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Introduction

This thesis consists of three studies on the determination of wages and prices in Sweden. In an economic policy perspective, an examination of wage and price determination can be motivated on several grounds. An analysis of price determination, wage determination and the wage linkages between different sectors of the economy has implications for the way a stabilisation policy is designed. An analysis of the way active labour market programmes, or ALMPs, affect real wages can have implications for the design of labour market policy. The first study below examines the impact of ALMPs on real wages in the Swedish engineering industry. The second study looks at possible intersectoral wage linkages in Sweden. Finally, the third study examines the joint determination of private-sector nominal wages and consumer prices in Sweden.

Study I: Real Wage Determination in the Swedish Engineering Industry

The first study explores the impact of ALMPs on real wages in the engineering industry. On the one hand, ALMPs may increase the utility of the jobless, which in turn could have the effect of raising real wages. Higher real wages could mean a crowding-out effect on regular employment. But, on the other hand, ALMPs may increase labour force participation and thereby job competition. This in turn could have a wage-reducing effect, thereby raising the regular employment level in the economy. The empirical results of this study could have implications for the design of labour market policy.

In the 1990s several empirical studies were produced on this topic, using Swedish data.¹ Most of these studies indicate that participation in an ALMP has a raising effect on real wages. However, most of these studies base their empirical examination on aggregated data. The present study seeks to answer the question as to whether or not the use of more disaggregated data changes the empirical results. Further, the estimation period has been continued closer to the present compared to most of the previous studies.

In this study I estimate vector error correction models for the determination of real wages in the engineering industry in Sweden. The theoretical framework is provided by the “monopoly union model”, from which I derive expressions in which the real producer wage is determined by labour productivity, a tax/price-wedge, a proxy for the real consumer wage in other industries, real UI benefits and some labour market variables. I interpret these expressions as long-run relations in the empirical analysis. The labour market variables used in the study are the open unemployment rate and the participation rate in ALMPs. The participation rate in ALMPs is also divided between the participation rate in public relief jobs and the participation rate in labour market training. Aggregate and industry-specific rates for the labour market variables are both used in the study. I use quarterly data for the period 1970:1–1996:4 in the empirical examination.

The estimation results indicate significant long-run wage-raising effects from positive changes in the participation rates in ALMPs, relief jobs or labour market training. The estimation results concerning the long-run effects do not change, regardless of whether I use aggregate or industry-specific participation rates for the ALMP-variables. Thus, ALMPs do appear to increase the utility of the jobless, which could in turn generate a crowding-out effect on regular employment. In the short run there is some evidence that a higher participation rate in ALMPs has a raising effect on real wages. Furthermore, in the short run there are mixed empirical results concerning the response of real wages to participation in labour market training. Thus, participation in labour market training can both increase and decrease real wages in the short run.

The estimation results confirm the presence of a long-run raising effect on the part of real wages to positive changes in the following variables: labour productivity, the tax wedge, the alternative real consumer wage and real UI benefits. Finally, the estimation results show evidence of a long-run wage-reducing effect in response to a positive change in the unemployment rate.
Study II: Intersectoral Wage Linkages in Sweden

In the second study I examine the impact of the wage-setting in one sector of the economy on the wage-setting in other sectors, and I investigate possible wage linkages between the private and public sectors in the study. The empirical results of the study can have implications for the design of stabilisation policy. Some research on intersectoral wage linkages has been produced previously using Swedish data.\textsuperscript{2} In the present study I use data that is more disaggregated relative to that in the previous studies. The hypothesis regarding intersectoral wage linkages is supported in all the previous studies, as it also is here.

In this study I estimate vector error correction models for wages in different sectors in Sweden. The theoretical background is provided by one of the equations in the “Scandinavian model of inflation”, which states that wage-setting in sectors exposed to international competition should lead wage-setting in the sheltered sectors of the economy. In the empirical examination I use quarterly data for monthly wages in manufacturing, construction, the wholesale and retail trade, the financial sector, the central government sector, the municipalities and county councils sector, and the aggregate private sector during the period 1980:1–2002:2.

The empirical results indicate substantial wage adaptability between manufacturing, construction, the wholesale and retail trade and the two public sectors. Thus, one-to-one relations between wages in the above sectors cannot be rejected in formal tests. Granger causality tests in the estimated vector error correction models provide strong evidence of intersectoral wage causality, but no evidence of a wage-leading role consistent with the assumptions of the Scandinavian model for any one of the sectors.

Study III: Wage and Price Determination in the Private Sector in Sweden

The third study examines the joint determination of private-sector nominal wages and consumer prices in Sweden. The empirical results of the study can have

\textsuperscript{2} See for instance Holmlund and Ohlsson (1992), Jacobson and Ohlsson (1994), and Tägtström (2000).
implications for stabilisation policy. As far as I know, there are only a few empirical studies on this topic using Swedish data.\(^3\) The empirical method adopted here differs from that used in previous contributions. The empirical results also differ to some extent from those of the earlier studies.

In this study a vector error correction model is estimated. The theoretical background is a variant of the “Imperfect competition model of inflation”. From the theoretical model two long-run relations are derived, one for the private-sector nominal wage determination and one for consumer price determination. I use quarterly data for private-sector nominal wages, consumer prices, private-sector labour productivity, import prices and the total unemployment rate during the period 1980:1–2003:3 in the empirical analysis. The total unemployment rate is defined as the number of the openly unemployed plus the number of participants in ALMPs relating to the labour force.

The vector error correction model consists of a mean-shift dummy for 1991:1. This dummy is assumed to capture both the change in wage formation due to the Rehnberg stabilisation agreement during the period 1991–92, and the monetary policy regime shift at the beginning of 1993. The shift in monetary policy towards an inflation-targeting regime may have affected inflation expectations among the labour market organisations which in turn could have led to a structural change in the wage-setting. The mean-shift dummy is significant in all the equations except the one for consumer prices. It might have been expected that the determination of consumer prices too, would be affected by the institutional changes in 1991–93, but this was not the case.

The model also consists of two permanent blip dummies, 1982:4 and 1993:1. The first dummy is assumed to capture the devaluation of the Swedish krona in October 1982, while the second is assumed to capture the start of a floating Swedish krona in November 1992 and the substantial depreciation of the krona thereafter. As expected, the permanent blip dummies are significant in the equation for import prices.

Private-sector wages are determined in the long run by consumer prices and the total unemployment rate. Thus the estimation results of the long-run structure indicate that an increase in consumer prices by 1 per cent increases...
private-sector nominal wages by about 0.8 per cent, while an increase in the total unemployment rate by 1 percentage point reduces the private-sector nominal wages by about 4.5 per cent. This is a relatively large long-run effect. Another result, and a surprising one, is that private-sector labour productivity is not significant in the long-run determination of private-sector nominal wages.

Consumer prices are determined in the long run by private-sector nominal wages, private-sector labour productivity and import prices. The empirical results indicate a one-to-one long-run relation between consumer prices and private-sector nominal wages. In addition, an increase in private-sector labour productivity by 1 per cent reduces consumer prices by about 1.2 per cent in the long run. Finally, an increase in import prices by 1 per cent increases consumer prices by about 0.3 per cent in the long run.

The Econometric Methodology

In all three studies the same econometric methodology, namely cointegration time series analysis, is used. Cointegrated time series means that two or more non-stationary series drift in parallel over time. In time series analysis a distinction is often made between non-stationary and stationary time series. A time series is defined as stationary if the following conditions are fulfilled: (i) the mean is constant over time, (ii) the variance is constant over time and (iii) the covariance between two observations depends exclusively on the time-interval between the observations and not on the actual time. If one or more of these conditions are unfulfilled the time series is defined to be non-stationary. The co-movement can be interpreted as meaning that the time series are long-run related. If real wages and productivity, for example, are co-moving over time, this can be interpreted as if the series are long-run related. The concept of cointegration was formally introduced in Engle and Granger (1987).

There is also a relation between cointegration and a so-called error correction representation. The Granger representation theorem, also formally introduced in Engle and Granger (1987), states that cointegrated time series have an error correction representation. The proof of the theorem can be found in
Johansen (1991), for example. The idea behind error correction is simply the following. Consider some series drifting in parallel over time and adjusting to a long-run equilibrium path. In the short run these long-run related series may be in disequilibrium. This disequilibrium or equilibrium-error is assumed to be adjusted to the long-run equilibrium path. The Granger representation theorem formalises this idea.

For the derivation of a single-equation error correction representation, consider the following example. Assume two series, denoted $x_{1t}$ and $x_{2t}$, that drift in parallel over time. Assume also that there exists a long-run equilibrium relation between the variables, that is $x_{1t} = \beta x_{2t}$, where $\beta$ is a long-run coefficient. From this expression a single-equation error correction model can be derived, namely

$$\Delta x_{1t} = \sum_{j=1}^{k} (\gamma_1 \Delta x_{1t-j} + \gamma_2 \Delta x_{2t-j} + \alpha (x_{1t-1} - \beta x_{2t-1}) + \varepsilon_{it},$$

where $\Delta$ is the difference operator defined by $\Delta x = x - x_{t-1}$, $\sum_{j=1}^{k} (\gamma_1 \Delta x_{1t-j} + \gamma_2 \Delta x_{2t-j})$ is the short-run structure, $\gamma_1$ and $\gamma_2$ are short-run parameters, $k$ the lag-length and $\varepsilon_{it}$ is the error term assumed to be $\varepsilon_{it} \sim iid(0, \sigma^2)$. The term $\alpha (x_{1t-1} - \beta x_{2t-1})$ in (1) is the single-equation error correction mechanism, where the term $(x_{1t-1} - \beta x_{2t-1})$ is viewed as the “error” from the long-run equilibrium, and $\alpha$ gives the “correction” to $x_{1t}$ caused by this error.

For the derivation of a multivariate (or vector) error correction representation, consider the following example. Assume three series, denoted $x_{1t}$, $x_{2t}$, and $x_{3t}$, that drift in parallel over time. Furthermore, assume that two long-run equilibrium relations exist between the variables, that is $x_{1t} = \beta_{12} x_{2t}$ and $x_{1t} = \beta_{23} x_{3t}$, where $\beta_{12}$ and $\beta_{23}$ are long-run coefficients. From these expressions a vector error correction model can be derived, namely
\[
\begin{bmatrix}
\Delta x_{1t} \\
\Delta x_{2t} \\
\Delta x_{3t}
\end{bmatrix} = \sum_{i=1}^{k} \Gamma_{i-1} \Delta X_{t-i+1} + \begin{bmatrix}
\alpha_{11} & \alpha_{12} \\
\alpha_{21} & \alpha_{22} \\
\alpha_{31} & \alpha_{32}
\end{bmatrix} \begin{bmatrix}
1 & -\beta_{12} & 0 \\
1 & 0 & -\beta_{23} \\
1 & 0 & -\beta_{33}
\end{bmatrix} \begin{bmatrix}
x_{1t-1} \\
x_{2t-1} \\
x_{3t-1}
\end{bmatrix} + \varepsilon_{2t},
\]

where \( \sum_{i=1}^{k} \Gamma_{i-1} \Delta X_{t-i+1} \) is the short-run structure, \( \Gamma \) are short-run parameter matrices, \( \Delta X' = [\Delta x_1 \ \Delta x_2 \ \Delta x_3] \), \( k \) is the lag-length and \( \varepsilon_{2t} \) is a Gaussian error term with zero mean and covariance matrix \( \Sigma \), i.e. \( \varepsilon_{2t} \sim iid(0, \Sigma) \). The term \( \alpha \beta' X_{t-1} \) in (2) is the vector error correction mechanism.

\section*{Some Policy Conclusions}

In the first study the impact of ALMPs on real wages in the engineering industry is examined. The empirical results of the study have implications for the design of labour market policy. If participation in ALMPs increases real wages this means that regular employment is crowded out. One policy conclusion that can be drawn from this is that the government should provide ALMPs to a lesser extent. On the other hand, if participation in ALMPs reduces real wages, this could be an indirect result of the ALMPs having increased the labour supply. An increase in the labour supply can have a reducing effect on real wages. One policy conclusion that can be drawn from this is that the government should provide more ALMPs.

The empirical results indicate significant long-run wage-raising effects of positive changes in the rates of participation in ALMPs, relief jobs and labour market training. The estimation results for the long-run real wage effects do not change, regardless of whether aggregate or industry-specific participation rates in the ALMP-variables are used. One policy conclusion that can be drawn from the empirical analysis is that ALMPs should not be provided, or be provided to a lesser extent, by the government. On the other hand the objective of the government’s policy does not necessarily need to be to reduce the growth of wages.
Finally, disaggregated data is used in the empirical analysis. Most studies in this field use aggregate data. The present study can perhaps provide an answer to the question as to whether the empirical results change when disaggregated data is used. The results of the study presented here coincide with the empirical results of the studies in which aggregate data is used.

In the second study the possibility of linkages in the wage-setting between different sectors of the Swedish economy is examined. This can have implications for the design of stabilisation policy. If the growth of private-sector wage costs is higher than private-sector productivity growth, due for instance to intersectoral wage linkages, this could lead to higher inflation in consumer prices. Thus if the presence of intersectoral wage linkages leads to higher consumer price inflation, then this could affect monetary policy. However, if this were the case, there should be incentives for the labour market organisations to prevent the emergence of intersectoral wage linkages. If potential intersectoral wage linkages are not prevented by the actors on the labour market, then the governmental policy should try to prevent them.

The empirical results of the study provide strong evidence of intersectoral wage linkages, but no clear evidence of a wage-leading role for any of the sectors consistent with the assumptions of the “Scandinavian model”. A possible explanation of this could be the presence of a time-varying sector wage-leadership during the sample period. The empirical results indicate that changes in central government wages do cause changes in wages in manufacturing, the financial sector and the aggregate private sector. Furthermore, the empirical results support the presence of wage linkages within the private sub-sectors. Changes in construction wages cause changes in wages in manufacturing and the wholesale and retail trade. Further, changes in manufacturing wages cause changes in wages in the financial sector and in the wholesale and retail trade. Changes in wages in the wholesale and retail trade wages cause changes in wages in manufacturing and the financial sector. Finally, changes in financial-sector wages cause changes in manufacturing wages.

The third study examines the joint determination of private-sector wages and consumer prices in Sweden. The empirical results of the study can have implications for stabilisation policy. The empirical evidence on the joint
determination of wages and prices can have implications for an inflation-targeting central bank.

The empirical results of the study indicate that consumer prices are determined in the long run by private-sector nominal wages, private-sector labour productivity and import prices. In the short run consumer prices are primarily affected by their own history, private-sector nominal wages and private-sector labour productivity. The positive short-run effect of nominal wages on consumer prices is somewhat greater than the negative short-run effect of labour productivity.

Finally, neither the “offensive” devaluation of the Swedish krona in October 1982 nor the substantial depreciation in 1992-93 affected the determination of consumer prices. The structural break in the wage-setting due to the Rehnberg agreement in 1991–92 and the shift in monetary policy regime in 1993 did not directly affect the determination of consumer prices.
References


