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The Swedish Phillips Curve

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The Swedish Phillips Curve

Introduction*

This article illustrates the relationship between unemployment and changes in wage rates in Sweden in the 20th century using a number of charts and calculations. The discussion is based on the so-called Phillips curve, which indicates a negative correlation between changes in nominal wage rates and unemployment. The emphasis in the article is on a description of fluctuations in employment and the level of wages, illustrated with the aid of charts.

The Phillips Curve

The discussion during the 1960's and 1970's of the relationship between unemployment and inflation centered on the so-called Phillips curve. This was named after an investigation published in 1958 by A. W. Phillips, which showed a negative relationship between changes in nominal wage rates and the level of unemployment in the UK during the years 1861—1957.¹⁾ According to the Phillips curve, a low level of unemployment is associated with positive changes in wage rates and a high level of unemployment with negative changes in wage rates. Attempts to explain the shape of the Phillips curve in theoretical terms include the following. Unemployment is regarded as an indicator of the pressure of demand on the labour market. When the demand for labour is high, the level of unemployment falls. Competition for labour forces up wage rates. The opposite applies in a situation

where the demand for labour is weak, resulting in a level of unemployment that tends to depress wage rates.

Phillips' study from 1958 has given rise to considerable research and discussion concerning the relationship unemployment — wage rates — inflation. These developments have broadly followed three main lines. *First*, attempts using econometric tests have been made, to measure and describe Phillips curves for different labour markets. The results of these enquiries vary depending on the type of function selected and on other explanatory variables. In addition, it has been shown that the simple Phillips curve provides a poor explanation of developments during the last few years, i.e. during the inflation of the 1970's.²⁾

Secondly, the Phillips curve has formed the basis of an extensive economic policy discussion concerning the choice between inflation/wage rises and unemployment. Economists and politicians have regarded the curve as a description of a conflict of goals between inflation/wage rises and unemployment in which a trade-off relationship exists between wage rises and unemployment: if there is to be a fight against inflation, a higher level of unemployment will have to be accepted; on the other hand, a policy resulting in a reduction of unemployment will bring about simultaneous rises in wages and prices. The aim, therefore, has been to concentrate labour market policy on making this trade-off relationship more favourable. Many of the Swedish labour market policy measures may be interpreted as attempts to influence the Phillips curve, the objective being to achieve a lower level of unemployment with the same rate of rise in wage rates as before.³⁾

Thirdly, the Phillips curve has formed the basis of extensive theoretical research. The existence of

*The authors Lars Jonung, Ph.D., and Eskil Wadensjö, Ph.D., are connected to the Department of Economics at the University of Lund. The results presented here form part of a research project "Unemployment, Price Trends and Wages in Sweden in the 20th century". The project is financed by the Bank of Sweden Tercentenary Foundation.

1) Phillips (1958) analysed not only the influence of the level of unemployment on changes in wage rates, but also the effect of changes in the level of unemployment and of changes in consumer prices. These two latter variables were, however, not incorporated in the relationship econometrically estimated by Phillips.

2) See also, studies by Rees & Hamilton (1967), Gordon (1975) and Eckstein and Girola (1978).

3) For a discussion concerning Swedish labour market policy, see, *inter alia*, Meidner (1969) and Meidner and Andersson (1973).

a simple, stable Phillips curve for which changes in nominal wage rates are solely a function of unemployment has been seriously questioned. Increasing attention has been paid to examining the influence of variables other than just unemployment, in particular, the role played by the expectations of inflation. As a result, the use of the simple Phillips curve as a basis of economic policy is also seriously questioned.⁴⁾ The trend is thus towards models more complicated than the Phillips curve both on empirical and theoretical grounds.

Unemployment and Changes in Wage Rates in Sweden

Unemployment and changes in wage rates in the period 1912—1971 in Sweden are described in Figs 1—6. The date 1912 was chosen as the starting year since it was the first year with complete statistics of both unemployment and wage inflation.⁵⁾ These 6 figures, which indicate considerable variations in unemployment, provide a good picture of the fluctuations of the Swedish business cycle in the 20th century.

4) See also, Friedman (1968), Phelps (1968), Tobin (1972) and Gordon (1977).

5) There are several reasons for the absence of unemployment figures for the 19th century. Unemployment was a punishable offence in Sweden. In addition, the industrialization of Sweden occurred much later than that of, for example, the United Kingdom. It was only with the emergence of industrialism that unemployment became a more observable as well as observed phenomenon. Unemployment was also a feature of the old agrarian economy, but it was hidden in comparison with the unemployment that could be recorded in the growing industrial sector. Nevertheless it is possible to determine a figure for "unemployment" by making use of the prison statistics of persons arrested for so-called vagrancy, i.e. individuals without employment. These figures were, however, largely related to the harvest. See Chapter 1 of "The Extent, Nature and Causes of Unemployment", The Swedish Government Official Reports 1931:20.

The unemployment series in Figs 1—6 have been constructed by linking trade union statistics for 1921—1954 to unemployment statistics for 1955—1971. (For 1955 figures are available from both unemployment series).

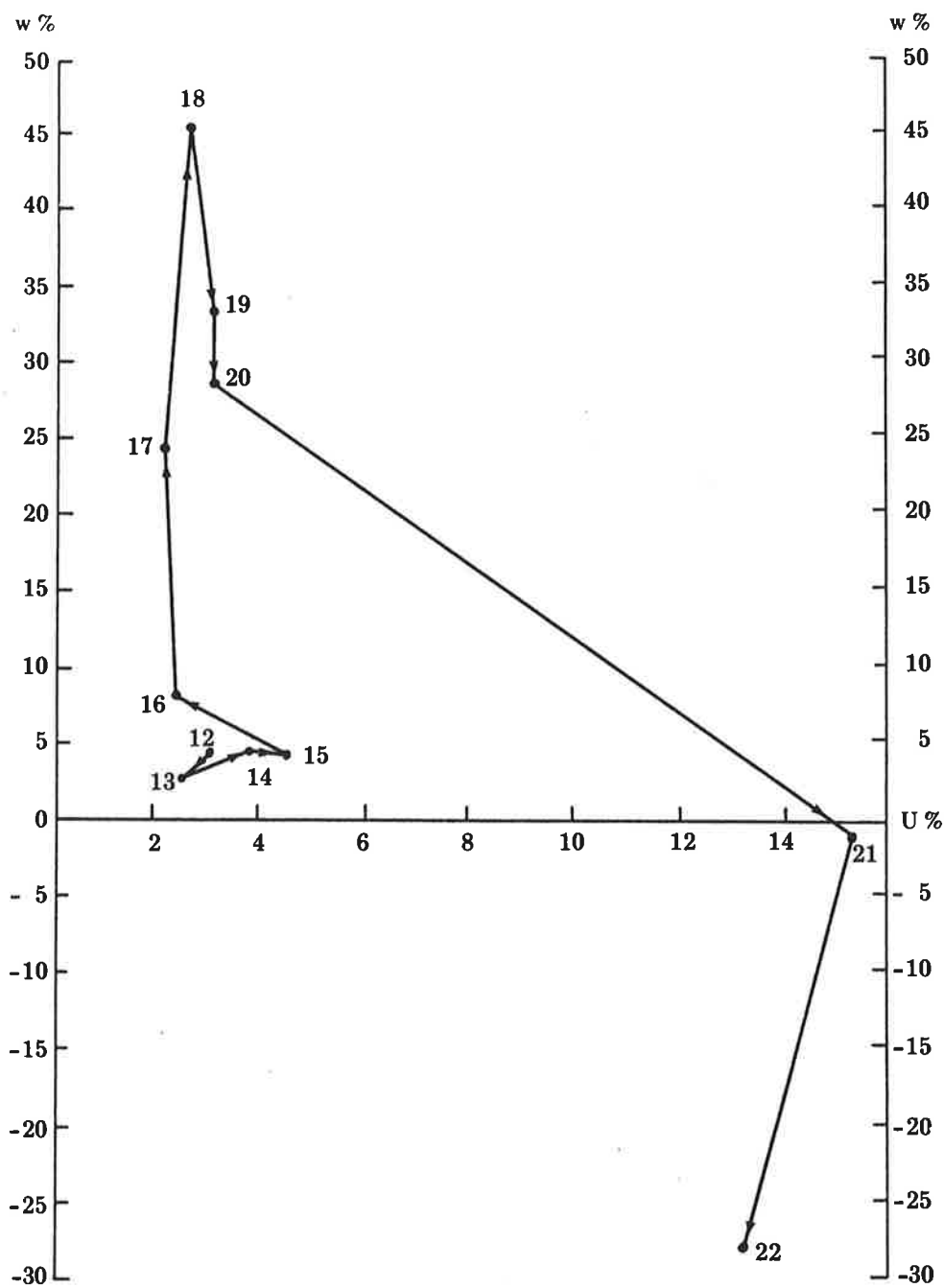
The years 1912—1922 — shown in Fig 1 — represent the most dramatic period. Before World War I, unemployment was low. The outbreak of war resulted in a small rise in 1914—1915, following the change-over to a war-time economy. As far as Sweden was concerned, the war led to a sharp rise in the price level. Wage inflation rose from 5 per cent in 1914 to a peak of 45 per cent in 1918. Peace was followed by a few years of sharp deflation and rising unemployment. The aim of economic policy was a return to the gold standard at the pre-war parity — a policy requiring severe deflation. The deflation was accompanied by a sharp rise in unemployment at the beginning of the 1920's.

The combinations of changes in wage rates and unemployment observed in Sweden from 1922—1971 are described in Fig 2. It will be seen that high levels of unemployment and small increases in wage rates were noted during the 1920's and 1930's. During the 1940's and 1950's there was a trend towards a lower level of unemployment and higher rises in wage rates. This trend was reinforced during the 1960's when the level of unemployment varied between one and three per cent, while changes in nominal wage rates were between 6 and 11 per cent per annum.

A comparison of Fig 1 and Fig 2 shows that the years during World War I and those at the beginning of the 1920's differ sharply from the experiences of the period 1922—1971. The inflation peak from 1918—1920 with an annual wage inflation of 30 % to 45 % is yet unparalleled. The Korean boom of 1951 and 1952 with annual wage rises of around 20 % comes closest. The wage deflation of 27 % in 1922 is unique. The deepest depression years of the 1930's exhibit a fall in wage rates of around 3—4 %. However, the unemployment figures during the 1930's are almost as high as those of 1921—1922. According to these figures, the recession of the 1920's was thus more severe than that of the 1930's in Sweden.

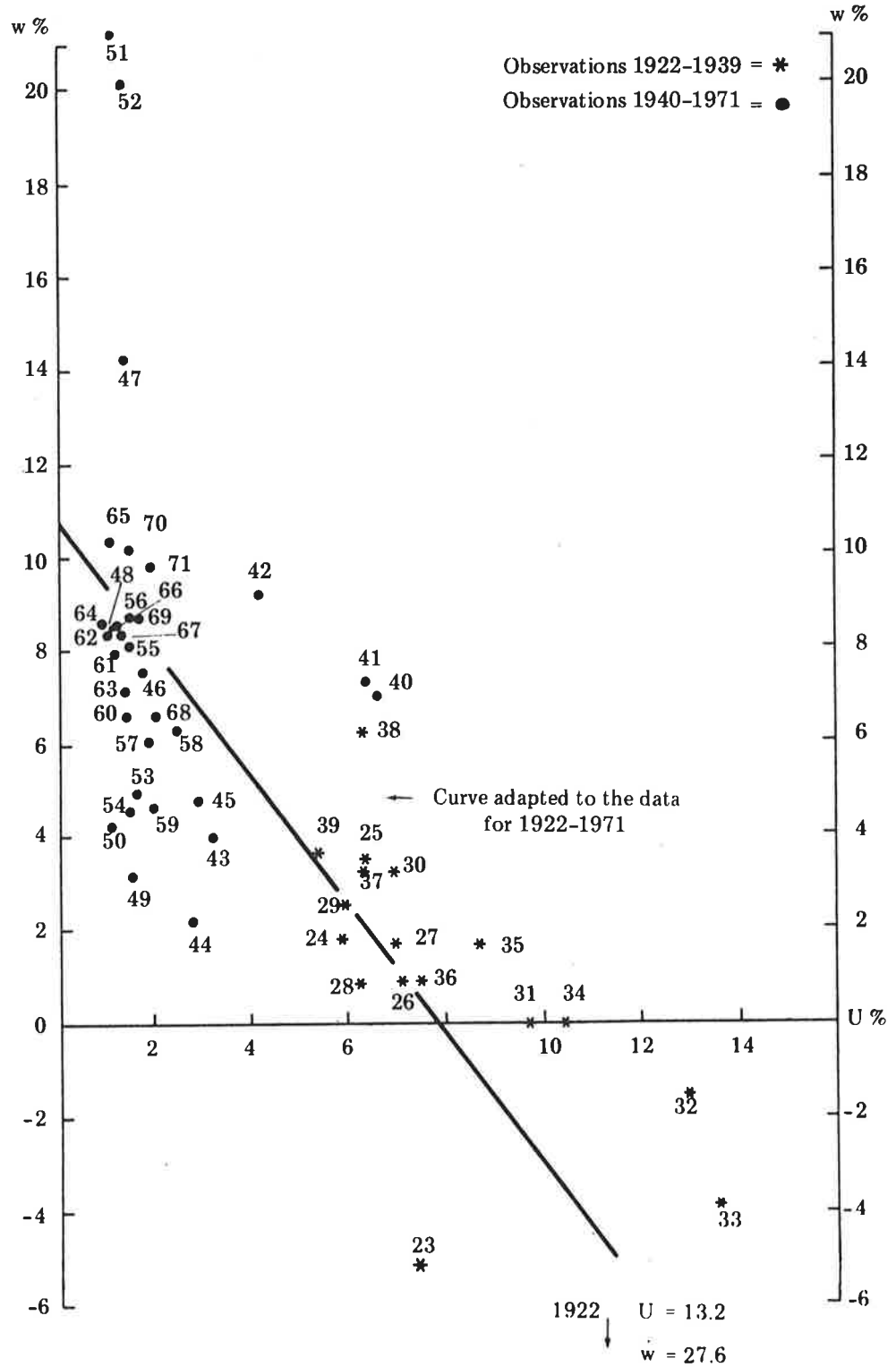
The interval 1922—1971 has been chosen here

Figure 1. Unemployment as a percentage (U) and annual percentage change in nominal wages (\dot{w}) 1912—1922.



Source: Jonung-Wadensjö (1979).

Figure 2. Unemployment as a percentage (U) and annual percentage change in nominal wages (\dot{w}) 1922—1971.



Source: Jonung-Wadensjö (1978).

Table 1. The simple Phillips Curve for Sweden, 1922—1971. Annual percentage change in nominal wages = \dot{w} . Unemployment as an annual percentage = U .

Period	Estimate (standard error within brackets)	R^2	DW
(1) Years 1922—1971	$\dot{w} = 10.919 - 1.404 U$ (1.051) (0.192)	= 0.527	= 0.944
<i>Calculation of equation (1) for different sub-periods</i>			
(2) Years 1922—1929	$\dot{w} = 27.814 - 4.172 U$ (2.739) (0.358)	$R^2 = 0.959$	DW = 1.290
(3) Years 1930—1945	$\dot{w} = 8.441 - 0.772 U$ (1.524) (0.197)	$R^2 = 0.524$	DW = 1.187
(4) Years 1946—1960	$\dot{w} = 19.540 - 6.877 U$ (6.421) (3.904)	$R^2 = 0.193$	DW = 1.653
(5) Years 1961—1971	$\dot{w} = 9.523 - 0.606 U$ (2.074) (1.362)	$R^2 = 0.022$	DW = 1.222

Comment: The calculation of equation (1) for different sub-periods in equations (2) — (5) constitutes a form of test of the stability of the Phillips curve. In this context, the stability means that Phillips curves, calculated for different sub-periods do not differ significantly from the curve valid for the whole period of investigation 1922—1971. The estimates for the sub-periods — see equations (2) — (5) — indicate, however that significant differences exist in several cases. The regression coefficients of unemployment are not always significantly different from zero and, in certain cases, differ significantly from one another. The Phillips curves presented in Table 1 are thus not stable in this statistical sense.

as an estimate period for the Phillips curve since the years 1912—1921 would appear to be unique in comparison with the experience of later periods.⁶⁾ There are also grounds for treating the statistical information from the 1910's with special caution.⁷⁾

The point cluster in Fig 2 gives the impression that a negative relationship exists between unemployment and changes in wage rates according to the simple Phillips curve. A series of Phillips curves have been calculated for the period 1922—1971. According to equation (1) in Table 1, the linear form seems to provide the best matching in the sense that it has the highest R^2 value. We shall, therefore, let the linear version represent the Phillips curve in our continued discussion.⁸⁾ This regression equation is plotted both in Fig 2, which covers the whole period and in Figs 3—6, which indicate combinations of unemployment and changes in wage rates in each of 4 sub-periods.

This makes it possible to study in-depth how closely the individual observations lie in relation to the regression line.

After the severe deflation and depression at the beginning of the 1920's, the level of unemployment remained fairly constant for the rest of this decade, while changes in wage rates varied between 0.5 % and 4 %. (See Figs 2 and 3.) Observations for the years 1924—1929 are well bunched and relatively close to the Phillips curve. The figures for the 1940's and 1950's, on the other hand, are much more widely dispersed as seen in Fig 4. During the two worst years of depression, 1932 and 1933, a reduction in wage rates was recorded. This is the most recent occasion where nominal wage rates have fallen in Sweden. Since the beginning of the 1930's, the rate of nominal wage rates has been rising. Even during the latter half of the 1930's, when the deepest depression had passed,

unemployment was at approximately the same level as during the period 1925—1929.

The first years of World War II led to sharp wage rises without any marked reduction of unemployment. It was not until the end of the war that unemployment was less than 3%. The observations for the years 1943—1945 are within the Phillips curve, while the other war years lie clearly to the right of the curve. The transition from a peace economy to a war-time economy and the effect on wage formation of sharp rises in import prices due to the blockade contributed to this picture.

World War II represents the transition from the relatively high unemployment figures of the inter-war years to the "full employment" of the post-war

period. During the years 1946—1971, unemployment was low. All the observations during the period 1946—1960 in Fig 5 are on or below the Phillips curve, with two exceptions: 1947 — when wage rises were enforced as compensation for the forcing-down of wage rises during World War II — and the years 1951—1952 — when the strong demand for exports during the Korean War led to large wage rises.

The observations for the period 1960—1971 in Fig 6 are centered around the same unemployment interval as for the years 1946—1960, while the wage rises are, as a rule, on a higher level. All the data points for the 1960's are placed relatively close to the Phillips curve in Fig 6.

Changes in the Phillips Relationship

On the basis of Figs 2—6, it may be said that the slope of the Phillips curve is determined by the fact that the observations of the post-war period exhibit a low level of unemployment with large wage rises and that the observations of the inter-war period exhibit a high level of unemployment with small wage rises (or wage reductions). On the other hand, this relationship cannot be found for each separate period. A study solely of the post-war period should exhibit a much steeper Phillips curve. On the basis of the figures of the sub-periods, Figs 3—6, it will be seen that the data points do not provide the same support for a negative relationship between unemployment and wage rises as Fig 2, which covers all the observations. For certain sub-periods, such as for the years 1960—1971, the data points would seem to allow a curve of almost any slope whatsoever.

The calculations for the various sub-periods 1922—1971 in Table 1 also indicate that the simple Phillips curve described in Table 1 and Figs 2—6 is not stable over the years. (See the commentary on Table 1.) For the whole period 1922—1971, a simple Phillips relationship does appear to exist, but this does not seem to apply to individual periods of the time interval. But there may be several

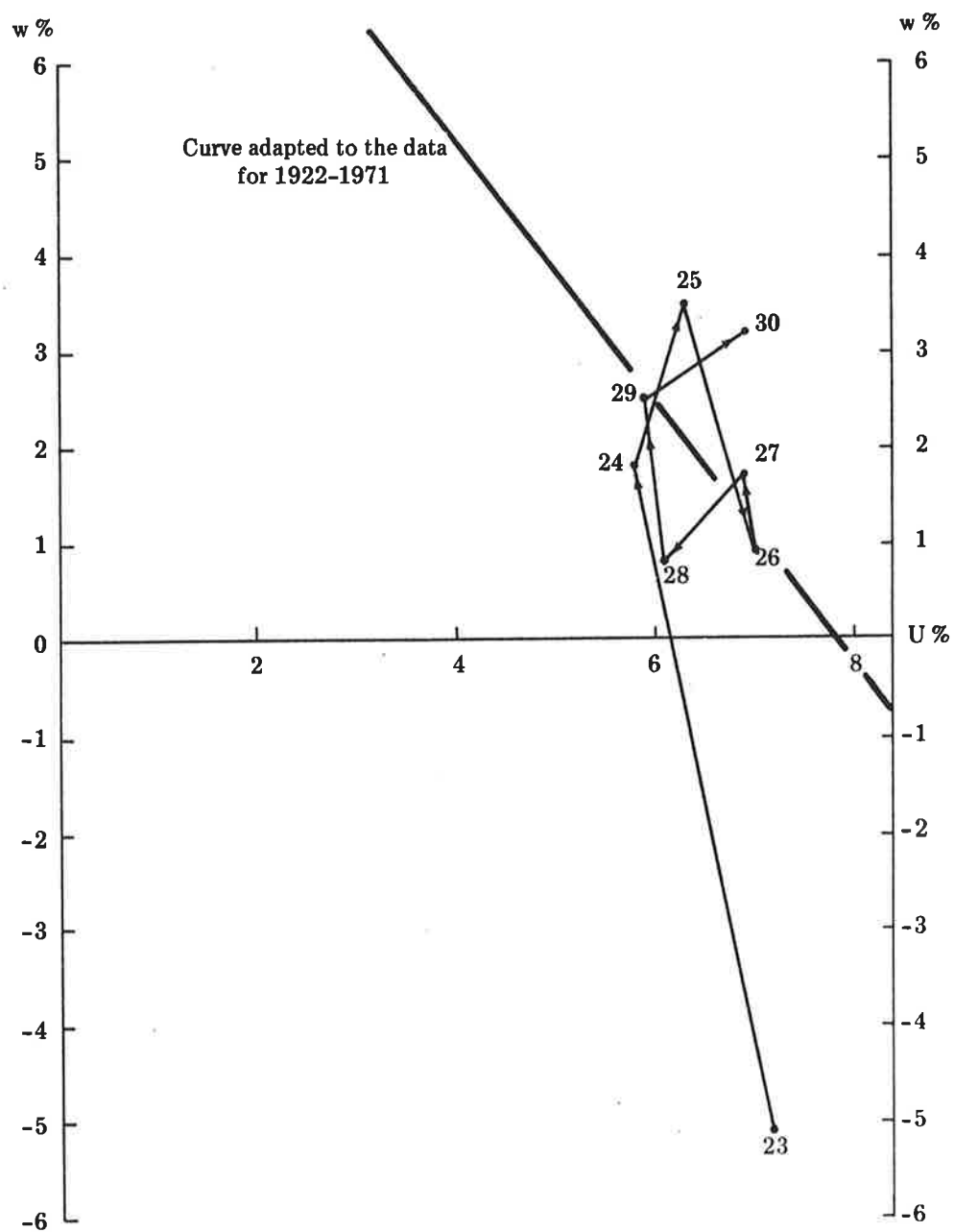
6) Compare with the discussion in Jonung and Wadensjö (1979) in which the formation of prices and wages during the years 1912—1921 is compared with the experiences of the period 1922—1971.

7) Furthermore, the result of the calculations of the simple Phillips curve for 1922—1971 can be compared with the conclusions from a more developed model of the formation of Swedish prices and wages, which is estimated for the same interval. See Jonung and Wadensjö (1978).

8) The theory of the Phillips curve does not indicate the function form of the curve. Economists have, therefore, chosen to experiment with different test functions in order to arrive at a suitable function form. Under certain conditions, which are fulfilled in the calculations on which Table 1 is based, the size of the R^2 can be used as a method for determining which specification is to be preferred. See Theil (1972) pp 542—545.

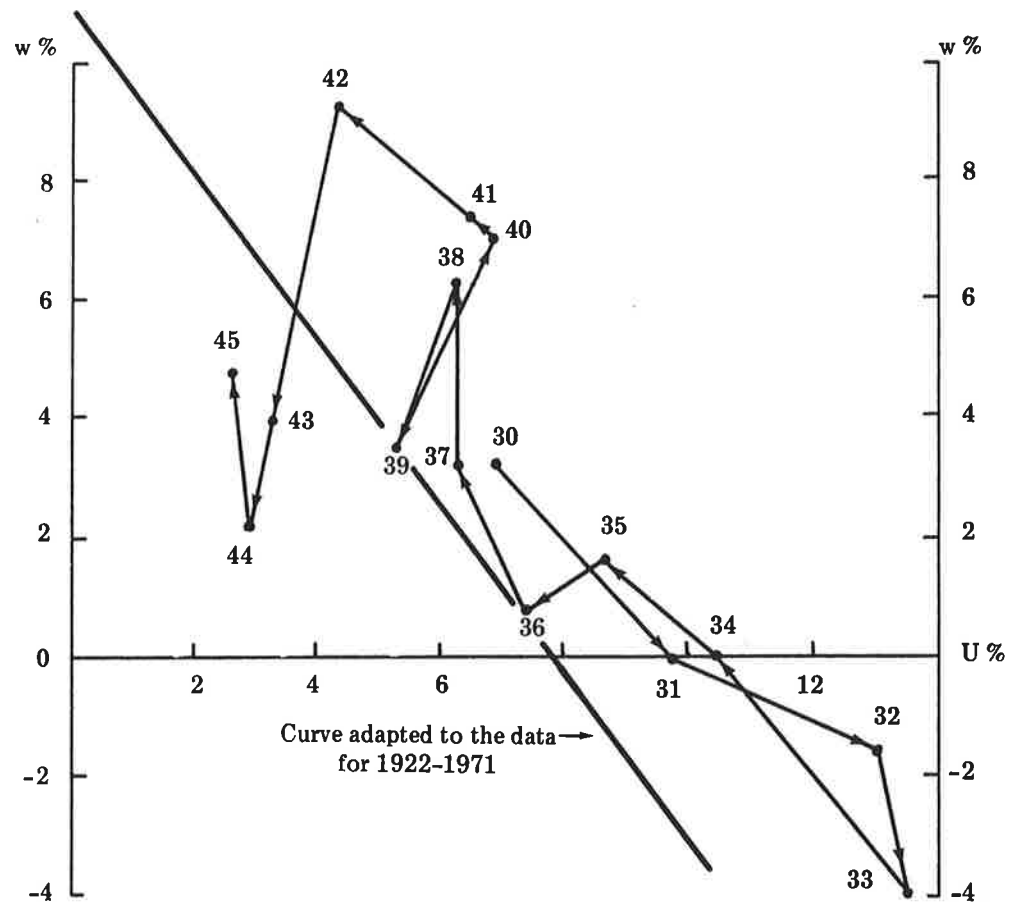
See also Jacobsson and Lindbeck (1969), who test four different mathematical relationships in their investigation of the trend in Swedish wages and unemployment in 1955—1967. There are several econometric surveys of the relationship unemployment and inflation in Sweden which cover parts of the post-war period, such as those of Jacobsson and Lindbeck (1969) and Calmfors and Lundberg (1974) — but few studies deal with experiences prior to the 1950's. Two exceptions are Jonung and Wadensjö (1978) and (1979), which cover the periods 1922—1971 and 1912—21, respectively.

Figure 3. Unemployment as a percentage (U) and annual percentage change in nominal wages (\dot{w}) in Sweden 1923—1930.



Source: Jonung-Wadensjö (1978).

Figure 4. Unemployment as a percentage (U) and annual percentage change in nominal wages (\dot{w}) in Sweden 1930—1945.



Source: Jonung-Wadensjö (1978).

reasons for this. In the first place, the composition of the data material should be examined and in the second place if one or more important explanatory variables have been omitted.

Both times series contain, of course, certain errors of measurement. This applies to the wage statistics and also, to a larger extent, to the series covering unemployment. The unemployment statistics employed are based on trade union statistics (1912—1955) and the statistics of unemployment benefit societies (1955—1971). With the passage of time, more and more trade unions made figures available and more unemployment benefit societies were formed. The possibility that the first trade unions to supply figures had a relatively high level of unemployment cannot be excluded. It is a known fact that the benefit societies which were organised later on were those whose members had a lower level of unemployment.⁹⁾ Unemployment was, therefore, probably over-estimated for the 1920's and 1930's compared with the post-war period. It is also likely that the criteria of unemployment changed during the period involved. To date, no surveys have been carried out of Swedish unemployment statistics which could clarify the extent of these sources of error. However, it appears reasonable to assume that the statistical sources of error do not sufficiently account for the major changes in the Phillips curve.

Probably the most important reason for the instability of the Phillips curve in the long run according to the calculations in Table 1 is that one or more central explanatory variables have been omitted in the simple Phillips curve. This postulates that the change in nominal wage rates is solely dependent on the amount of unemployment. The Phillips relationship assumes accordingly that the labour market organizations base their calculations purely on nominal terms and that they have

9) A survey of Danish unemployment statistics by Pedersen (1976) supports the hypothesis that the groups with considerable unemployment were the first to form unemployment benefit societies.

no expectations of inflation: a certain nominal rise in wage rates should thus be regarded as equally large whatever the rate of inflation.

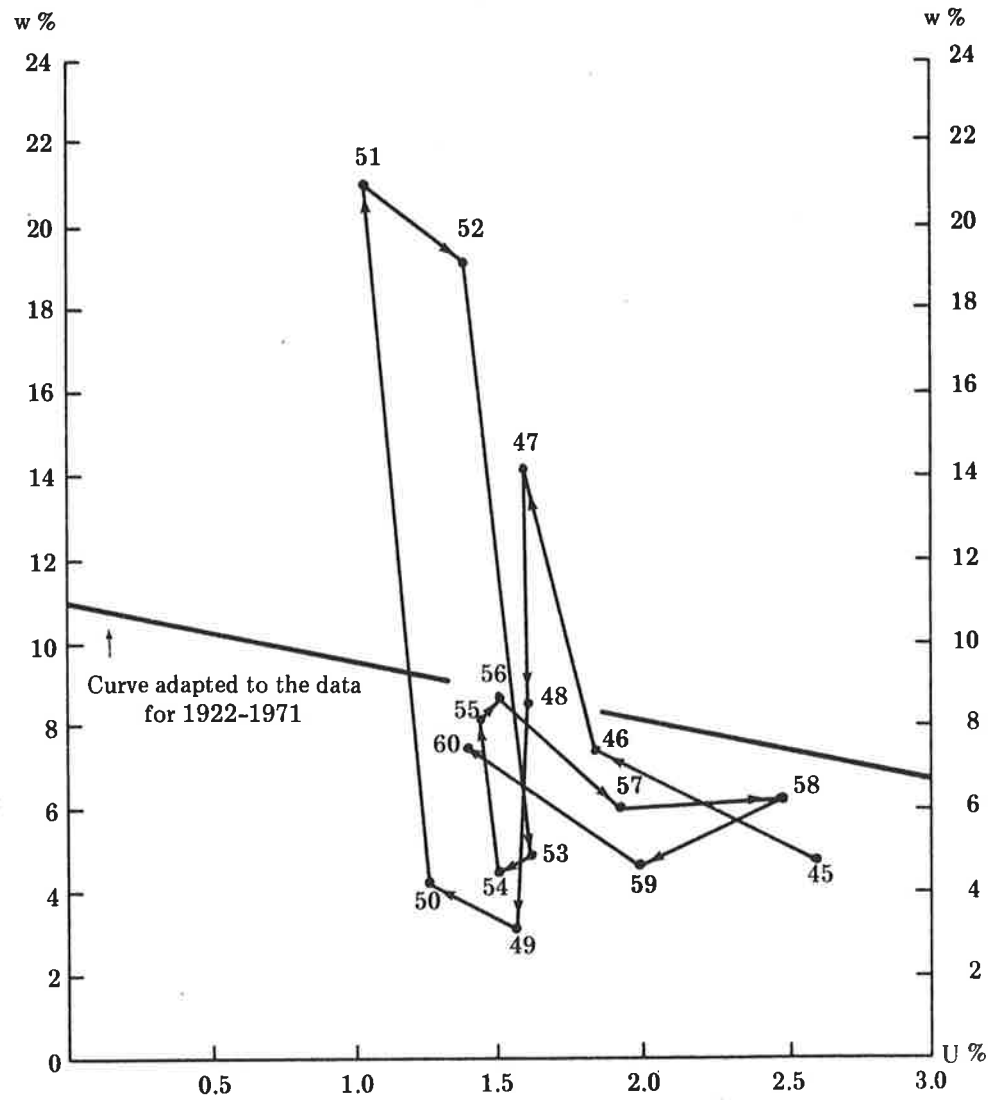
During the years 1946—1971, the average annual rise in nominal wage rate remained at a relatively constant level in Sweden. Since the variations in unemployment have been so limited during the post-war period, they alone can scarcely explain the sharp trend towards ever rising nominal wage rates. The rate of inflation must also be taken into account here. It has increased on a trendwise basis during the post-war period and there are strong indications that this trend has been reflected in wage negotiations, partly in the form of compensation for previous price rises and partly in the form of demands to cover expected price rises.¹⁰⁾

The reaction pattern of the labour market organizations has adapted to inflation. Requests for larger nominal wages are both forwarded and accepted. The higher the expected inflation, the larger wage compensation in the form of higher nominal wage rates employees will demand and employers will be ready to allow, within a given labour market situation. In other words, changes in nominal wage rates are not merely a function of the unemployment situation, but also of the expectations concerning the future price level held by the labour market organizations. If expectations of inflation are included in the relationship which explains the changes in nominal wage rates, the original stability of the Phillips curve disappears. Instead, there will be a series of Phillips curves whose positions will depend on existing expectations of future inflation.

There are a number of other factors in addition to the expectations of inflation which can also be included in the Phillips relationship and which may possibly contribute to a higher explanatory value. The existence of price and wage control

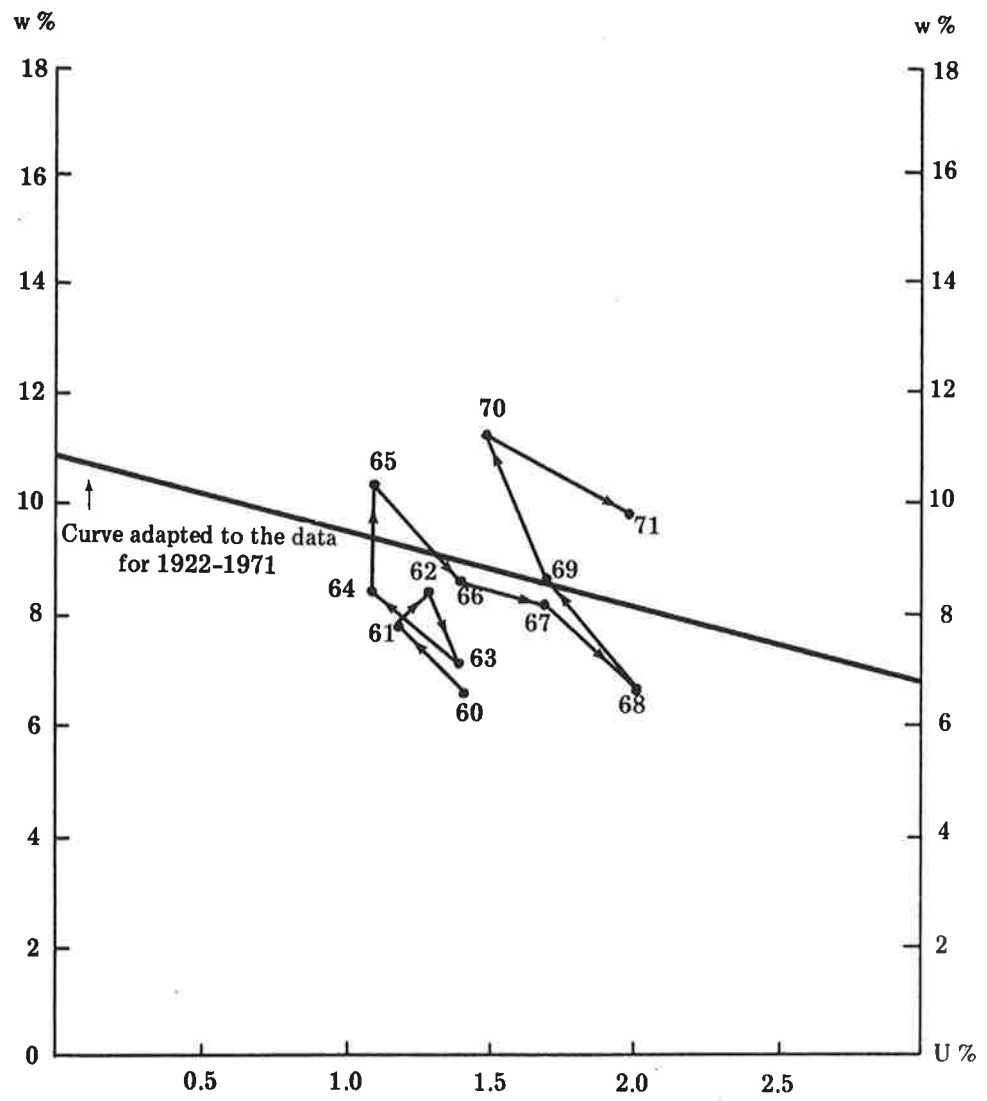
10) A more in-depth discussion of the role played by the expectations of prices in a price-wages model of Sweden for the period 1922—1971 is to be found in Jonung and Wadensjö (1978).

Figure 5. Unemployment as a percentage (U) and annual percentage change in nominal wages (\dot{w}) in Sweden 1945—1960.



Source: Jonung-Wadensjö (1978).

Figure 6. Unemployment as a percentage (U) and annual percentage change in nominal wages (\dot{w}) in Sweden 1960—1971.



Source: Jonung-Wadensjö (1978).

during World War II has probably influenced the formation of prices and wages. The growth of the trade union movement is a further factor to take into account. The growth of productivity, profit trends, changes in export and import prices are also variables which may influence the determination of wages as well as the expansion of labour market policy and the system of unemployment insurance. Regional differences of unemployment, structural changes in the functions of the labour market and the design of the system of taxation are further variables which can be observed in the discussion on the determination of prices and wages.¹¹⁾

Once a larger number of explanatory variables is included, however, the original Phillips relationship is abandoned in favour of larger models for the determination of prices and wages. One of the advantages of the original Phillips curve was that it comprised a small and, therefore, easily manageable number of variables which appeared to have a large explanatory value.

Summary

The estimates and arguments presented here indicate that the simple Phillips curve — which states that changes in nominal wage rates are a function of unemployment alone — is insufficient to explain the relationship between unemployment and changes in wage rates in Sweden since the beginning of the 1920's. Our conclusion is that variables other than unemployment must be taken into account when attempting to find an explanation for changes in nominal wage rates in Sweden during the 20th century. More intensive studies of

the formation of prices and wage rates in Sweden require an extensive review of the statistical material.

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11) The effects of taxation on the inflationary process were discussed at an early stage by Lundberg (1953) pp 408—410 which include an analysis of the effects of high marginal tax rates on wage demands. It is clear that high nominal marginal taxes have exerted an effect on the formation of Swedish wages in recent decades.

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