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Wage rigidity in the United States: the role of price expectations

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In this paper a model is constructed which enables the determination of wage rigidity in the United States. In this model wage changes result from a confrontation of intended and actual wage changes. In such a process expected prices obviously play an important role. For this reason the model is estimated under various assumptions regarding the formation of price expectations. The study suggests that US wages are highly flexible and that prices are fully indexed. These results appear to be robust as they do not depend on the assumption concerning the nature of expected prices.

I. INTRODUCTION

Empirical estimates of equations explaining the change in the level of nominal wages have served several purposes. From a policy point of view they offer insights into the effectiveness of inflationary policy measures aimed at reducing real wages. These possibilities seem to be closely related to the assumed nature of price expectations. It is, for example, well known that under rational expectations there is no effect of inflationary policy on real wages.

Another possible cause for the neutrality of real wages to inflationary policy is the existence of real wage rigidity. However, if wages are nominally rigid, real wage growth is affected by price changes. Empirical analyses suggest that the United States is characterized by nominal wage rigidity (Branson and Rotemberg, 1980; Bruno and Sachs, 1985; Van der Ploeg, 1988). Moreover, the existence of nominal wage rigidity in the United States has developed almost into a stylized fact (cf. Kahn, 1984), which has far-reaching consequences in existing models of international policy coordination, as is shown by Garretsen and Lensink (1989).

This paper analyses the combined effect of different concepts of expected prices and wage rigidities on the explanation of money wage growth in the United States. It improves on previous models of wage growth on three points. First, it explicitly models the separate effects of *ex ante* intentions based on expected inflation, and *ex post* realizations based on market rigidities. Second, it allows for the possibility of disentangling indexation of unexpected price movements from real wage rigidities, which are often treated as equivalent phenomena (cf. Branson and Rotemberg, 1980; Sachs, 1980). Finally, it investigates how different assumptions concerning price expectations affect the estimation. Particular attention is devoted to the determination of a time series of rational price expectations. A time

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series of rational price expectations is derived from a partial model of government behaviour in which expected inflation depends on the initial state of the economy and the preferences of policy makers with respect to economic and political issues. The results contrast with the prevailing evidence, and suggest that nominal wage rigidity in the United States cannot be regarded as a robust stylized fact. As use is made of various time series of price expectations, the results do not rely on a specific assumption concerning the formation of expectations.

Section II presents a model of wage growth and derives the estimated equations. Four basic concepts of price expectations and their time series are given in Section III. Estimation results are presented in Section IV, followed by conclusions in Section V.

II. THE MODEL

This section presents a model of wage change that allows for an assessment of the impact of different expectation concepts on estimation results. The basic feature of the model is the distinction that is made between intentions of economic agents and realizations in the market. Intentions are modelled by a specification of the target growth rate of wages. The actual wage change adjusts partially to the target wage change. Similar models are used, for example, by Branson and Rotemberg (1980), Kahn (1984), and Sachs (1980).

Interaction between private sector agents results in a target rate of real wage change, which may be viewed as the outcome of a negotiation process. This is an *ex ante* wage change equation and therefore expected inflation enters this equation. The target wage change also depends on the deviation of realized from expected inflation. For this reason contracts fix a partial indexation of the target wage change to unexpected price changes in the current period t. The target change of money wages is given by the following equation:

$$w_t^* = p_t^e + \beta(p_t - p_t^e) + \mathbf{a}\mathbf{X}_t + \eta_t \tag{1}$$

where w_t^* is the target rate of change of money wages, p_t^e is the expected change of prices for the current period t on the basis of information available at time $t-1$, p_t is current inflation, β is an indexation parameter which value lies between 0 and 1, $\mathbf{X}_t$ is a column vector of other relevant variables, and $\mathbf{a}$ is a row vector of coefficients. The equation is written in stochastic form, with identically distributed and independent error terms, η_t.

The second equation links the realized outcome of the wage formation process to the target wage change. The observed real wage change is modelled as a partial adjustment from the previous period realization to the current target value. It is important to note that this is an *ex post* process. Only actual values of inflation can therefore enter an equation of real wage adjustment. This is not the case in the model of Branson and Rotemberg (1980), where expected real wages adjust to the target real wage change.[1] It is also possible that a partial adjustment path is followed by the money wages instead of real wages. Like Branson and Rotemberg the present paper allows for both possibilities; real and nominal adjustment:

$$w_t - p_t = \rho(w_{t-1} - p_{t-1}) + (1-\rho)(w_t^* - p_t) \tag{2}$$

$$w_t = \nu w_{t-1} + (1-\nu)w_t^* \tag{3}$$

[1]As a result they omit an explanatory variable in their estimated equation, leading to biased estimates of the degree of wage rigidity.

Equation 2 describes real adjustment, and Equation 3 describes nominal adjustment. The adjustment parameters ρ and ν determine the degree of real and nominal wage rigidity, respectively. A higher value in both cases means less flexible wages. If ρ or ν equals 0, wages are completely flexible and the difference between the cases in Equations 2 and 3 vanishes.

Combination of the target wage Equation 1 and one of the adjustment equations gives an expression for the growth of money wages that encompasses two essentially different kinds of adjustment. The first adjustment is based on unexpected price changes in the current period, and the second adjustment is based on target wage growth changes with respect to previous wage growth. It should be noted that we do not equate price indexation to real wage rigidity. The former describes the behaviour of private sector agents, the latter is an *ex post* feature that describes the way the market works (or better still, doesn't work). Substitution of Equation 1 into Equation 2 yields in the case of real wage stickiness:

$$w_t - p_t^e = \rho(w_{t-1} - p_{t-1}) + [\rho + \beta(1-\rho)](p_t - p_t^e) + \mathbf{a}(1-\rho)\mathbf{X}_t + \varepsilon_t \tag{4}$$

With sticky nominal wages, combining Equations 1 and 3 gives:

$$w_t - p_t^e = \nu(w_{t-1} - p_t^e) + \beta(1-\nu)(p_t - p_t^e) + \mathbf{a}(1-\nu)\mathbf{X}_t + \varepsilon_t \tag{5}$$

It appears that the latter two equations have one term in common and one term that is not found in the other equation. This enables an estimation equation to be written that can be used to discriminate between the two kinds of wage rigidity. For the additional explanatory variables, X_t, the inverse of the unemployment rate, u_t', GNP growth, y_t, and a constant term, C, respectively are used. The explanatory variables of Equations 4 and 5 are combined, hence the equation to be estimated is:

$$\begin{aligned} w_t = {} & p_t^e + \alpha_0(w_{t-1} - p_{t-1}) + \alpha_1(w_{t-1} - p_t^e) + \alpha_2(p_t - p_t^e) \\ & + \alpha_3 u_t' + \alpha_4 y_t + C + \varepsilon_t \end{aligned} \tag{6}$$

With Equation 6 it is possible to estimate both the degree of nominal or real wage rigidity, and the degree of price indexation. There is real wage rigidity if $\alpha_0 > 0$ and $\alpha_1 = 0$; Equation 6 then turns into Equation 4. If $\alpha_0 = 0$ and $\alpha_1 > 0$ Equation 5 is obtained and there is nominal wage rigidity. The value of the indexation parameter can be derived from the estimate of α_2. It is expected that the inverse of unemployment and GNP growth both have a positive effect on the dependent variable.

III. DIFFERENT CONCEPTS OF EXPECTATIONS

To estimate Equation 6 a time series of price expectations is needed. As Equation 6 clearly shows, an inappropriate time series of price expectations affects the estimates. In fact, if $\alpha_2 = 0$ and Equation 6 is estimated under a too naive expectation assumption, estimation of Equation 6 may yield $\alpha_2 > 0$ because $p_t - p_t^e$ contains an anticipated component, leading to a wrong conclusion with respect to wage rigidity and indexation. Only in the extreme case with $\alpha_1 = 0$ and $\alpha_2 = 1$ do estimates of Equation 6 not rely on the assumption with respect to how expectations are formed. To obtain reliable results Equation 6 is estimated with various time series of price expectations.

Various concepts of expectations can be found in the economic literature. In this section four time series of price expectations are determined. In the extreme case future inflation is

predicted perfectly (perfect foresight). In the other extreme the expected inflation for the next year is set at the current level of inflation (naive expectations). In addition to these extremes, two series of price expectations are derived from a partial model of government behaviour for the United States as developed by Swank (1989b).[2] This model enables 'natural' price movements to be distinguished from price movements which are the result of policy makers' actions. In one of the two series economic agents consider only natural price movements and in the other the influences of economic policy on inflation are also anticipated. Some knowledge of the government model is necessary to understand the nature of these series. For this reason the main elements of the model are discussed briefly, referring for a detailed exposition to the paper mentioned above.

In the government model, administrations have both economic and political goals. The political goal is to stay in power. It is assumed that policy makers use presidential popularity, pop_t, as measured by opinion polls as an indicator of the probability of an administration to stay in power. The economic goals in the model are full employment ($u_t = u^f$) and zero inflation ($p_t = 0$). Policy makers try to affect pop_t, u_t and p_t by deviating the unemployment rate from its 'natural path'. The natural path of the unemployment rate is described by an autoregressive scheme of the unemployment rate $L(u_t)$. The error terms of this estimation are taken as the sum of a policy intervention variable, e_t, and a disturbance term.[3]

It is assumed that the objectives of policy makers can be characterized by minimization of the following loss function:

$$W_j = \sum_{t=0}^{n} \Big\{ a_{1,j}[p_t]^2 + a_{2,j}[u_t - u^f]^2 + (1 - a_{1,j} - a_{2,j})[pop_t - pop^d]^2 + a_{3,j}[e_t]^2 \Big\} \tag{7}$$

Equation 7 expresses that administration j minimizes W over the period $t = 0$, the time administration j is installed, to $t = n$, the election date. The preferences of administration j are denoted by $a_{i,j}$, representing the weight attached to variable i. These weights depend on the political colour of the administration in office. All target variables enter the loss functions in deviation from their desired values (0, u^f, and pop^d, respectively), which are assumed to be equal for all administrations.[4] The last term in the objective function denotes that deviating the unemployment rate from its natural path involves costs.

In the model, policy makers minimize the loss function subject to their perception on the links between the target variables and the unemployment rate. The perceived relationships between inflation and the unemployment rate are based on estimated relations, explaining inflation by the lagged level of inflation, the unemployment rate and a dummy for supply shocks, s_t.

$$p_t = f_t(p_{t-1}, u_t, s_t) \tag{8}$$

[2]We do not consider expectations generated by ARMA or related models because they violate the criterion of data availability (De Jong, 1988), which states that expectations should not be based on any information that becomes available only after the time the expectations are formed (cf. Muth, 1961).

[3]It is assumed that policy intervention does not affect $L(u_t)$.

[4]Taking into account ideal and past values of the target variables u_t and pop_t, their desired values were set at $u^f = 3\%$ and $pop^d = 76\%$. Small changes in these values hardly affect the results.

For each administration a separate equation is estimated using data available at the time the administration was installed. The links between popularity and the unemployment rate are based on a study on popularity functions by Swank (1989a). This study shows that presidential popularity in the United States can be explained by economic variables as inflation and unemployment if distinction is made between Democratic and Republican administrations. The popularity of a Democratic president rises when unemployment increases and inflation declines, whereas the popularity of a Republican president increases when unemployment declines and inflation rises. The basic idea behind such popularity functions is that voters believe political parties to perform better on different issues ('issue hypothesis'). These functions contrast with the conventional, from an empirical point of view less satisfactory, popularity functions in which the popularity of the president is negatively related to unemployment and inflation regardless of the political colour of the president. The idea behind conventional popularity functions is that voters hold the president in office responsible for the economic outcomes ('score hypothesis'). Both types of popularity functions are taken into the government model.

$$pop_t = g(u_t, p_t, \text{political factors}) \tag{9}$$

Equation 9 completes the framework of the government model. The working of the model can be described as follows. At $t = 0$ an administration with political colour j is installed. This administration minimizes Equation 7 subject to Equations 8 and 9, where Equation 8 is estimated with the data set available at $t = 0$. This optimization yields a value of e_0, the measure of policy intervention, and through Equations 8 and 9 planned values of u_0, p_0 and pop_0. At $t = 1$ information becomes available on the actual values of u_0, p_0 and pop_0. On the basis of this new information, Equation 7 is again optimized for the period $t = 1$ to $t = n$, yielding a value of e_1. Such optimizations are repeated each year until the election date at $t = n$, after which the process starts again for the next administration.

Given Equations 8 and 9, the values of e_t only depend on the weights in Equation 7. These weights are estimated with maximum likelihood. Two sets of weights are estimated: one representing the preferences of Democratic administrations and one representing the preferences of Republican administrations. An impression of the preferences of Republican and Democratic administrations can be obtained from Table 1.

Table 1 shows that Democratic administrations assign higher priority to reducing unemployment than Republicans, whereas Republican administrations assign higher priority to suppressing inflation. The estimates further suggest that both Democrats and Republicans have tried to increase their popularity.[5] Another striking result is that Democrats have met more resistance in manipulating the unemployment rate.

With the government model discussed above two time series of price expectations can be generated. In one of these time series future policies are anticipated by private sector agents and in the other future policies are not anticipated. In the present model anticipated inflation means that in forming expectations of inflation, agents take the impacts of government actions on inflation into account. This implies that agents are assumed to know policy makers' preferences and the information available to policy makers on which their actions are based. Once the colour of the administration in office for the forthcoming year is

[5]In estimating the loss functions we have found that the perception of Democratic administrations on the popularity function has been in line with the score hypothesis, whereas the perception of Republican administrations has been in line with the issue hypothesis.

Table 1. *Loss functions attaching costs to the average situation*

mean value (1956–84)	Democrats	Republicans
$p = 4.56\%$	4	63
$u = 5.40\%$	47	9
$pop/10 = 5.5\%$	31	19
$e = 0.87\%$	18	9

The values can be derived as follows. First, the mean value of a variable is calculated over the period 1957–84 and reduced by its desired value. After squaring this outcome, it is multiplied by the corresponding weight as obtained by estimating 1. Finally, the outcomes are normalized by 100.

known, expected inflation is set at the value of inflation which is generated by the model. Only in an election year the colour of the administration in the next year is uncertain. For those years price expectations are a weighted average of the inflation generated by the model if the Democratic party would have won the elections, p^D, and the inflation generated by the model if the Republican party would have won the elections, p^R. As weights we use expected popularity, pop_t^e, as an indication of the perceived probability that the president in power in the election year would have won the elections. If a Republican administration is in power in the election year $(t-1)$, this can be formalized as follows:

$$p_t^e = pop_t^e \cdot p_t^R + (1 - pop_t^e) \cdot p_t^D \tag{10}$$

In case a Democratic administration is in power the price expectation for the year after the election year is obtained by

$$p_t^e = pop_t^e \cdot p_t^D + (1 - pop_t^e) \cdot p_t^R \tag{11}$$

Let us summarize the main characteristics of the generated time series of expected inflation. The time series rests on the assumption that private sector agents know the goals of policy makers, their restrictions and their behaviour. This means that private sector agents can anticipate the impact on economic outcomes of a change of the administration's colour. The relevance of this for the United States is clearly illustrated by Table 1, which shows that Democratic and Republican administrations have different priorities. As a consequence future economic developments do not only depend on economic relationships but also on the colour of the administration in office. It is worth mentioning that private sector agents are forward looking, using only information available when the expectations are formed. Because model outcomes serve as expectations, there is symmetric information.

The time series generated here is closely connected with the rational expectations hypothesis (Muth, 1961). We think that the approach followed here is worthy in spite of its partial nature. Theoretically the potential impact of economic policy on expectations is often emphasized, but it is neglected in empirical studies.

If in the present model policy makers' actions are not anticipated, a series of expected inflation can be derived by combining Equation 8 and the natural path of the unemployment rates. By assumption this path describes the unemployment rates connected with the situation where policy makers abstain from policy intervention. Substituting these rates into Equation 8 yields a series of 'unanticipating' price expectations.

Table 2. *Different time series of price expectations (1957–1984)*

Time	Perfect foresight	Naive expectations	Unanticipating expectations	Rational expectations
1957	3.4	3.1	2.8	2.2
1958	1.8	3.4	2.8	3.1
1959	2.1	1.8	1.0	2.3
1960	1.5	2.1	1.8	2.5
1961	0.9	1.5	1.6	1.3
1962	2 0	0.9	0.8	1.1
1963	1.4	2.0	1.8	2.9
1964	1.6	1.4	1.5	1.8
1965	2.1	1.6	1.8	4.0
1966	3.4	2.1	2.3	2.6
1967	3.0	3.4	7.3	9.3
1968	5.0	3.0	2.9	3.2
1969	5.0	5.0	4.1	4.8
1970	5.5	5.0	4.2	4.6
1971	5.2	5.5	3.6	4.9
1972	4.3	5.2	2.9	4.2
1973	5.6	4.3	3.6	4.0
1974	8.8	5.6	5.0	6.3
1975	9.0	8.8	7.3	9.3
1976	5.7	9.0	6.1	7.0
1977	6.0	5.7	6.0	5.5
1978	7.5	6.0	6.4	7.0
1979	8.7	7.5	8.1	9.1
1980	9.4	8.7	9.0	8.4
1981	9.4	9.4	9.2	9.1
1982	6.4	9.4	9.0	8.6
1983	3.9	6.4	5.6	4.2
1984	3.7	3.9	3.7	4.3

Data source: see Appendix. Columns 3 and 4 are derived by the method described in Section III.

In examining the role of different concepts of price expectations in estimates of wage equations use is also made of a time series of expected inflation based on perfect foresight and a series based on naive expectations.[6] In the former, actual prices are used as expected prices and in the latter, current inflation serves as an indication of next year's inflation.

Table 2 shows the series of price expectations discussed above.[7]

IV. ESTIMATION RESULTS

Equation 6 is estimated with the four series for expected inflation, over the priod 1957–1984. It should be noted that the assumption of naive price expectations and the assumption of

[6]Because we only model expectations based on information available at the time the expectations are formed, we have insufficient data at our disposal to construct a series relying on the assumption of adaptive expectations.

[7]The variance of the deviation of the actual series from the expected series is for naive expectations 2.03, for unanticipating expectations 1 60, and for rational expectations 1.28.

perfect foresight affect the equation to be estimated. Under naive expectations it is not possible to discriminate between real and nominal wage adjustment, as the first two terms in Equation 6 are perfectly correlated. Under perfect foresight the third coefficient cannot be estimated, as in that case expected inflation is by definition equal to actual inflation.

The choice of an appropriate estimation method depends on the *a priori* expectation that Equation 6 is in fact an individual equation of a larger structural model. Consequently, there might be endogenous variables, which would result in simultaneous equation bias if OLS is used. In order to test whether this is the case the procedure introduced by Hausman (1978) is followed. Equation 6 is augmented by the residuals of the least squares estimate of $p_t - p_t^e$ against instrumental variables. In addition, an unrestricted version of Equation 6 is augmented by residuals of separate least squares estimates of p_t and p_t^e against instrumental variables. OLS estimation of the augmented Equation 6 generates coefficients of these residuals not significantly different from zero, hence there is no sign of misspecification due to endogeneity of variables (Hausman, 1978).[8] Application of OLS to Equation 6 leads to the estimates in Table 3.

These estimates are striking. The first two coefficients never differ significantly from zero (at a 5% level), indicating that wages are very flexible. Thus it can be said that changes in the target wage instantaneously work through the actual wage, which means there is neither nominal nor real wage rigidity. This result appears to be independent of the assumption which is made regarding the nature of price expectations. Furthermore, the estimates of α_2 suggest that prices are fully indexed. To put it differently, when actual prices deviate from

Table 3. *The expected real wage growth Equation 6, 1957–1984*
$w_t = p_t^e + \alpha_0(w_{t-1} - p_{t-1}) + \alpha_1(w_{t-1} - p_t^e) + \alpha_2(p_t - p_t^e) + \alpha_3 u_t' + \alpha_4 y_t + C$

	Rational expectations	Unanticipating expectations	Naive expectations	Perfect foresight
α_0	− 0.07 (0.21)	0.04 (0.20)	− 0.06 (0.15)	− 0.12 (0.19)
α_1	0.02 (0.19)	0.22 (0.20)	—	0.06 (0.13)
α_2	0.90 (0.15)	0.83 (0.14)	0.94 (0.13)	—
α_3	0.11 (0.04)	0.13 (0.04)	0.11 (0.04)	0.11 (0.04)
α_4	0 32 (0.06)	0.33 (0.06)	0.33 (0.06)	0.33 (0.06)
C	− 1.75 (0.65)	− 1.86 (0.61)	− 1.70 (0.63)	− 1.70 (0.63)
R^2	0.89	0.90	0.89	0.89
LM (d f.)	1.45 (6,16)	0.79 (6,16)	1.32 (6,17)	1.30 (6,17)
White (d.f.)	11.31 (9)	13.24 (9)	7.31 (9)	13.89 (9)

Values in parentheses are standard errors of the estimated coefficients R^2 is the ratio of the explained sum of squares and the total sum of squares. LM is a Lagrange multiplier test statistic, F-distributed, for autocorrelation in the residuals (Breusch and Godfrey, 1981, p. 71). White is a test statistic for heteroskedasticity (White, 1980, p. 825). Data source: see Appendix.

[8]Because the validity of this test is only asymptotic, Equation 6 has additionally been estimated by 2SLS. The results, available from the authors upon request, hardly change the OLS estimates and do not affect any of the conclusions.

expected prices the target wage will immediately be adjusted. Since actual wages are flexible this implies that expectation errors do not affect real or nominal wages.[9]

The above shows that the assumption which is made regarding the nature of price expectations does not affect the present results. It is easy to demonstrate that in a world characterized by full indexation the impact of price expectations on wages is negligible. By taking $\beta = 1$ in Equation 1, or in Equations 4 and 5, expected inflation disappears from the right hand side of the equation. Hence in this case neither nominal nor real wages depend on expected inflation. Due to this it is not possible to determine how expectations are actually formed. However, considering our findings, this does not appear to be an important issue in explaining real wage growth.

V. CONCLUSIONS

In this paper a model has been constructed and estimated which enables the determination of wage rigidity in the United States under various assumptions regarding how price expectations are formed. The study suggests that wages in the United States are highly flexible and that inflation is fully indexed. The assumption which is made concerning price expectations does not affect the findings. If wages are fully indexed to expected and unexpected price movements, wage changes do not depend on price expectations.

The results have important implications for economic policy. If wages are flexible and prices are fully indexed, real wages cannot be affected by inflationary policies. Of course, this conclusion is not new. In previous studies it has been pointed out that under rational expectations inflationary policies will be anticipated, and as a consequence will not affect real wages. However, in this paper it has been found that this consequence is the case under all kinds of expectations.

APPENDIX

Variable definitions

w_t Growth of wage rate private sector per man year. (source: OECD.)
p_t Growth of price gross domestic product. (source: OECD.)
y_t Growth of gross domestic product (constant prices). (source: OECD.)
u_t Unemployment rate. (source: OECD.)
pop_t the fraction of the Gallup Poll respondents who answered 'Yes' when asked if they approved of the way the incumbent was handling his job as president. (source: Gallup Polls.)

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[9]Separate estimation of Equations 4 and 5 in order to reduce multicollinearity in Equation 6 does not change the results presented in Table 3. Considering the standard deviations of the estimated coefficients, testing joint hypotheses with a more sophisticated estimation procedure will not affect the results significantly.

REFERENCES

Branson, W. H. and Rotemberg, J. J. (1980) International adjustment with wage rigidity, *European Economic Review*, **13**, 309–32.

Breusch, T. S. and Godfrey, L. (1981) A review of recent work on testing for auto-correlation in dynamic simultaneous models, in: *Macroeconomic Analysis* (Eds) D. Currie, R. Nobay and D. Peel, Croom Helm, London, 63–105.

Bruno, M. and Sachs, J. (1985) *Economics of Worldwide Stagflation*, Harvard University Press, Cambridge, Mass.

Garretsen, H. and Lensink, R. (1989) International policy coordination and European wage rigidity, *De Economist*, **137**, 76–90.

Hausman, J. A. (1978) Specification tests in econometrics, *Econometrica*, **46**, 1251–71.

Jong, E. de (1988) Expectation formation: criteria and an assessment, *De Economist*, **136**, 435–67.

Kahn, G. A. (1984) International differences in wage behavior: real, nominal, or exaggerated?, *American Economic Review: Papers and Proceedings*, **74**, 155–9.

Muth, J. F. (1961) Rational expectations and the theory of price movements, *Econometrica*, **29**, 315–35.

Ploeg, F. van der (1988) *International Interdependence and Policy Coordination in the OECD Economies*, Network for Quantitative Economics, Tilburg.

Sachs, J. (1980) Wages, flexible exchange rates, and macroeconomic policy, *Quarterly Journal of Economics*, **94**, 731–47.

Swank, O. H. (1989a) Presidential popularity and reputation, *Discussion Paper, 8907/G*, Erasmus University, Rotterdam.

Swank, O. H. (1989b) A rationalization of US economic policy making, *Discussion Paper, 8911/G*, Erasmus University, Rotterdam.

White, H. (1980) A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity, *Econometrica*, **48**, 817–38.