized by strongly diverging price movements in different industries. A picture of this diversity is given in Figure 1, which shows the median, quartiles and deciles in yearly price changes in 42 industries. This, for instance, means that a point on the bottom curve delimits those four industries that experienced the lowest rate of change in prices that year.

Figure 1 illustrates that the simple figure on aggregate inflation conceals large differences among industries. It also points to the role of prices in the industrial transformation process. The fundamental task of the price system is to communicate information to the participants in the market process, producers as well as

Figure 1 Prices in Swedish industry 1913-1977

(Annual change in prices in 42 industries; median, quartiles and deciles)



customers. They need this information to be able to decide what to produce and how, as well as what to buy. The efficiency with which a working price system performs this task and coordinates the fragmentary knowledge possessed by the participants in the market process makes it indispensable in a working market economy.[1]

The relevant price signal, as to resource allocation, is, however, not the nominal increase in prices, but the change in prices related to the change in price on other commodities and factors, i.e. the change in relative prices. As to product price movements between 1968 and 1977 in, for instance, the machine industry the relevant price signal in this context is not that prices have gone up by 107 p.c. Since industry prices on average have increased by the same percentage relative prices in the machine industry were the same in 1977 as in 1968.

This paper focuses on relative prices as the most important part of the information system in a market economy. Changes in relative prices indicate a need to reallocate resources in one way or another. One question to ask is whether long run changes in the structure of relative prices should be expected at all. The spread in price development that we can observe in Figure 1 might be a result of instabilities in the price system and inertia in the structural adjustment process. To discuss this issue we start with a brief discussion of which factors decide the development of relative prices.

A characteristic feature of economic development is the movement from one set of disequilibria to another. Under certain as-

[1] See for instance Hayek, p 86.

sumptions and conditions given, we can, however, deduct equilibrium solutions at any point of time. We can also assume that these equilibria, although never attained in reality, indicate the direction in which the economy is heading in the long-run. In order to simplify the argument let us nevertheless start by assuming that the economy has reached a state of long-run equilibrium. All economic agents have full knowledge of tastes, technical possibilities, etc. All their expectations and actions are consistent with the unique constellation of prices and quantities that make up the equilibrium solution.

As to prices this means that on each product market the prices of the product correspond to the cost of production, including the cost of capital. This can also be expressed as

$$P_i = c_i$$

where $i = 1, 2, \ldots, n$

The cost to produce product i can be expressed as

$$c_i = \Sigma v_{ij} p_j$$

where

$i = 1,2,\ldots\ldots,n$

$j = 1,2,\ldots\ldots,m$

v_{ij} = requirement of factor j in the production of product i

p_j = price of factor j

Since in equilibrium, factor prices in a competitive economy are the same for all producers, the structure of relative costs and

hence the structure of relative prices will be determined by the amount of factors used in the production process, i.e. the productivity.

If we introduce technical change as an exogenous dynamic element in this static world, the equilibrium structure of relative prices will change over time. The change will reflect the impact of technical change on productivity in different industries. Via factor requirements the structure of relative costs will be altered and consequently the structure of relative prices. If a change in conditions is anticipated or becomes immediately known to everybody and the adjustment to it is immediate we will have a price structure moving along a path of equilibrium sets of prices. In Figure 2 this path is represented by α.[1] Consequently we will have long-run changes in relative prices even under these very restrictive assumptions.

An economy in equilibrium, consisting of omniscient units, who react but do not act, and immediately and painlessly adjust to changing conditions on the supply side, is however a poor representation of the reality we can observe. This is at least true in the context of the industrial transformation process and the role played by prices in the market process.

The economy is never in equilibrium. Furthermore, an equilibrium concept at the macro-level makes no sense once endogenous structural change has been introduced in the model. In a market system knowledge is fragmentary and far from complete. Plans

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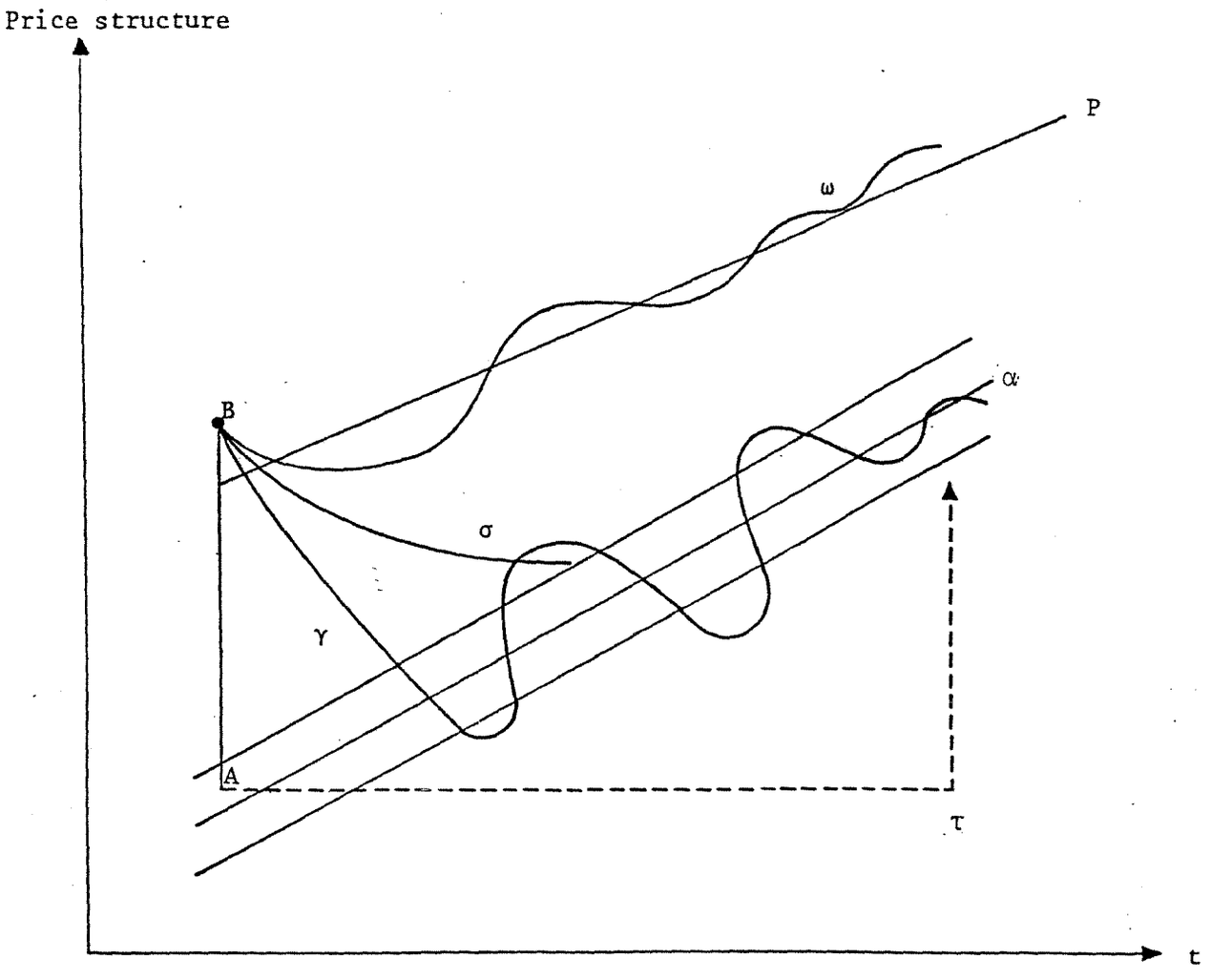
[1] A point in Figure 2 represents a set of all prices in the economy.

Figure 2. Price structure instability



are frustrated all the time. They are revised in accordance with the participants' interpretation of market signals, among which prices are the most important. How signals are conveyed to the participants from the market and how these react make up the market process.[1] Thus the adjustment to changing conditions is not an uninteresting parenthesis but maybe as important as the change itself. "A system - any system, economic or other - that at every given point of time fully utilizes its possibilities to the best advantage may yet in the long run be inferior to a system that does so at no given point of time, because the latter's failure to do so may be a condition for the level or speed of long-run performance."[2]

This means that we will have an incessant flow of disturbances in the price system, reflecting the alterations of plans in light of the outcome of yesterday's plans. Changes in the underlying conditions will also bring about disturbances. Still, even if we have no major disturbances we might still say that the price structure will oscillate around the equilibrium path α.

Major disturbances do, however, occur and move the price structure far from its equilibrium set. In figure 2 this is represented by the point B. This is a state of disequilibrium characterized by widespread ignorance. The path which the price structure follows from B towards a new set of equilibrium prices, either on the old equilibrium path α or on a new one is a process where the most important ingredients are learning and interpretation of market signals. This means that the way price signals are transmitted to the market participants and to what extent these signals

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[1] For an example of a model working with the market process as a micro-macro concept, see Eliasson (1978).

[2] Schumpeter, s. 83.

are allowed to influence the allocative decisions in the economy are essential ingredients in the market process. The degree of inertia in the economy will determine how long and how sluggish the adjustment process will be and consequently how big the costs of adjustment will be.

Given a structure of relative prices represented by A and a major disturbance, which moves it to B, how will the process of adjustment be reflected in relative prices? If the underlying equilibrium solution has not changed we should expect a gradual return towards α. How rapid is the process of adjustment and what are its characteristics? What track is chosen? Track γ in Figure 2 with repetitive overshooting phenomena or track σ with a gradual and smooth return?

Another question is whether we have reason to believe that the economy should return to the old equilibrium path α at all. The disturbance itself leads to feedback effects on the supply and demand sides. Demand patterns are altered and technical change is induced. The more sluggish the adjustment process the greater the feed-back effects and the more the economy will interppret the temporary disturbance as a long term phenomenon and make long-run adjustments to the new signals. In figure 2 this case is illustrated by the new equilibrium path ρ and the movement towards it by ω. We can illustrate this case by referring to the Swedish cost explosion in 1974-1975. Much of the discussion on economic policy in Sweden since then has focused on the need to return to the unit labour cost Sweden enjoyed relative to that of its competitors prior to the crisis. It is, however, not altogether clear what this means since Sweden's economy, to some extent at least, has adapted to the new cost situation. We cannot return to the situation prior to the crisis no matter how desirable this

would be. In terms of figure 2 we might say that the long-run equilibrium path has changed to ρ for the Swedish economy.

A special case is illustrated in figure 2 by τ, which shows a price structure gradually moving away from its equilibrium path. As a consequence of price-controls for instance, a price structure might be conserved, which is no longer even remotely consistent with the underlying productivity structure. If controls are abolished we should expect prices to adjust and move towards the equilibrium set of prices. This means that what we perceive as a strong shock to the price system might in fact be an adjustment.

Results

The total amount of price signals in the economy during one period is an indicator of the aggregate need to reallocate resources. We label this the reallocation_pressure in the economy during that period.[1] It is measured as the weighted sum of relative price changes in 42 industries[2].

Our first question concerns the stability of the price structure. Is the structure of relative prices in its movement over time characterized by a relatively stable walk along an equilibrium path like α in Figure 2? From Figure 1 we could notice that the general price level in the economy has meandered between 1913 and 1977. In general, prices in different industries have tended to follow. The question is, however, whether the spread in relative price movements has been more or less constant over time.

The results do not support this hypothesis. The variability of relative prices has varied considerably over time (Figure 3). The reallocation pressure has been especially great during the two

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[1] M. Josefsson, J. Örtengren: Priser och omvandling (IUI stencil 1980).

[2] Data and methods of measurement are given in Appendix.

world wars, including their prologues and aftermaths, as well as during the stagflationary crisis of the seventies. On the other hand, the great depression of the thirties did not represent a great upheaval on the price structure in Swedish industry.

A related question is whether these results merely reflect a short-run instability in the price system and would disappear if price movements are accumulated over a longer period of time. We have done this for five-year-periods. The results are also presented in Figure 3. The differences between the curves illustrate that many relative prices were associated with short-run phenomena. Nevertheless, the characteristics of the one-year-curve (RPS 1) remain in the five-year-curve (RPS 5).

Our second question is whether the variability in relative prices is connected with changes in the general price level. Our data sustain this hypothesis for Sweden. There is a strong correlation between fluctuations in the general price level and the spread in relative prices. This relationship holds on a five-year basis as well as on a one-year basis.

The inflationary periods have coincided with periods of extreme imbalances in the Swedish economy. We have characterized them as crises. In each crisis, the Swedish industry has had to adapt to radically changed conditions. In terms of Figure 2 we might say that the price structure has been subject to a shock which has moved it far from its equilibrium path. In this paper special interest is attached to the development of relative prices during and after these crises. Can we distinguish repetitive patterns? Can the crises be characterized as "bubbles" that only temporarily moved the set of relative prices from its equilibrium set, or did they have long-run implication for the resource allocation among industries?

The picture given by our data is that price movements during these crises to some extent included overshooting phenomena but also a very considerable structural element. The crises have begun with a rapid increase in the rate of inflation coinciding with turbulent relative price movements. There has, however, been a tendency to return towards the pre-shock price structure once the general price level has stabilized. The tendency to return to the original structure of relative prices is, somewhat surprisingly, stronger for the stagflationary crisis of the seventies than for the earlier crises.

Price structure stability in Swedish industry 1913-1977

The first thing to establish is whether the structure of relative prices has been stable and if not the characteristics of its movements. In figure 3 relative price change dispersion over one-year and five-year periods is shown.

It is clear from the figure that the price structure has in fact been far from stable. Furthermore, the instability itself has varied considerably. Periods with large shifts in relative prices can be distinguished. To a large extent these periods coincide with great upheavals in the international economic order like for instance the world wars which have radically changed demand and supply curves. It is also obvious that these changes in conditions did not reflect technical change.

World War 1 and the following deflationary crisis in Swedish industry was characterized by an extreme instability in the structure of relative prices. After that relative prices were comparatively more stable until the end of the 30'ies. The great depression during the first years of the 30'ies seems to have had minor effects on relative prices in Sweden. This is well in line with other findings that this crisis had much less impact on long run resour-

ce allocation than the crisis in the beginning of the 20'ies.[1] World War II and its aftermath represented a new period with considerable shifts in the structure of relative prices. This development culminated in the Korean boom in 1951. A stabilization of the price structure followed up to the stagflationary crisis of the 70'ies which has led to a new hump in the curves.

A comparison between the one-year curve and the five-year-curve shows that many of the changes in relative prices have been temporary and disappear when we study relative price dispersion over five year. Nevertheless, the characteristics of the curves remain the same.

Inflation and relative prices in Swedish industry

Inflation means noise in the information content of a price signal. It becomes more difficult to differentiate between changes in nominal prices and changes in relative prices, which are the relevant ones as regards to reallocation decisions. Nevertheless, it has been widely arglued among economists that we have no reason, a priori, to expect that changes in the general level should have an impact on the structure of relative prices or vice versa. In a Walrasian world the general price level is just a multiple by which the equilibrium set of prices should be multiplied.[2] On the other hand, it has for instance been popular among policymakers to blame much of the inflation of the 70'ies on rising oil prices.

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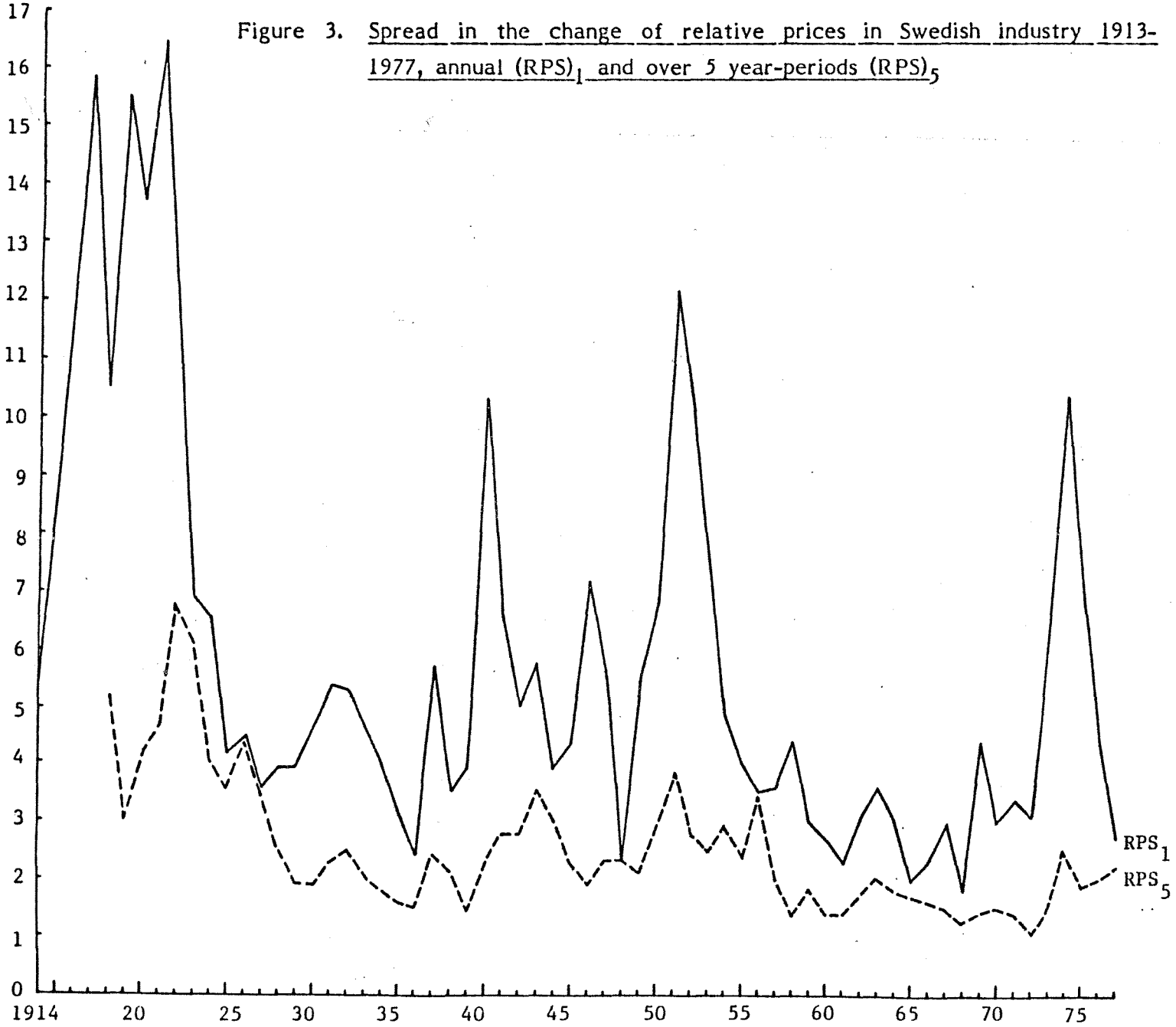
[1] Teknik och industristruktur, IUI-IVA 1979.

[2] Patinkin p 131. For some illuminating references see also Vining & Elwertowski.

Figure 3. Spread in the change of relative prices in Swedish industry 1913-1977, annual $(RPS)_1$ and over 5 year-periods $(RPS)_5$



Empirical findings, however, seem to support that there is a connection between changes in the general price level and changes in the structure of relative prices although it is far from clear what the direction of the causality should be. The relationship was pointed out already in 1927 by Mills and tested again by Graham in 1930. To our knowledge the issue was not raised again until the middle of the 60'ies when Gleiser (1965) tested and found a strong correlation between the rate of inflation and relative price dispersion. During the 70'ies similar conclusions have been reached by for instance Parks (1978)and Vining & Elwertowski (1976).

It is not difficult to find arguments that support the hypothesis that movements in the general price level should have considerable effects on relative prices. Different markets react with different speed to an inflationary pressure. An economy consists of a multitude of markets ranging from goods where prices are adjusted daily, to markets where prices are set according to complicated administrative routines. The latter type can be illustrated by markets where prices are decided upon in long term contracts or where prices can be adjusted only after negotiations with the authorities.[1] The multitude of price setting procedures in an economy means that we should expect at least a temporary shift in relative prices even if we could apply an inflationary pressure evenly over the economy. It can also be expressed as different markets having different response coefficients as to an inflationary pressure. Furthermore, demand patterns are altered in times of rapid inflation. In order to protect themselves as far as possible from the effects of rising prices economic agents try to keep the real value of their assets. Therefore we should expect an increase in the demand for durable goods and for raw materials, that can be kept in stock, relative to the demand for other products. Thus the demand for different goods should have different elasticities with regard to the rate of inflation.

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[1] See for instance J.M. Clark, p. 104.

Another point is that in inflationary periods it becomes more difficult to identify changes in relative prices. Consumers and producers become less sensitive to nominal price signals. The supply and demand curves become less elastic. A given change in demand or supply will then generate a greater spread in relative prices.

A rise in the general price level, regardless of its origin, might result in a claim for compensating wage increases. In Sweden this would probably take the form of wage drift. Depending on the relative bargaining power between labour unions on one hand and employers on the other, the rise in costs will be different in different industries. This will lead to changing relative prices.

So far we have assumed that the main direction of causality is from inflation to shifts in relative prices. Proponents for the opposite causality, that is that changes in relative prices initiate inflation, have, however, also a strong case. Their main argument is the existence of structural imbalances and the stickiness of prices in the downward direction. An economy characterized by structural imbalance, which is more or less the case of all economies, is by definition an economy where prices and costs do not clear each market, including the foreign trade sector. This means that prices tend to rise on markets with excess demand. If, however, prices are sticky downwards, we do not get a corresponding fall in prices on markets with excess supply. The result will inevitably be a rise in the general price level.

A related issue is that more rapid inflation tends to increase the variability in the rate of inflation. This hypothesis has recently been tested by Foster (1978)and Logue-Willett (1976)with the aid of cross-section analysis on a sample of countries. Their findings support the hypothesis. Neither can it be rejected on the basis of our data on Swedish industry either. The coefficient of correlation between absolute change in the general price level (DP1) and fluctuations in the rate of inflation (VP_1) is 0.44.

This has implications for the behaviour of relative prices. Expectations as to the rate of future inflation will differ widely among economic agents. Furthermore the element of uncertainty in expectations will also increase. Since individual prices are set on the basis of these expectations, an increase in the variability of relative prices is likely to occur.

The relationship between changes in the general price level and changes in relative prices for Swedish industry is illustrated in Figure 4. It shows the aggregate annual change in relative prices (RPS_1) and the absolute annual change in industry prices. No distinction is consequently made between inflation and deflation.

The superficial impression one gets from the figure is that there has been a connection between the two variables. This is supported by the results reported in Table 1. The simple correlation coefficient between the spread in relative price change (RPS_1) and the absolute change in industry prices (DP_1) is given. The coefficient is 0.72 which is strongly significant.[1] The correlation coeffi cient between RPS_1 and fluctuations in the rate of inflation (VP_1) is even stronger with a coefficient 0.76.

If we take a step further and estimate a linear regression where the spread in relative price change (RPS_1) is regressed on the absolute change in the general price level (DP_1), the variability of the rate of inflation (VP_1) and a trend factor (T), we get the result in Table 2.

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[1] For 64 observations a correlation coefficient of 0.25 is sufficient for significance at the 5 % level.

Figure 4. Annual change in prices for industrial products, absolute value (DP_1) and relative price change dispersion for 42 industries (RPS_1), 1913-1977 (%)

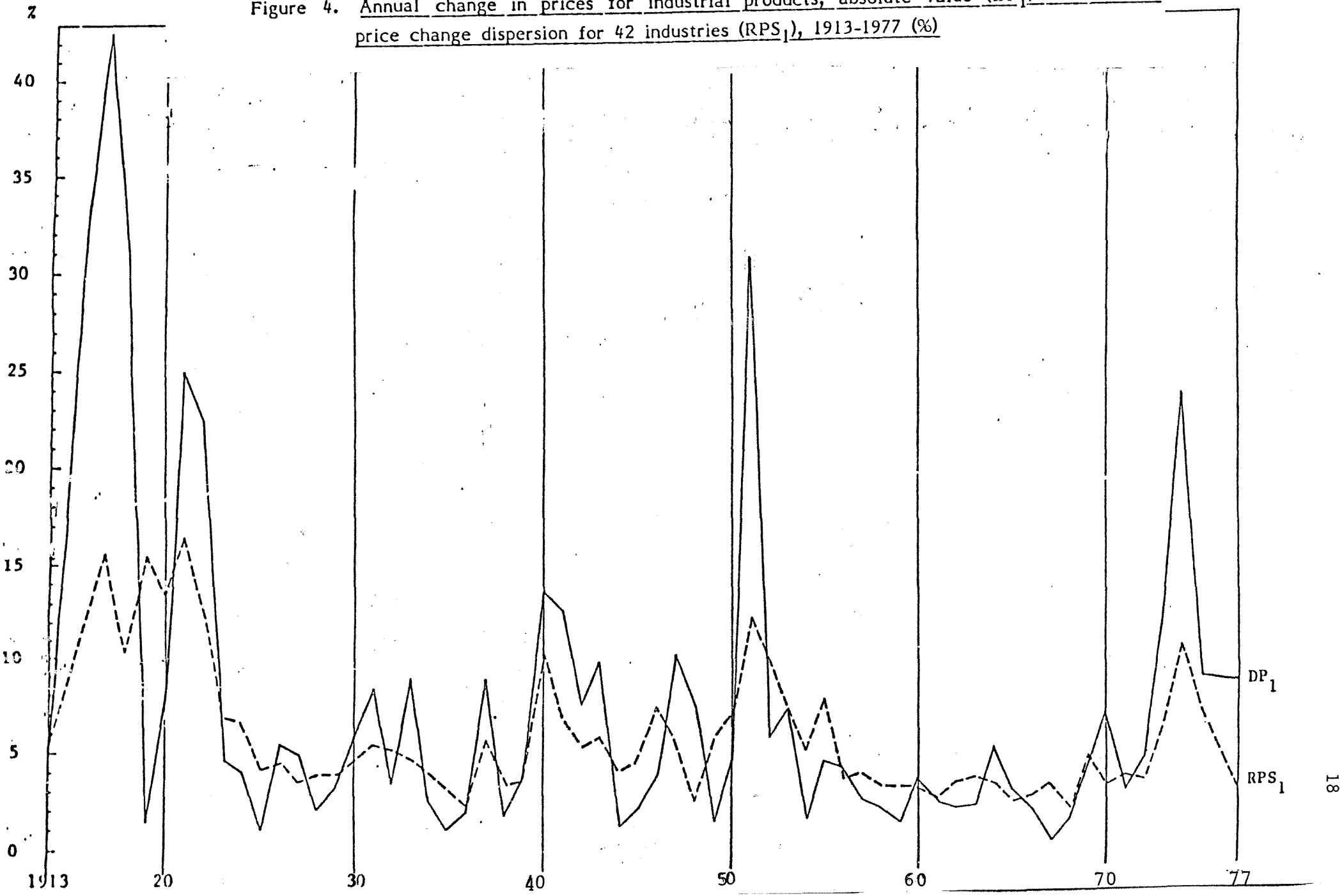

Table 1. Correlation between annual relative price dispersion (RPS_2), annual change in industry prices, absolute value (RDP_1) and annual change in the rate of inflation (VP_1)
(64 observations)

	RPS_1	DP_1	VP_1
RPS_1	1	0,72	0,76
DP_1	0,72	1	0,44
VP_1	0,76	0,44	1

Table 2. Linear regression with annual relative price dispersion (RPS_1) as dependant variables and annual change in industry prices, absolute value (DP_1), annual change in the rate of inflation (VP_1) and a trendfactor (t) as independent variables

Dependent variable	Independent variables					
RPS_1	Constant	DP_1	VP_1	Trend	DW	R^2
	0,0432	0,1679	0,2355	-0,0004	1,545	0,797
	(7,87)	(6,6)	(7,60)	(-3,78)		

(Student t-values in parenthesis, R^2 corrected for degrees of freedom)

Relative prices and reallocation - short-run or long-run

The fundamental role of the price system is to transfer information needed by the participants in the market process - producers as well as consumers - to decide what to produce and in what way. The relevant content of the price signals in this capacity is relative prices, like for instance, the price of oil relative to that of coal, the price of labour relative to that of capital, the price of engineering products relative to that of textile products etc.

We have seen that as the rate of inflation increases it tends to become more variable over time. We have also seen that there is a strong tendency for price signals to diverge more, i.e. the spread in relative price changes to increase. Sometimes the changes in relative prices are temporary and reflect instabilities in the price system. When this is the case and the original relative price is quickly reestablished there is no need for the participants in the market process to make any long-run adjustments to the new temporary relative price. If, however, the new relative price reflects long-run changes in the conditions for the market process, we have a reallocation pressure.

Under general equilibrium assumptions there is an immediate adjustment. Reality is, however, more complicated. The decisions to reallocate depend on whether the participants in the market process perceive the new relative price as temporary or permanent. A reallocation pressure is created if the change in relative price is conceived as a long-run phenomenon. This can be fictitious if expectations are frustrated and the old relative price is reestablished. When, for instance, the Swedish steel industry interpreted the rise in 1973 in the relative price of steel as a long-run phenomenon and started to invest heavily, it became the victim of a mirage. On the other hand, we have a real reallocation pressure-if the interpretation was correct.

For a change in relative price to be perceived as a long-run change the time lapsed is of course crucial. A reallocation pressure will hardly arise if for instance a rise in the relative price on a product one year is wiped out the next year. On the other hand the more time that passes the more the participants will see the new price signals as permanent and start to make long-run adjustments to them. The choice of period when studying whether a reallocation pressure has had time to arise or not is rather arbitrarily. We have chosen to start with five-year-periods.

In order to analyze the structural content of the price signals we have calculated relative price changes over five-year-periods (RPS_5) for the period 1918-1977. This measure is shown in figur 5 together with the arithmetic mean of absolute changes in industry prices on a five-year basis (DP5)[1]. These variables are analogous to the price variables on a yearly basis presented above. A comparison between the one-year-curve and the five-year-curve on relative prices shows that many of the changes in relative prices were temporary and disappear when we study a five-year period. Nevertheless the characteristic features remain.

The connection between relative price dispersion and changes in the general price level also remains strong. As we can see from Table 3 the coefficient of correlation between these two variables is 0.679 on a five-year basis. The hypothesis that a high rate of inflation also means greater variability in the rate inflation is also supported. The coefficient of correlation between these variables on a five-year basis is 0.895, i.e. considerably higher than

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[1] See appendix.

Figure 5. Change in industry prices, absolute value (DP_5) and relative price change dispersion (RPS_5) over five-year periods
(42 industries, % per year)

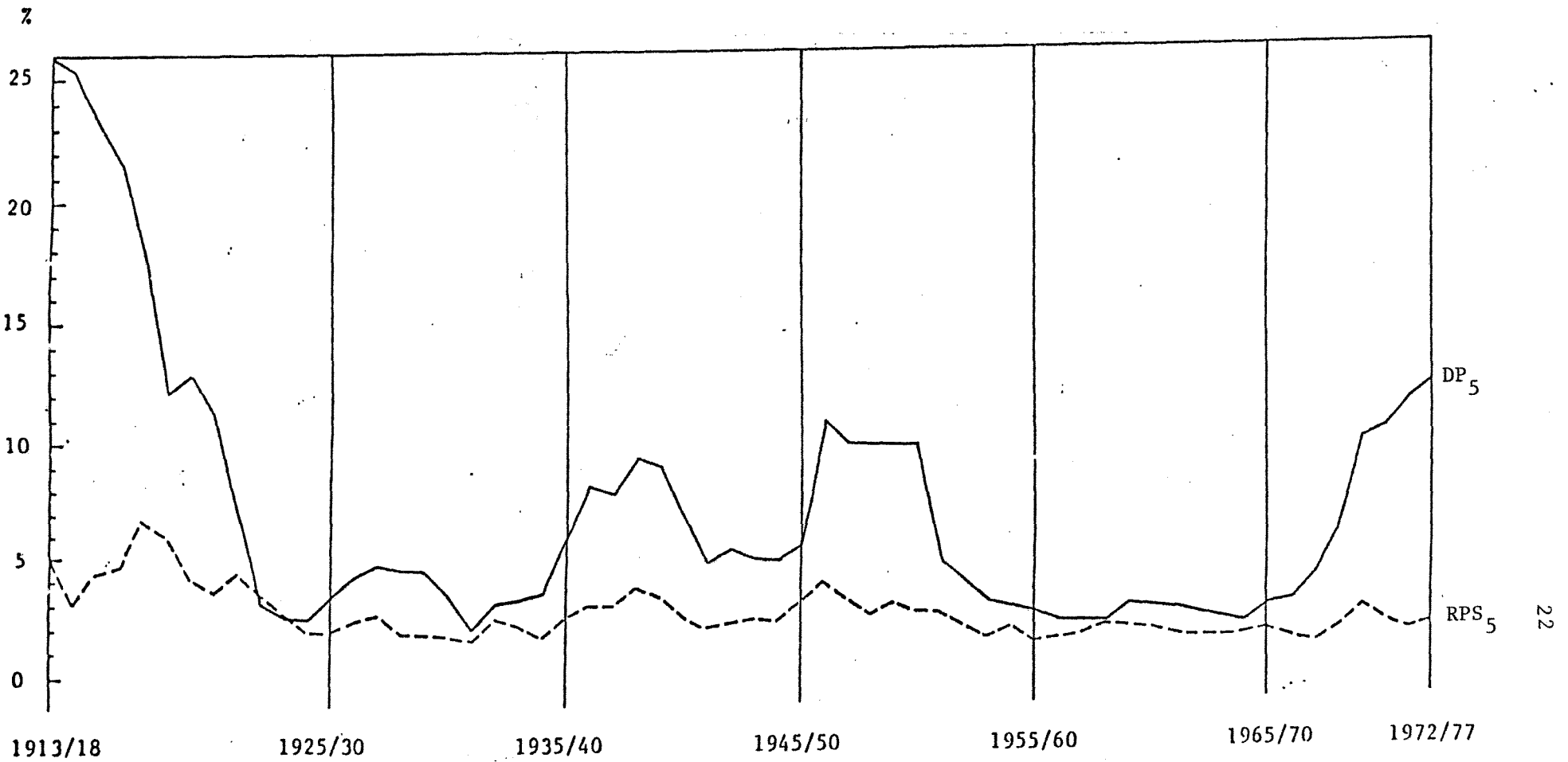

Table 3. Correlation between relative price change dispersion (RPS_5), change in industry prices (DP_5) and variability in the rate of inflation (VP_5). All variables on a five-year basis
(% per year)

	RPS_5	DP_5	VP_5
RPS_5	1	0,68	0,80
DP_5	0,68	1	0,90
VP_5	0,80	0,90	1

Table 4. Linear regressions with relative price change dispersion (RPS_5) as dependent variable and change in industry prices, absolute value (DP_5), variability in the rate of inflation (VP_5) and a trend factor (t) as independent variables. All variables on a five-year basis.

Dependent variables	Constant	Independent variables				
		DP_5	VP_5	Trend (t)	DW	R^2
RPS_5	0,0255 (8,475)	0,1038 (5,356)	-0,003	0,895 (-4,417)	0,5839	
RPS_5	0,0220 (8,491)		0,0360 (7,984)	-0,0002 (-3,906)	1,247	0,7047
RPS_5	0,0224 (8,602)	-0,0389 (-1,1806)	0,0453 (4,987)	-0,0003 (-3,921)	1,308	0,7067

(Student t-values in parenthesis, R^2 corrected for degrees of freedom.)

on a yearly basis. We also find a strong correlation between the spread in relative price changes and the variability in the rate of inflation. As we can see from Table 4 we obtain a better estimate of the linear relationship between relative price changes and inflation variability than between price changes and the changes in the general price level. If both variables are considered variability takes over completely as explanatory variable (3). This is of course due to the strong correlation between the two independent variables.

Crises and relative price movements

We have concluded above that some periods in the history of Swedish industry have been characterized by larger changes in relative prices than other periods. These periods are the two world wars including their preludes and aftermaths, the Korean boom in 1951 and the stagflationary crisis of the 70'ies. The economy was characterized by extreme imbalances during these periods. The discussion above has indicated that they were not just temporary bubbles. They had a considerable structural content. This meant that these price signals indicated needs for long-run adjustments. We have labelled these periods crises and see them as shocks that moved the structure of relative prices in industry far from equilibrium. Their implications for price structure stability is of particular interest in connection with the KRAN-project. What, for instance, was the time profile of aggregate relative price changes? Can we identify repetitive patterns?

In order to explore these questions we want to study how the price structure developed during and after the crises in compari

son with the price structure prior to the crises. We have, somewhat arbitrarily chosen 1913, 1920, 1939, 1950, and 1972 as base years, that is the price structure with which we wish to compare relative price changes. Starting from these years we have accumulated relative price changes 20 years onwards. The behaviour of this measure RPS_{ACC}[1] is illustrated in figure 6. It shows how the structure of industry prices evolved 1913-1933, compared to the price structure of 1913. Price dispersion increased up to 1918 when relative price change in industry averaged 26 per cent. After that the price structure started to move towards the structure of 1913. The movement was interrupted in 1920-1921 and resumed again in 1922. The relative prices of 1913 were, however, not reestablished. If this had been the case, RPS_{ACC} would have been 0 that year. As it happened, the movement towards pre-war relative prices ceased in 1927 at a relative price change of some 15 percent on average.

The behaviour of the price structure is shown in Figure 8. The measure can serve as an alternative way to study the question whether relative price changes have been short-run phenomena or not. Did the structure of relative prices rapidly return to the structure they had before the economy was hit by an inflationary, or deflationary, shock with consecutive relative price changes, or did the diverging price movements also contain structural elements and thus create a reallocation pressure in the Swedish economy. If price shocks were temporary phenomena, the curve over accumulated relative price change should rapidly move towards zero or towards a long-run trend of relative price change. When

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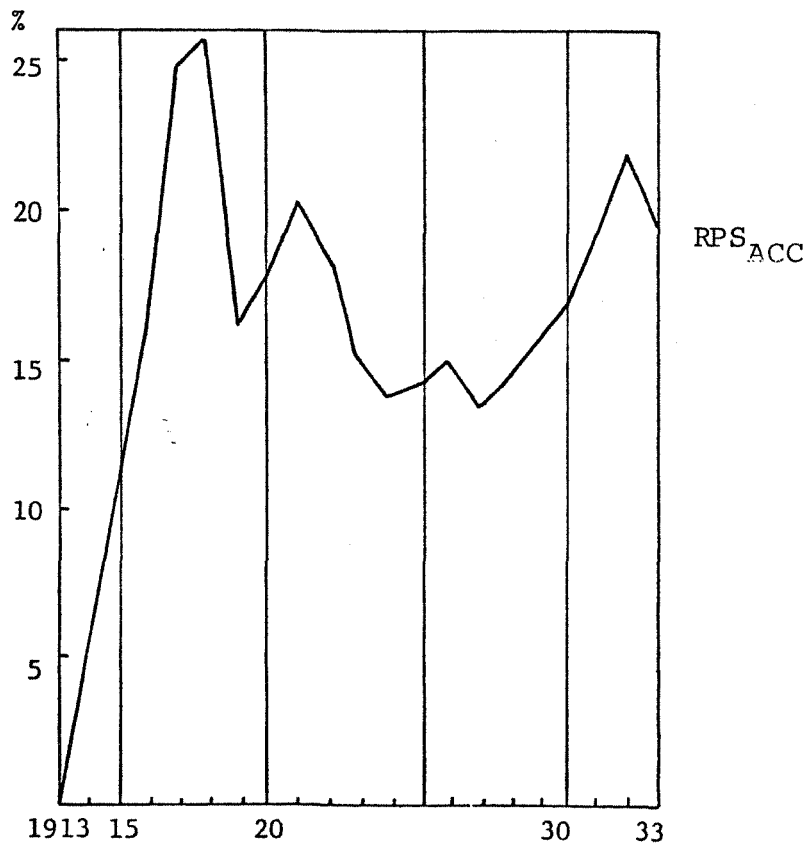
[1] See appendix.

Figure 6. Accumulated change in relative prices 1913-1933 (% per year)



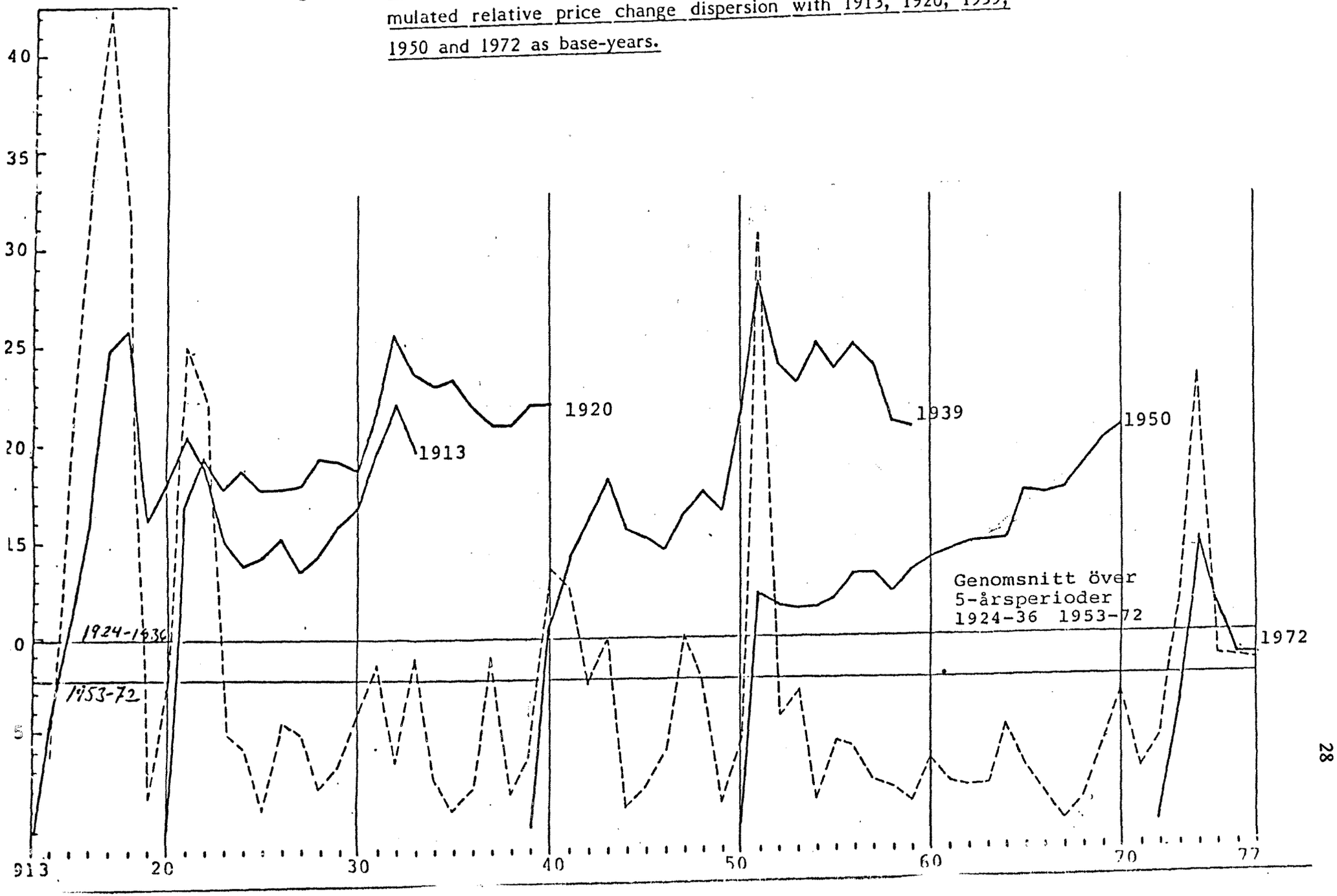
interpreting Figure 7 we have some conceptual problems since, regardless of external shocks, there is a continuous change in relative prices reflecting productivity changes. In order to give a standard of reference average relative price changes over five year periods for 1924-1936 and 1953-1977 are shown in the figure.

The curve with 1913 as base year shows the effect of World War I on relative price development. The outbreak of the war led to considerable shifts in relative prices. The accumulated relative price change increased up to 1918. This period was also characterized by very high rates of inflation, on average 25 percent per year. These price movements reflected the abnormal situation the Swedish economy experienced in the shadow of the war on the continent.

It is obvious that much of these very large changes in relative prices could be labelled as reflecting long-run shifts in the composition of demand, provided that the war continued. As has been stated above the change in relative prices 1913/1918 was 26 % whereas average five-year change 1924-1936 was about 8 %. It was a question of adapting to a war economy or rather to an economy in a state of alert. This was done in an inflationary boom with a rapidly increasing degree of speculation.

On the other hand, much of the price signals were attributable to the extraordinary demand and supply conditions of World War I. The fact that Swedish industry made long-run adjustments to them meant that once the war was over, a painful readjustment to peace-time conditions started. Considerable sectors of the Swedish industry had small chances of surviving this readjustment. A certain movement in relative prices towards the structure of 1913 was initiated in 1919 and the rate of inflation decreased

Figure 7. Annual change in industry prices, absolute value (DP_I) and accumulated relative price change dispersion with 1913, 1920, 1939, 1950 and 1972 as base-years.



markedly. Comprehensive stock replenishment delayed the readjustment crisis. At the end of 1920, however, prices started to fall. The deflation culminated in 1921 when the prices of industrial goods on average fell by 25 percent and by another 22 percent in 1922.[1]

So far, this is the most severe crisis Swedish industry has experienced. As to relative prices we can see from the 1913-curve that some movement towards the price structure of the base year occurred. This continued in 1922-1924 when the general price level had stabilized. Nevertheless, if we summarize the accumulated changes in relative prices World War I and its aftermath meant far greater changes, also long-run changes, than any other period during the 20th century.

If we study the curve starting in 1920 it gives a slightly different picture of the deflationary crisis as it has been called. The very large changes in relative prices that occurred in 1921-1922 were structural and between 1922 and 1930 the structure of relative prices underwent small further changes in relation to the structure of 1920.

The rest of the 20'ies and the beginning of the 30'ies was characterized by deflation. Not until the middle of the 30'ies did prices began to rise instead of fall.

The next wave of inflation started in connection with the outbreak of World War II in 1939. We have chosen this as the base year of our next curve. Just like during World War I Swedish industry had to face an adaptation to a "war economy" This was much better handled than during the preceding war partly be-

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[1] Note that we depict absolute price changes in the figures. For nominal price changes see figure 1.

cause of better management on behalf of the authorities but also partly because the conditions were different. Swedish industry had a much larger home market to lean on and was to a much larger extent directed towards it. Furthermore it had experienced more than 15 years of consolidation, albeit from a weak position, instead of hectic growth with a considerable element of speculation in it like in the beginning of the century. Altogether Sweden had a much more stable and mature industrial sector.

Nevertheless, it is remarkable how seemingly smoothly Swedish industry adapted to the great changes in relative prices. Under wartime conditions most of these price signals must be considered as being structural, that is expected to persist. Thus they created a strong reallocation pressure. This is indicated by the 1939-curve which shows that price dispersion was great and cumulative during the first half of the war. A comparatively high rate of inflation was also a characteristic feature. In 1944 prices stabilized and three years of gradual movement of the price structure towards that of the base year took place.

At the end of World War II Swedish economic policy was geared to meet a structural crisis like the crisis of the 20'ies. It never materialized, however, and the economic development was, on the whole, entirely different. The Swedish economy obviously adjusted very easily to post-war conditions. As to relative prices they showed no tendency to return to the prewar structure like they did after World War I. On the contrary the 1939-curve over accumulated changes in relative prices indicates a movement still further away from the price structure of 1939. Furthermore, it was a price movement that, on the whole, was extremely favourable for the Swedish industry, reflecting the unique competitive position it held after the war.

This development peaked in the strongly inflationary Korean boom of 1951. It was also characterized by rapidly shifting relative prices. The label "crisis" on the Korean boom can seem somewhat surprising. The price signals, however, had a strong structural

content as can be seen from the curve over accumulated price changes starting in 1950. They created a reallocation pressure with far-reaching long-run consequences for the development of Swedish industry. We can identify a small tendency to reestablish the price structure of 1950. It is small, however, and most of the relative price changes represented long-run shifts.

From the middle of the 50'ies we have almost 20 years of smooth, gradual accumulated change in the price structure relative to the structure in 1950. The curve seems rather compatible with the hypothesis that in an economy that is not subject to strong external shocks, relative prices tend to oscillate around an equilibrium path in accordance with the underlying productivity change. There seems, however, to be an increase in the rate of change from the middle of the 60'ies.

In 1973 inflation gathered speed once more as the stagflationary crisis deepended. Also relative price changes increased as can be seen from the curve with 1972 as the base year. This development was reinforced in 1974. As the rate of inflation decreased in 1975-1977 there was a marked return of relative prices towards the structure of 1972. This implies that most of the changes in relative prices that we experienced in 1973-1975, were not long-run shifts. In this respect the stagflationary crisis of the 70'ies differs markedly from the earlier economic crises. Furthermore, and perhaps more surprisingly, it implies that with regard to prices, the latest crisis has meant less need to reallocate resources than earlier crises. The accumulated change in relative prices in the five year period 1973-1977 is insignificantly above the postwar average. This is a somewhat puzzling conclusion bearing in mind the considerable structural problems in large parts of Swedish industry today. A sombre interpretation would be that large sectors of Swedish industry have, with the aid of government subsidies, lost their ability to reallocate even when facing "normal" changes in relative prices.

In conclusion we can state that Swedish industry has experienced several external shocks meaning dramatic changes in the conditions under which Swedish industry worked. These periods also meant turbulent price movements. This has been true for average prices as well as relative prices. The crises have begun with a rapid increase in the rate of inflation (or deflation), coinciding with very large shifts in relative prices. To some extent these changes in relative prices have been short-run phenomena. There has been a tendency to move towards the original price structure rather soon. This movement has started when the general price level has stabilized. The "return cycle" has also been comparatively short - two to three years. Thus we can identify a tendency to return to pre-shock price relations. It might reflect some overshooting effects on behalf of the participants in the market process. With the exception of the stagflationary crisis in the 70'ies the strong shifts in relative prices in the crises contained a considerable structural element. This is no surprise considering the upheavals they reflected.

Appendix

The analysis is based on data showing how prices have developed in 42 industries 1913-1977.[1] These price series have been aggregated into a producer price index for industrial goods. The index formula used is a Divisia-index formula. This means that changes in prices in different industries between year t and year t+1 have been weighted according to their shares of the total production value of manufacturing industry in year t[2] When henceforth reference is made to the general price level or price on industrial products we have this price index in mind.

A measure of the dispersion of relative price changes (RPS) is computed on the basis of this aggregated price index and the price series for different industries.

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[1] The statistical material is presented in Josefsson & Örtengren: Priser och omvandling. IUI, stencil 1980.

[2] $$P_t = P_{t-1} \cdot \sum_{j=1}^{42} \left(\sigma_{j_{t-1}} \cdot \frac{P_{jt}}{P_{j_{t-1}}} \right).$$

where

P = price index total manufactuiring and mining industries

P_j = price index, bransch

σ_j = share of production value of manufacturing and mining industry for branch j.

a. Relative price dispersion (RPS)

$$RPS_{x_t} = \frac{1}{x} \sum_{j=1}^{n} \sigma_{j_{t-x}} \left| \left(\frac{P_{j_t}}{P_{j_{t-x}}}\right) / \left(\frac{\bar{P}_t}{\bar{P}_{t-x}}\right) - 1 \right|$$

where

x = The length of period (here 1 and 5 years)

$\sigma_{j_{t-x}}$ = The share of branch j in the total production value of manufacturing and mining industry in year t

P_j = Price index for branch j

$\bar{P}$ = Price index for industrial products

b. Accumulated relative price dispersion (RPS)

$RPS_{ACC_{t-(t+x)}}$ = Accumulated relative price dispersion between the base year t and year t+x

$$RPS_{ACC_{t-(t+x)}} = \sum_{j=t}^{n} \sigma_{j_t} \left| \left(\frac{P_{j_{t+x}}}{P_{j_t}}\right) / \left(\frac{\bar{P}_{t+x}}{\bar{P}_t}\right) - 1 \right|$$

where

$x = 1, 2, 3, \ldots 20.$

c. Change in the prices of industrial products, absolute value (DP)

1. DP_{1_t} = Annual change in the price index for industrial products, absolute value

$$DP_{1_t} = \left| \dot{P}_t \right|$$

$\dot{P}$ = Annual rate of change in industry prices, per cent

2. DP_{5_t} = Average change over 5-year periods in the price index for industrial products, absolute value

$$DP_{5_t} = \frac{1}{5} \sum_{i=t-x}^{t} \left| \dot{p}_t \right|$$

d. Variability in the rate of change in the price index for industrial products (VP)

1. VP = Annual variability in the prices of industrial products

$$VP_{1_t} = \left| \dot{p}_t - \dot{p}_{t-1} \right|$$

2. VP = The variability in the prices of industrial products over 5-year periods

$$VP_{5_t} = \sum_{i=t-5}^{t} \left| \dot{p}_i - \sum_{i=t-5}^{t} \dot{p}_i/5 \right|$$