STUDIECENTRUM VOOR ECONOMISCH EN SOCIAAL ONDERZOEK

V A K G R O E P M A C R O - E C O N O M I E

Wage formation and labour market performance : on the (non)existence of superior wage formation mechanisms

J. VAN GOMPEL
A. VAN POECK (*)

Report 92/277

June 1992

(*) The authors thank M. Meulepas and F. Heylen for some critical comments.

Universitaire Faculteiten St.-Ignatius
Prinsstraat 13 - B 2000 Antwerpen

D/1992/1169/12

Abstract

Labour market performance diverged markedly in OECD countries in the 1970s and 1980s, with some countries having clearly done so much better than others. The contribution of this paper lies in a modest theoretical and empirical investigation of the impact of wage formation characteristics and exchange rate flexibility on the unemployment evolution in the light of both a negative and positive supply shock. The analysis points out that the impact of wage indexation and wage responsiveness to unemployment depends on the kinds of shocks the economy undergoes as well as on the resulting change in the unemployment rate. Moreover, the direction of the exchange rate change plays a crucial role in deciding in favour or against wage indexation. This means that no particular wage formation mechanism can be expected to provide a panacea in all circumstances.

1. Introduction

During the 1970s and 1980s, labour market performance of the OECD countries has been characterized by sharp cross-country differences. As table 1 shows, almost all countries experienced first increasing (1971-73 to 1983-84) and afterwards declining (1983-84 to 1989-90) unemployment rates. But the size of the increase (decrease) has been quite different between countries.

In this paper we attempt to 'explain' these observed differences in unemployment change by differences in the characteristics of wage formation and in the exchange rate experiences of these countries.

Table 1. Unemployment in the 1970s and 1980s

	change in unemployment[1] between 1971-73 and 1983-84	change in unemployment[1] between 1983-84 and 1989-90
Canada	5.55	-3.71
France	6.36	0.08
Germany	6.17	-1.51
Italy	3.98	1.54
Japan	1.39	-0.51
United Kingdom	8.65	-5.28
United States	3.07	-3.16
Australia	7.12	-2.86
Austria	2.73	-0.55
Belgium	11.02	-4.17
Denmark	8.83	-0.89
Finland	2.95	-1.86
Greece	5.58	-0.62
Ireland	9.00	-0.09
Netherlands	9.97	-4.25
New Zealand	4.69	2.44
Norway	1.76	1.77
Spain	16.11	-2.41
Sweden	0.68	-1.33

[1] as a % of the labour force; the average of 1971-73 (1983-84) compared to the average of 1983-84 (1989-90)

Source: OECD, *Economic Outlook*.

The role of macroeconomic wage formation and labour market institutions for performance in the labour market has been stressed by many economists (most notably, in the context of the adverse supply shocks of the 1970s and the early 1980s). In this respect, the concept of real wage flexibility has received some respectability. In spite of these contributions, the relationship between wage formation and the prevailing exchange rate system has not received as much attention, especially not in the empirical literature. For some recent theoretical studies see e.g. De Bruyne (1987), Argy (1990) and Pilbeam (1991).

The contribution of this paper lies in a modest theoretical and empirical investigation of the interdependence between wage formation and exchange rate flexibility in the light of both a negative and favourable supply shock. The theoretical analysis suggests that no particular wage formation mechanism can be expected to be superior. The analysis indeed points out that the impact of wage indexation and wage responsiveness to the unemployment evolution depends on the kinds of shocks the economy undergoes as well as on the exchange rate evolution.

The empirical work reported in this paper shows that differences in the unemployment evolution between the OECD countries are indeed partially explained by differences in the wage formation mechanism and exchange rate experiences between these countries.

The structure of the paper is as follows. In section 2 we present a theoretical model which enables us to analyse labour market performance in the context of a supply shock under different wage formation and exchange rate assumptions. Section 3 describes the wage formation characteristics and the exchange rate experiences of the OECD countries during 1973-1990. Section 4 reports the results of a cross-country regression analysis, set up to assess the empirical relevance of the theoretical insights for the observed unemployment change. Finally the conclusions are set out in section 5.

2. Unemployment after a supply shock

2.1. The model and its solution

The framework we use is a standard model of a small open economy under rational expectations; see e.g. Marston (1982, 1985), Turnovsky (1983), De Bruyne (1987) and Argy (1990). These studies examine how wage indexation and the exchange rate system interact in determining the effects of different kinds of shocks on macroeconomic performance.

However, we differ from these earlier approaches in two important respects. First, we adopt a different criterion to evaluate economic performance. Most of the literature on the subject takes as objective the minimization of output or price fluctuations (or some weighted average of both) (see e.g. Turnovsky (1983) and Argy (1990)). In this paper, we take labour market performance as the proper performance indicator. Indeed, since we are particularly interested in the evolution of unemployment in the OECD countries after the adverse and favourable supply shocks of 1973&79 and 1986 respectively, we evaluate economic performance on the basis of the change in unemployment after these shocks.

Second, we concentrate on the broader concept of wage formation. More specifically, besides the degree of wage indexation we also consider the sensitivity of wages to the unemployment rate. The latter aspect of wage formation has been stressed in a number of empirical studies (see e.g. Grubb et al. (1983)) but not been fully integrated in the theoretical literature.

As we will see, an oil price shock implies (1) *a change in the consumer price* (foreign price shock) and (2) *a change in labour productivity* (productivity shock). Our strategy is to solve the system for the relevant endogenous variables (unemployment and the exchange rate) in terms of these disturbances and the parameters reflecting wage and exchange rate flexibility. It is then shown that both wage formation and exchange market intervention interact in determining the influence of the shocks on unemployment. The model is described by

the following set of equations [1]:

Aggregate demand

$$(1) \quad Y_D = a_0 + a_1(P_f+E+S_2-P) - a_2(R-(CP^e_{+1}-CP)) + a_3Y_f$$

Aggregate supply and labour market

$$(2) \quad L_D = m_0 - m_1(W-P) + m_1S_1$$
$$(3) \quad L_S = n_0$$
$$(4) \quad U = 1 - (L_D/L_S)$$
$$(5) \quad CP = vP + (1-v)(P_f+E+S_2)$$
$$(6) \quad W-W_{-1} = g_0 + g_1(CP-CP_{-1}) - g_2U$$
$$(7) \quad Y_S = a + bL_D + S_1$$

Money market

$$(8) \quad M_S = M_S^* - \mu E$$
$$(9) \quad M_D - P = d_0 + d_1Y - d_2R$$
$$(10) \quad R = R_f + (E^e_{+1}-E)$$

Equilibrium conditions

$$(11) \quad Y_D = Y_S = Y$$
$$(12) \quad M_D = M_S = M$$

Y	domestic output (real)
P	price of domestic output
CP	consumer price
R	domestic interest rate (nominal)
L	employment
U	unemployment rate
W	nominal wage
M	stock of money
E	exchange rate (units of domestic currency per unit of foreign currency)
Y_f	foreign output (real)
P_f	price of foreign output (in foreign currency)
R_f	foreign interest rate (nominal)
CP^e	the expected value of the consumer price[2]
E^e	the expected value of the exchange rate
g_1	degree of nominal wage indexation
g_2	degree of responsiveness of nominal wages to the unemployment rate
μ	degree of leaning against the wind

$a_1, a_2, a_3, m_1, g_2, d_1, d_2 \geq 0$
$0 \leq v, g_1, b \leq 1$
$0 \leq \mu \leq \infty$

S_1	productivity shock
S_2	foreign price shock

an adverse oil price shock implies $S_1 < 0$ and $S_2 > 0$
a favourable oil price shock implies $S_1 > 0$ and $S_2 < 0$

---

[1] All variables are expressed in logarithms (except the interest rate and the unemployment rate).

[2] Expectations are assumed to be formed rationally.

Equation (1) describes real aggregate demand for domestic output as a function of the relative prices of foreign and domestic goods, the real interest rate and foreign output. A rise in the foreign price relative to the domestic price (a deterioration in the terms of trade) is assumed to increase aggregate demand. The same holds for a rise in foreign output, while a rise in the real interest rate is assumed to reduce aggregate demand.

Labour demand (equation (2)) is derived from a Cobb-Douglas production function given in equation (7) [3]. Labour supply (equation (3)) is assumed to be exogenously given. Equation (4) defines the unemployment rate as the disequilibrium in the labour market. Consumer prices (equation (5)) are a weighted average of home and import prices. In the wage equation (equation 6), nominal wage increases are determined by consumer price inflation and the unemployment rate (the latter exerts a negative influence on wage inflation). The inclusion of the unemployment variable in the wage equation constitutes an important difference with earlier work in this field (see before).

Equation (8) represents the monetary policy reaction function. It covers a variety of potential exchange rate regimes. If $\mu = 0$, we obtain an exogenous money stock M_S^* and a flexible exchange rate regime. If, on the contrary, $0 < \mu < \infty$ we obtain a managed float, with μ reflecting the degree of 'leaning against the wind'. The limiting case of $\mu = \infty$ corresponds to a completely fixed rate regime. In this case the supply of money is determined endogenously by exchange market intervention, since monetary policy is directed at stabilizing the exchange rate (M_S adjusts to keep E fixed). In equation (9) the demand for real balances is expressed as a function of income and the domestic interest rate, with money being deflated by the domestic price level. Equation (10) represents the assumption of perfect asset substitution. The domestic interest rate is assumed to be equal to the foreign interest rate

---

[3] The analytical derivation of labour demand is presented in appendix 1.

plus the expected depreciation ($E^e-E>0$) or appreciation ($E^e-E<0$) of the currency. The model is closed by equations (11) and (12).

The model determines four variables as functions of the two disturbances: domestic output Y and its price P, the unemployment rate U and the exchange rate E (under flexible exchange rates) or the domestic money stock M (under fixed exchange rates). In this paper we only focus on the unemployment rate (as a criterion of economic performance) and the exchange rate (to make comparisons between different degrees of exchange rate flexibility). More particularly, we will consider the effects of the disturbances S_1 and S_2 on U and E and analyse how the structure of wage behaviour and exchange rate flexibility affect the influence of these exogenous shocks on unemployment. For each variable X of the model, we consider how it changes with respect to $\bar{X}$, the solution for X when the disturbances are equal to zero and expectations are realized.

Because of analytical tractability it is necessary to make some simplifications. First, we assume that the foreign output, price and interest rate are exogenous and will therefore be left out of consideration. The foreign price shock will be the only foreign variable that is explicitly concentrated on in the model. We furthermore assume that there are no shocks in the prior periods ($S_{-1}=S_{-2}=...=0$ for $S=S_1,S_2$ and $(X-\bar{X})_{-1}=(X-\bar{X})_{-2}=...=0$). With the economy only being confronted with shocks in the present period, equation (6) can be reduced to the following static wage equation:

$(W-\bar{W}) - (W-\bar{W})_{-1} = g_1(CP-C\bar{P}) - g_1(CP-C\bar{P})_{-1} - g_2(U-\bar{U})$ or

$W-\bar{W} = g_1(CP-C\bar{P}) - g_2(U-\bar{U})$ since $(W-\bar{W})_{-1} = (CP-C\bar{P})_{-1} = 0$.

Substitution of (2), (3), (5) and (6) in (4); (2), (5) and (6) in (7); (5) in (1); and (8), (9) and (10) in (12) reduces the model into the following set of equations:

$$(13)\quad U-\bar{U} = \frac{m_1g_1(1-v)(E-\bar{E}) - m_1(1-g_1v)(P-\bar{P}) - m_1S_1 + m_1g_1(1-v)S_2}{n_0+m_1g_2}$$

$$(14)\quad Y-\bar{Y} = -m_1bg_1(1-v)(E-\bar{E}) + m_1b(1-g_1v)(P-\bar{P}) + m_1bg_2(U-\bar{U}) + m_1S_1 - m_1bg_1(1-v)S_2$$

$$(15)\quad Y-\bar{Y} = (a_1+a_2v)(E-\bar{E}) - (a_1+a_2v)(P-\bar{P}) + (a_1-a_2(1-v))S_2$$

$$(16)\quad E-\bar{E} = \frac{-(P-\bar{P}) - d_1(Y-\bar{Y})}{d_2+\mu}$$

To facilitate comparison between different exchange rate regimes ($0 \leq \mu \leq \infty$), equations (13) to (16) are solved for $U-\bar{U}$ as a function of $E-\bar{E}$ and the disturbances S_1 and S_2 [4]. The resulting expression is given by equation (17).

$$(17)\quad U-\bar{U} = \frac{-m_1(1-g_1)(a_1+a_2v)(E-\bar{E}) + m_1(1-g_1v-a_1-a_2v)S_1 - m_1[a_1(1-g_1)-a_2(1-v)]S_2}{D_1}$$

$$(18)\quad E-\bar{E} = \frac{m_1(n_0+g_2)(1-d_1(a_1+a_2v))S_1 - [(n_0+m_1g_2)(a_1-a_2(1-v)) + n_0m_1bg_1(1-v)+d_1n_0m_1b(a_1(1-g_1)-a_2(1-v))]S_2}{D_2}$$

where $D_1 = (n_0+m_1g_2)(a_1+a_2v) + n_0m_1b(1-g_1v) > 0$

$D_2 = (d_2+\mu+1)D_1 - n_0m_1b(1-g_1)(1-d_1(a_1+a_2v)) > 0$

From equation (18) it is clear that the model covers alternative exchange rate regimes, including that of a managed float ($0 < \mu < \infty$). Under fixed rates ($\mu = \infty$) E is kept equal to $\bar{E}$. Under a pure float, the discrepancy $E-\bar{E}$ due to the shocks is expressed as in equation (18), setting $\mu = 0$. As can be seen, the *effect of the shocks on the currency is ambiguous*. Whether it depreciates or appreciates after the productivity shock S_1 depends on the sign of the expression $1-d_1(a_1+a_2v)$ [5]. The effect

---

[4] The solutions for $P-\bar{P}$ and $Y-\bar{Y}$ are given in appendix 2.

[5] In appendix 3, it is shown that the denominator of equation (18) D_2 has a positive sign. Notice also that the sign of $1-d_1(a_1+a_2v)$ corresponds to the relative slope of the aggregate demand equation (1) and money demand equation (9) in a (P,Y) diagram (see also Pilbeam (1991, p. 53-56)).

of the foreign price shock S_2 on the currency is even more complex. It depends on the sign of the following expression:

$$- (n_0+m_1g_2)(a_1-a_2(1-v)) - n_0m_1bg_1(1-v) - d_1n_0m_1b[a_1(1-g_1)-a_2(1-v)]$$

2.2. Wage formation characteristics, exchange rate flexibility and unemployment change

Substitution of equation (18) into equation (17) gives the solution for the unemployment change after the shocks for different degrees of exchange rate flexibility ($0 \leq \mu \leq \infty$). As can be seen from (17'), the effect of both shocks on unemployment is ambiguous. Neither an adverse oil price shock ($S_1<0$ and $S_2>0$), nor a favourable oil price shock ($S_1>0$ and $S_2<0$) exerts an unambiguous effect on unemployment. The ultimate effect of the shocks will be determined by the different parameters of the model.

(17') shows the partial derivative of $U-\bar{U}$ with respect to μ, the parameter reflecting the *degree of exchange rate rigidity*. The sign depends on whether the currency depreciates or appreciates, indicating that a higher degree of exchange rate flexibility (a lower μ) only improves labour market performance if the currency depreciates.

(17') also shows the partial derivatives with respect to the parameters of the wage equation. The sign of the derivative with respect to *wage indexation* depends on 1) the kind of shocks the economy undergoes and 2) whether the currency depreciates or appreciates. A higher degree of wage indexation unambiguously deteriorates labour market performance if the oil price shock is a negative one and if the currency depreciates. If the currency appreciates after an adverse shock, the sign becomes ambiguous. If, on the contrary, the economy experiences a favourable shock, a high degree of wage indexation is favourable in terms of the unemployment criterion. However, now there is ambiguity if the currency depreciates.

The degree of *wage responsiveness to the unemployment rate* has an ambiguous influence, depending on whether unemployment increases or decreases due to the shocks. If unem-

ployment increases, wage responsiveness to the unemployment rate exerts a negative effect on the unemployment change. However, if unemployment decreases, the effect will be positive.

$$(17')\quad U-\bar{U} = \frac{\begin{array}{l} m_1[(1-g_1v-a_1-a_2v)(d_2+\mu+1)-(1-g_1)(1-d_1(a_1+a_2v))]S_1 \\ -m_1[(a_1(1-g_1)-a_2(1-v))(d_2+\mu+1)-(1-g_1)(a_1-a_2(1-v))]S_2 \end{array}}{D_2}$$

$$\frac{\partial(U-\bar{U})}{\partial\mu} = (E-\bar{E})\,\frac{m_1(1-g_1)(a_1+a_2v)}{D_2} \qquad \begin{array}{ll} < 0 & \text{if } E-\bar{E} < 0 \\ > 0 & \text{if } E-\bar{E} > 0 \end{array}$$

$$\frac{\partial(U-\bar{U})}{\partial g_1} = \frac{\begin{array}{l} -m_1v(d_2+\mu+1)S_1 + [(a_1(d_2+\mu+1)(n_0+m_1g_2) \\ +a_1n_0m_1b(1-g_1)d_1+n_0m_1b(1-v)(d_2+\mu+g_1)]S_2 + (E-\bar{E})D_2 \end{array}}{D_2^2 \;/\; m_1(d_2+\mu+1)(a_1+a_2v)}$$

$$\begin{array}{ll} > 0 & \text{if } S_1 < 0,\ S_2 > 0 \text{ and } E-\bar{E} > 0 \\ < 0 & \text{if } S_1 > 0,\ S_2 < 0 \text{ and } E-\bar{E} < 0 \end{array}$$

$$\frac{\partial(U-\bar{U})}{\partial g_2} = -(U-\bar{U})\,\frac{m_1(d_2+\mu+1)(a_1+a_2v)}{D_2} \qquad \begin{array}{ll} < 0 & \text{if } U-\bar{U} > 0 \\ > 0 & \text{if } U-\bar{U} < 0 \end{array}$$

Table 2 provides a summary of the above analysis. It clearly illustrates the ambiguous role of *wage indexation* for the effects of exogenous supply shocks on the unemployment rate. The impact of wage indexation depends on both the kind of shocks the economy undergoes (adverse versus favourable supply shocks) and the direction of change in the exchange rate due to these shocks. If the authorities give priority to employment (as is supposed in this paper), this finding implies that there exists no invariant indexation scheme that could be considered as superior in all circumstances. Indeed, in the case of a *negative supply shock* and a depreciating currency

the unemployment increase (decline) will be larger (smaller) if wages are highly indexed. If the exchange rate appreciates, wage indexation can influence the unemployment change either positively or negatively. However, in the case of a *positive supply shock* and an appreciating currency the higher the degree of wage indexation the larger (smaller) the unemployment decline (increase). Now there is ambiguity if the exchange rate depreciates, with wage indexation again influencing the unemployment change either positively or negatively [6].

The direction of the impact of the shocks on unemployment (increase or decrease) is important for deciding whether a high or a low *wage responsiveness to unemployment* is preferable: the higher the wage responsiveness to unemployment the lower the unemployment change (decline or increase), irrespective of the kind of shock the economy undergoes. This means that there does not exist a superior degree of wage responsiveness to unemployment that would always lead to a better labour market performance: if unemployment decreases (increases), a low (high) responsiveness is preferred.

In economies where wage indexation is less than complete and wage responsiveness to unemployment is not extremely high, the exchange rate movement, which seemed ambiguous, becomes crucial in determining the relative performance of different exchange rate regimes (i.e. different μ-values). Indeed, if the currency appreciates after the shocks a low *degree of exchange rate flexibility* is preferred in terms of the unemployment decline criterion. If, on the other hand, the currency tends to depreciate a high degree of exchange rate flexibility is preferred.

Notice further that if wage indexation is complete ($g_1 = 1$), the shocks change unemployment equally irrespective of the degree of exchange rate flexibility. Exchange market intervention is rendered totally ineffective as a policy in supporting the unemployment decline.

---

[6] The ambiguities are also found in other studies for the effect of a supply shock on output (see e.g. De Bruyne (1987), Argy (1990) and Pilbeam (1991)).

If wage responsiveness to unemployment is infinite ($g_2 = \infty$), the shocks will have no impact on unemployment. Exchange market intervention becomes less effective the higher the sensitivity of wages to the unemployment rate.

Table 2. The structural impact of wage and exchange rate flexibility on the unemployment change after a positive and negative oil price shock[1]

	negative oil price shock increase in U		positive oil price shock decrease in U	
	appr.	depr.	appr.	depr.
wage indexation g1	?	+	-	?
wage responsiveness to unemployment g2	-	-	+	+
exchange rate rigidity μ	-	+	-	+

[1] In the table it is assumed that unemployment increases after a negative shock, and decreases after a positive shock.
- : favourable (smaller increase, larger decrease in the unemployment rate)
+ : unfavourable (larger increase, smaller decrease)

3. Wage formation characteristics and exchange rate flexibility of OECD countries (1973-1990)

Section 2 revealed that the theoretical effects of an oil price shock depend on both the wage formation mechanism and the degree of exchange rate flexibility. Section 3.1. reports wage formation characteristics of a set of OECD countries. In section 3.2. we give a brief overview of their exchange rate experiences.

3.1. Wage formation characteristics

In order to introduce wage indexation and wage responsiveness to unemployment in the empirical analysis, we make use of the wage equations reported in a number of OECD studies (see Chan-Lee et al. (1987) and Kawasaki et al. (1990)). The specification of these wage equations closely corresponds to equation (6) outlined in section 2.

Table 3 shows the estimated values of the degree of wage indexation and the degree of wage responsiveness to unemployment. It can be seen that there exist substantial differences in the process of wage formation between countries. E.g. Belgium and Germany can be characterized as countries with a high degree of wage indexation. In Canada, the United States, Denmark, Spain and Sweden, on the contrary, wage indexation is rather low. Table 3 further indicates that Japanese and Swedish wage formation is relatively responsive to unemployment. Germany, the United Kingdom, Denmark, Ireland and Spain, on the other hand, seem to be countries where unemployment exerts little or no influence on wage behaviour.

Table 3. Wage indexation[1] (g_1) and wage responsiveness[2] to unemployment (g_2) in the OECD

	g_1	g_2 1973-83	g_2 1984-90
Canada	0.20	0.51	0.51
France	0.50	0.33	0.33
Germany	0.75	0.13	0.07
Italy	0.60	0.60	0.60
Japan	0.67	1.69	1.05
United Kingdom	0.33	0.15	0.15
United States	0.14	0.60	0.60
Australia	0.50	0.39	0.39
Austria	0.33	0.90	0.50
Belgium	1.00	0.54	0.54
Denmark	0.25	0.17	0.13
Finland	0.33	0.46	0.45
Greece	0.50	0.41	0.41
Ireland	0.62	0.25	0.13
Netherlands	0.50	0.38	0.20
New Zealand	-	0.65	0.65
Norway	0.39	0.69	0.25
Spain	0.25	0.20	0.09
Sweden	0.25	2.25	2.06

[1] Since the estimates are based on semi-annual data g_1 reflects the degree to which nominal wages are adjusted to a change in consumer prices within six months.

[2] For some countries, the unemployment rate was entered in the inverse (1/U) or the log-form (log U), instead of the linear form. The inverse specification proved superior for Norway, Sweden and Japan, while the log-form was preferred for Austria, Denmark, Finland, Ireland, the Netherlands, Spain and Germany. In the case of these non-linear specifications the sensitivity of nominal wages to the unemployment level depends on the unemployment rate for which the computations are made. The results shown are based on the average unemployment rate during 1973-83 and 1984-90, respectively.

Source: Chan-Lee et al. (1987); Kawasaki et al. (1990).

3.2. An exchange rate rigidity index

In the appendix we give a brief overview of the exchange rate regimes that applied to the large and small OECD countries during 1973-90. This classification is mainly based on the IMF Annual Reports on exchange arrangements and exchange restrictions. However, the relationship between the *declared* regime (according to this IMF taxonomy) and the *actual* regime is at best tenuous. In this respect, even the IMF (1976, p.24) states: "Such classification can be a misleading guide to the actual policy being followed. Currencies that are officially floating are often managed to achieve a result that may be little different from formal pegging. Conversely, with countries that maintain a formal peg, frequent adjustments may be used to obviate policy changes that might otherwise have been necessary to maintain the pegged value".

Therefore, an analytically more meaningful method of describing exchange rate policy is presented in this section. More specifically, we propose a simple measure of exchange rate rigidity, based on Holden et al. (1979). This indicator relates the amount of exchange market intervention to the amount of exchange rate volatility, because neither would by itself provide an accurate description of the prevailing exchange rate policy. Indeed, the amount of intervention is only relevant when it is related to the pressure on the exchange rate. Similarly, exchange rate volatility gives no adequate indication of the efforts by the monetary authorities to defend a particular rate.

We therefore measure the exchange rate rigidity index μ by the ratio of the sum of the absolute value of quarterly percentage changes [7] in official holdings of foreign exchange [8] expressed in U.S. Dollars [9] to the sum of the absolute value

---

[7] Percentage changes in end-of-quarter values.

[8] Including the reserve position in the IMF and SDR holdings. Gold stocks have been excluded from reserves since the price at which they should be valued is unclear, and because of their effective illiquidity.

of quarterly percentage changes in the nominal effective exchange rate (MERM rate). In formal notation this gives:

$$\mu = \frac{\sum_{t=1}^{n} \frac{|R_t - R_{t-1}|}{R_{t-1}}}{\sum_{t=1}^{n} \frac{|E_t - E_{t-1}|}{E_{t-1}}}$$

where R_t: the U.S. Dollar value of the country's holdings of foreign exchange at time t;
E_t: an index of the MERM exchange rate at time t;
t=1 : the first quarter of the period considered;
t=n : the last quarter of the period considered.

Our index is clearly a simplified version of the one suggested by Holden et al. (1979). Indeed, in order to facilitate the calculation of the index we use quarterly data instead of monthly data. Furthermore, reserve changes are not related to the amount of trade. In other words, we assume no variation in the size of a country's external sector.

Theoretically, μ takes values ranging from zero to infinity, with the limits being defined respectively by a completely intervention-free exchange rate policy (pure float, $\mu = 0$) and a perfectly pegged policy ($\mu = \infty$). Evidently, μ has significance only in a comparative sense.

In practice, the exchange rate rigidity measure of the OECD countries (see table 4), ranges in value from less than 2 for Japan and the United States in the second period (1984-90) to more than 18 for Sweden (also in the second period). Furthermore, the large countries show, on average, a rigidity score of 4.8 (for each period) which is clearly lower than the average value of 6.8 (1973-83) and 7.2 (1984-90) for the small countries.

---

[9] No allowance is made for intervention by other countries which may negate the need for exchange market action by the authorities of the country under consideration.

Table 4. Exchange rate evolution

	exchange rate rigidity index[1]		exchange rate change[2]	
	1973-83	1984-90	1973-83	1984-90
Canada	7.54	10.98	1.26	0.59
France	5.61	3.57	2.54	0.16
Germany	2.39	3.69	-3.92	-2.18
Italy	8.45	7.98	7.73	1.77
Japan	2.23	1.91	-3.94	-8.24
United Kingdom	4.16	3.03	3.33	1.90
United States	3.31	1.98	-1.45	3.22
Australia	10.84	2.90	1.24	3.87
Austria	4.12	3.76	-3.58	-2.19
Belgium	7.59	6.48	0.72	-0.98
Denmark	9.68	7.00	1.03	-1.31
Finland	10.50	14.07	1.72	-1.32
Greece	-	-	-	11.89
Ireland	5.56	6.04	4.50	0.16
Netherlands	6.21	2.99	-1.91	-2.16
New Zealand	-	-	-	3.73
Norway	6.32	3.98	0.14	1.99
Spain	2.73	6.12	5.34	-0.55
Sweden	4.29	18.55	2.67	-0.07

[1] Due to data inavailability, the first period is restricted to 1979-1983 for Australia, Finland, Ireland and Spain.
[2] The average yearly change in the MERM exchange rate (a positive sign refers to a depreciation of the currency, while a negative sign refers to a an appreciating currency).

Source: IMF, *International Financial Statistics*, several issues.

Some important differences between the IMF classification (see appendix 4) and the Holden-rigidity index should be pointed out. Canada's high rigidity scores clearly contradicts with the assumed independent float regime. The actual exchange rate policy of the Netherlands for the second period could also be labeled as contradictory, albeit to a lesser degree. We also note that two countries with a system of basket pegging during the second period, viz. Finland and Sweden, show the highest degree of exchange rate rigidity. This indicates that the degree of commitment to fixed exchange rates implied by independent basket pegging is not a priori less than that implied by participation in a cooperative arrangement like the EMS [10].

[10] It seems interesting to quantify the existing correlation between the IMF taxonomy (appendix 4) and the calculated flexibility scores (table 4). To this end, we transform the IMF classification scheme into a dummy variable which takes the value 2 for countries with fixed exchange rate systems (EMS, basket peg), 1 for countries with a managed float or a changed regime during the period considered, and 0 for coun-

4. The experience of unemployment

As already set out in the introduction, the unemployment evolution of OECD countries has exhibited sharp cross-country differences since 1973. In this section, we investigate whether differences in *wage formation characteristics* and *exchange rate experiences* in OECD countries have caused the observed disparity in labour market performance during the 1970s and 1980s. To 'answer' this question we analyse across countries and across time (two periods, viz. 1971-83 and 1984-90) pooled data on differences in the change in the unemployment rate by relating them to differences in wage formation characteristics and exchange rate flexibility.

The theoretical insights obtained in section 2 (Cf. table 2) can be used in order to set up the following equation:

$$\blacktriangle U_{it} = a_0 + a_{111}d_{111}g_{1i} + a_{121}d_{121}g_{1i} + a_{112}d_{112}g_{1i} + a_{122}d_{122}g_{1i} + a_{21}d_{21}g_{2it} + a_{22}d_{22}g_{2it} + a_{31}d_{31}\mu_{it} + a_{32}d_{32}\mu_{it}$$

where $\blacktriangle U$: the change in the unemployment rate (i.e. 1983-84 compared to 1971-73, and 1989-90 compared to 1983-84, see table 1);
g_1: degree of wage indexation (see table 3);
g_2: degree of responsiveness of wages to the unemployment rate (see table 3);
μ : degree of exchange rate rigidity (see table 4);
$i = 1,\ldots,19$; $t = 1,2$.

In this equation, we use dummies in order to account for the ambiguous effects of the shocks (see table 5). d_1 is a dummy variable that takes 1 for a particular period and change in the exchange rate: d_{111} takes 1 when the country on average experienced an appreciation during the first period (and 0 otherwise); d_{121} is a dummy with value 1 if the currency depreciated during the first period (and 0 otherwise); d_{112} takes 1

---

tries with floating exchange rates. The low correlation coefficient (0.30) affirms the finding that there exists not always a firm relationship between the declared and the actual regime.

when the country experienced an appreciation during the second period (and 0 otherwise); finally, d_{122} takes 1 when the country experienced a depreciation during the second period (and 0 otherwise).

Table 5. Dummies taking into account a particular period and change in the exchange rate

	negative oil price shock t=1 increase in U		positive oil price shock t=2 decline in U	
	appr.	depr.	appr.	depr.
wage indexation g1	d111	d121	d112	d122
wage responsiveness to unemployment g2	d21	d21	d22	d22
exchange rate rigidity μ	d31	d32	d31	d32

The existence of a reversed effect of the unemployment coefficient in the case of an unemployment decline vis-à-vis an unemployment increase, is checked by the use of d_{21} and d_{22}: d_{21} takes 1 if unemployment increases ($\blacktriangle U > 0$) and 0 otherwise; d_{22} takes 1 if unemployment decreases ($\blacktriangle U < 0$) and 0 otherwise.

In order to see whether exchange rate flexibility improves labour market performance, it is necessary to make the distinction between an appreciating currency (d_{31} = 1 and 0 otherwise), and a depreciating currency (d_{32} = 1 and 0 otherwise).

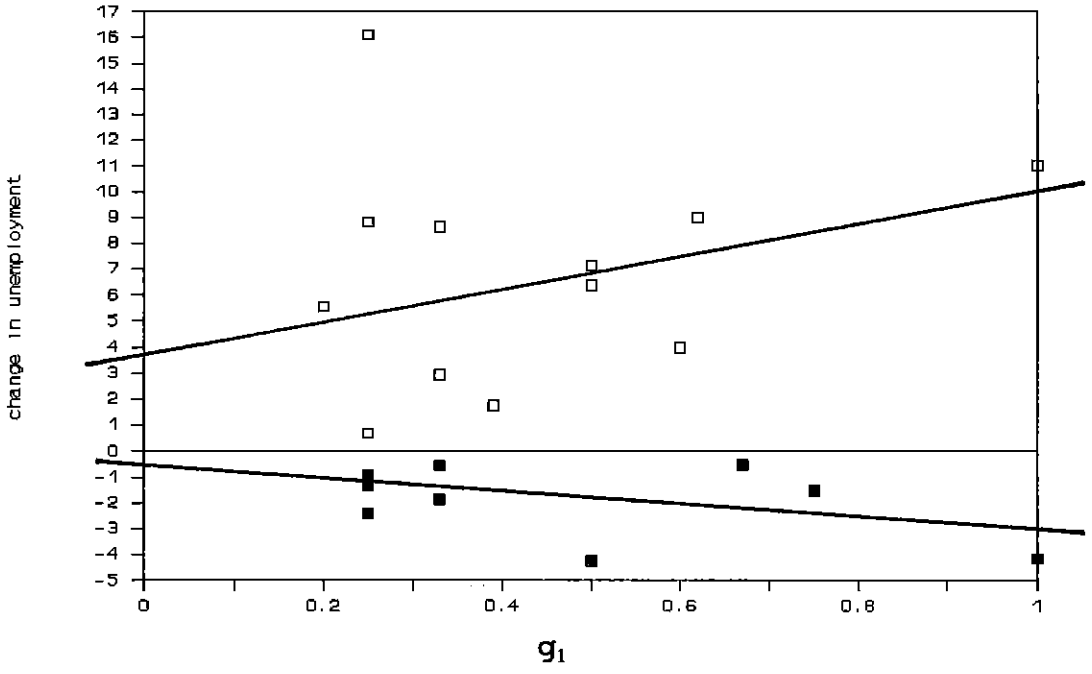
We expect the signs of the regression coefficients to be as follows (see also table 2): a_{112}, a_{21}, $a_{31} < 0$; a_{121} a_{22}, $a_{32} > 0$ and a_{111}, a_{122} ambiguous. First, we will discuss the relationships seperately. At the end, all findings will be grouped into one estimated equation.

Table 6. Measuring the impact of wage and exchange rate flexibility for the evolution of unemployment (see the above equation) [1]

a_0	a_{111}	a_{121}	a_{112}	a_{122}	a_{21}	a_{22}	a_{31}	a_{32}	$\bar{R}^2$	SER
1.24 (0.88)	6.41 (1.65)	11.01 (3.28)	-5.66 (1.78)	-4.27 (1.08)	-	-	-	-	0.50	3.57
-	-	-	-	-	-5.13 (8.30)	1.24 (2.22)	-	-	0.59	3.16
6.70 (4.56)	-	-	-	-	-	-	-4.15 (4.13)	-19.55 (2.89)	0.33	3.55
2.11 (1.67)	1.05 (0.50)	7.39 (3.88)	-3.98 (2.34)	-1.62 (0.74)	-2.52 (5.08)	0.53 (1.31)	-0.83 (1.37)	-10.78 (2.86)	0.86	1.61

[1] The equation considering the effect of exchange rate rigidity and the last equation shown in the table are estimated leaving out the Netherlands and Spain (only the first period) and Canada (only the second period). For a_{21}, a_{22} and a_{31} a logarithmic relationship is used, for a_{32} a reciprocal relationship is used (hence we expect $a_{32} < 0$).

Figure 1. Unemployment and wage indexation

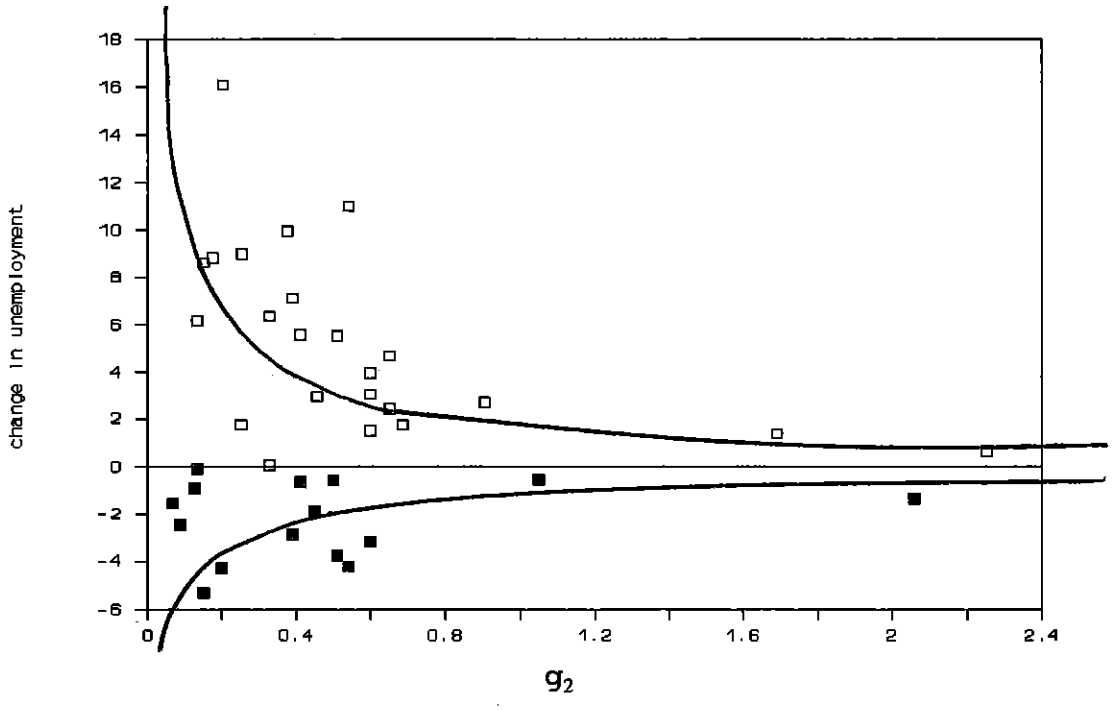


□ first period, depreciation
■ second period, appreciation

There is evidence that countries with a relatively high degree of wage indexation suffered the steepest rise in unemployment between 1971-74 and 1983-84 (see table 6 and figure 1). Adequate real wage flexibility obviously facilitated adjustment to the 'stagflationary' oil price shock in the 1970s. Notice however that for countries experiencing on average an appreciating currency during this period the effect is less significant. Indeed, according to our theoretical conclusions (see section 2) there was ambiguity w.r.t. the effect of wage indexation under an appreciating currency.

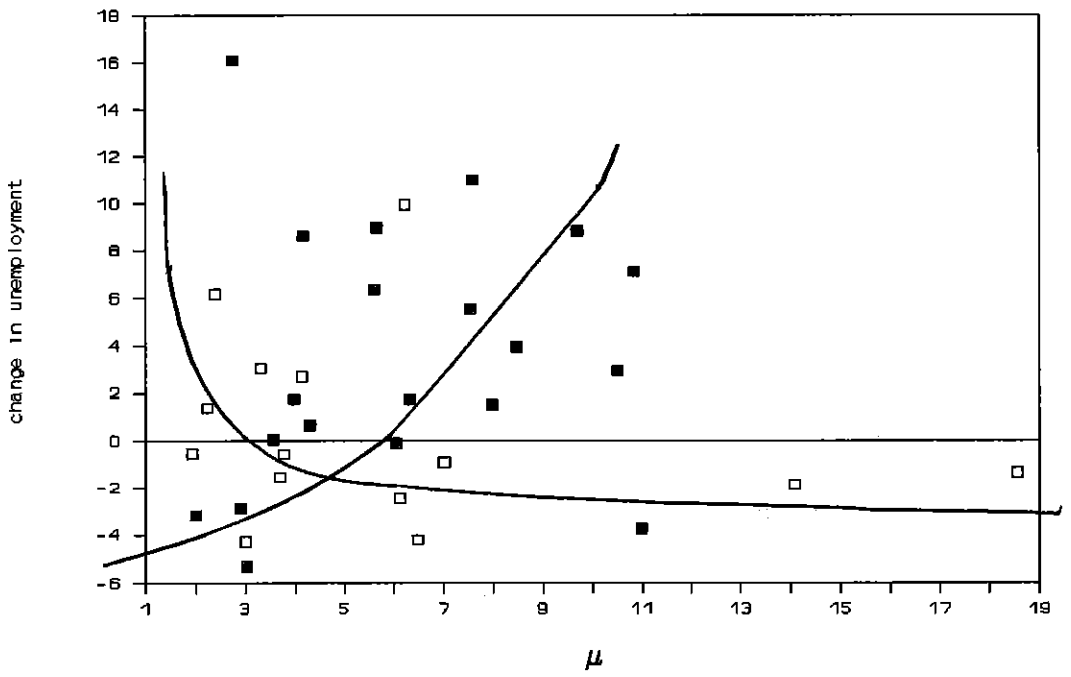
The situation in the second half of the 1980s was rather different: oil prices fell, and in this case a quick response of wages to prices was needed to accommodate the unemployment decline. Again, the less significant effect for the depreciating countries suggest that the effect of wage indexation is less clear in such circumstances.

Figure 2. Unemployment and wage responsiveness to unemployment



From figure 2 it can be seen that the unemployment change is also strongly associated with the degree of wage responsiveness to unemployment (see also table 6). First, notice the opposite effect of the latter for an unemployment increase viz. an unemployment decline. Moreover, the figure clearly reveals a nonlinear relationship; both a reciprocal and a logarithmic curve fit the data quite well, albeit to a lesser extent for the unemployment decline (table 6 only shows the logarithmic relationship).

Figure 3. Unemployment and exchange rate rigidity



□ appreciation
■ depreciation

In figure 3 we show the relationship between unemployment and exchange rate rigidity (see also table 6). As can be seen, this relationship is clearly positive for those countries that experienced a depreciation in the period considered. Spain (for the first period) and Canada (for the second period) are the only exceptions to this finding. On the contrary, for countries that experienced an appreciating currency, the relationship is less clear. However, if the Netherlands (for

the first period) are left out of consideration, a slight negative relationship can be detected. In table 6 we show results when using a reciprocal curve (depreciation), hence the negative sign of a_{32}, and a logarithmic curve (appreciation), respectively.

Table 6 also shows the estimation results combining all relevant variables [11]. They confirm our main findings:
- The unemploment increase after the oil price shock of 1973 is higher in countries with a high degree of wage indexation; the effect of wage indexation for countries that experieced an appreciating currency in this period is less clear. A high degree of wage indexation, however, seemed favourable after the reversed oil price shock of 1986; now the effect is less clear when the currency depreciated on average.
- Wage responsiveness to unemployment only improves labour market performance if unemployment increases: the increase will be lower for countries with a high responsiveness. The relationship is reversed if labour market performance improves (although this effect seemed less significant).
- A high degree of exchange rate flexibility is favourable (in terms of labour market performance) if the currency on average depreciates. If it appreciates the reversed effect is found (although less significant).

[11] The equation considering μ seperately and the last equation are based on a dataset leaving out the Netherlands and Spain (first period), and Canada (second period). Including these countries does not change our findings, although less significant results are obtained.

5. Conclusions

The main conclusions of the paper are easily restated. First, the theoretical analysis suggests that no particular wage formation mechanism can be expected to provide a panacea. Indeed, the survey points out that the impact of wage indexation and wage responsiveness to the unemployment evolution depends strongly on the kinds of shocks the economy undergoes and the resulting change in the unemployment rate (increase versus decline). Moreover, the direction of the exchange rate change can make it harder to decide in favour or against a high degree of wage indexation.

More particularly, the model revealed that the optimal values of the crucial parameters (g_1, g_2 and μ) are highly sensitive to relevant parameters in the economy (Cf. the uncertainty whether unemployment decreases or increases as a result of the shocks; the uncertainty whether the currency appreciates or depreciates; the uncertainty whether wage indexation influences the unemployment change positively or negatively (Cf. appreciation and a negative shock, depreciation and a positive shock)). From this, it follows that any recommendations concerning g_1, g_2 and μ should be based on a study of the characteristics of the particular economy. Even if economies face similar shocks we may be led to make different recommendations due to structural differences between economies.

Second, the empirical part of the paper revealed that labour market performance diverged markedly in OECD countries in the 1970s as well as in the 1980s, with some countries having clearly done so much better than others. It was shown that these differences can partly be explained by differences in their wage formation characteristics and in their degree of exchange rate flexibility.

One should be appropriately circumspect in drawing strong conclusions, however. It would be surprising if just a few key variables could provide a single explanation which fits the unemployment experience of so many countries. One can partly

appeal to other (even more) important (country-specific) influences not captured by this analysis [12]. Athough it is recommended not to draw strong conclusions from the empirical results, they are surely indicative and supportive (although some correlations were far from perfect). Moreover, they are based on a coherent model of the economy within which the investigated relationships are incorporated. However, it is clear that further progress on this model can be made.

In this respect, one should notice the limitations imposed by considerations of analytical tractability. Indeed, the assumption that we only consider the effects of a present shock on the present period, means that the analysis is based on a simple static model. One might ask, however, how effects (and even cumulative effects if the shock is sustained over several periods) which will occur in the periods after the shock change the above conclusions (Cf. the dynamics in the wage equation (6)).

Finally, it should be mentioned that our approach may be misleading because it takes labour market performance as the only performance indicator. This is so since we are particularly interested in the evolution of unemployment of the OECD countries in the 1970s and 1980s. However, different countries may have different priorities. Different countries, even if they have similar economic structures and face similar shocks, may well require different wage formation characteristics and different degrees of exchange rate management simply because their objectives differ.

---

[12] The role of structural reform and macroeconomic policy is not considered in the analysis, which could be considered as a serious shortcoming.

Appendix 1

Let the Cobb-Douglas production function be $Y = a + bL + S_1$ $(0 \leq b \leq 1)$. Producers are assumed to maximize the value of profits. Thus, in their demand for labour, they are assumed to equate the real wage to the marginal product of labour:

$W-P = a + \log b + (b-1)L + S_1$

or $L = (1/b-1)(-a - \log b + W-P - S_1)$

If we define $m_0 = (a+\log b)/(1-b)$ and $m_1 = 1/(1-b)$, the demand for labour is $L_D = m_0 - m_1(W-P) + m_1S_1$

Assuming that employment is determined by labour demand, we substitute the above equation in the production function and obtain the level of output that corresponds to the employment of labour $Y_S = a + bL_D + S_1$ or $Y_S = m_1 + m_0b - m_1b(W-P) + m_1S_1$

Appendix 2

$$P-\bar{P} = \frac{(n_0+m_1g_2)(a_1+a_2v)+n_0m_1bg_1(1-v)(E-\bar{E}) - m_1(n_0+g_2)S_1 - [(n_0+m_1g_2)(a_1-a_2(1-v))+n_0m_1bg_1(1-v)]S_2}{D_1}$$

$$Y-\bar{Y} = \frac{n_0m_1b(a_1+a_2v)(1-g_1)(E-\bar{E}) + m_1(n_0+g_2)(a_1+a_2v)S_1 - n_0m_1b(a_1(1-g_1)-a_2(1-v))S_2}{D_1}$$

Appendix 3

In this appendix, we prove that the denominator of equation (18) is positive: $(d_2+\mu+1)D_1-n_0m_1b(1-g_1)(1-d_1(a_1+a_2v)) > 0$

$$\begin{aligned}
&(d_2+\mu+1)((n_0+m_1g_2)(a_1+a_2v)+n_0m_1b(1-g_1v))-n_0m_1b(1-g_1)(1-d_1(a_1+a_2v)) \\
&= (d_2+\mu+1)(n_0+m_1g_2)(a_1+a_2v)+(d_2+\mu)n_0m_1b(1-g_1v)+n_0m_1bd_1(1-g_1)(a_1+a_2v) \\
&\quad +n_0m_1b(1-g_1v)-n_0m_1b(1-g_1) \\
&= (d_2+\mu+1)(n_0+m_1g_2)(a_1+a_2v)+(d_2+\mu)n_0m_1b(1-g_1v)+n_0m_1bd_1(1-g_1)(a_1+a_2v) \\
&\quad +n_0m_1bg_1(1-v) > 0
\end{aligned}$$

Appendix 4 Exchange rate arrangements in OECD countries (1973-90, as of june each year)

country	period	arrangement
Canada	1973-90	independently floating
France	1973	snake arrangement
	1974-78	independently floating
	1979-90	EMS arrangement
Germany	1973-78	snake arrangement
	1979-90	EMS arrangement
Italy	1973-78	independently floating
	1979-90	EMS arrangement
Japan	1973-90	independently floating
Un. Kingdom	1973-90	independently floating
Un. States	1973-90	independently floating
Australia	1973-76	independent adjustable peg regime
	1977-82	crawling peg regime
	1983-90	independently floating
Austria	1973-76	independently floating
	1977-90	independent adjustable peg regime
Belgium	1973-78	snake arrangement
	1979-90	EMS arrangement
Denmark	1973-78	snake arrangement
	1979-90	EMS arrangement
Finland	1973-77	independently floating
	1978-90	independent adjustable peg regime
Greece	1973-82	independently floating
	1983-90	independently managed floating
Ireland	1973-78	pegged to a single currency (sterling)
	1979-90	EMS arrangement
Netherlands	1973-78	snake arrangement
	1979-90	EMS arrangement
New Zealand	1973-79	independent adjustable peg regime
	1979-82	crawling peg regime
	1982-84	independent adjustable peg regime
	1985-90	independently floating
Norway	1973-78	snake arrangement
	1979-90	independent adjustable peg regime
Spain	1973-78	independently managed floating
	1988	independently floating
	1989-90	EMS arrangement
Sweden	1973-77	snake arrangement
	1978-90	independent adjustable peg regime

Source: IMF, *Annual report on exchange arrangements and exchange restrictions*, several issues.
Argy & De Grauwe (1990).

References

Argy, V & P. De Grauwe (1990), *Choosing an exchange rate regime: the challenge for smaller industrial countries*, Washington, IMF.

Argy, V. (1990), 'The transmission of foreign disturbances under different exchange rate regimes', *Journal of Banking and Finance*, 14, pp. 929-946.

Chan-Lee, J.H., D.T. Coe & M. Prywes (1987), 'Microeconomic changes and macroeconomic disinflation in the 1980s', *OECD Economic Studies*, 8, pp. 121-157.

De Bruyne, G. (1987), 'Indexering', in *Sociaal-Economische deregulering of herregulering*, 18de Vlaams Wetenschappelijk Economisch Congres (8 and 9 may 1987, Brussels), Vereniging Voor Economie, pp. 249-263.

Grubb, D., Jackman, R. & R. Layard (1983), 'Wage rigidity and unemployment in OECD countries', *European Economic Review*, 21, pp. 11-39.

Holden, P., Holden, M. & E.C. Suss (1979), 'The determinants of exchange rate flexibility: an empirical investigation', *The Review of Economics and Statistics*, 3, pp. 327-333.

IMF (1976), *Annual Report*.

IMF, *Annual Report on exchange rate arrangements and exchange restrictions*, several issues.

IMF, *International Financial Statistics*, several issues.

Kawasaki, K., P. Hoeller & P. Poret (1990), 'Modelling wages and prices for the smaller OECD countries', *OECD Working Papers*, 86.

Marston, R.C. (1982), 'Wages, relative prices and the choice between fixed and flexible exchange rates', *Canadian Journal of Economics*, 15(1), pp. 87-103.

Marston, R.C. (1985), 'Stabilization policies in open economies', in R.W. Jones & P.B. Kenen (eds) *Handbook of international economics*, volume 2, pp. 859-915.

Pilbeam, K. (1991), *Exchange rate management: theory and evidence*, London, MacMillan.

Turnovsky, S.J. (1983), 'Wage indexation and exchange market intervention in a small open economy', *Canadian Journal of Economics*, 21(4), pp. 574-592.

Van Poeck, A. & J. Van Gompel (1992), 'De werkloosheidsdaling (1984-1990) en de loonvormingshypothese', *Maandschrift Economie*, 1, pp. 42-56.

LIJST VAN RECENTE SESO-RAPPORTEN

MEULEPAS M. en J. PLASMANS, ESTIMATING AND FORECASTING EXCHANGE RATES BY MEANS OF PPP AND UIP, An application on the Belgian Franc and the Dutch Guilder vis à vis the DM and US Dollar, September 1991, 49 blz. **(91/262)**

PEERSMAN G. en A. VAN POECK, De Belgische competitiviteitswet : een betwistbaar instrument, november 1991, 23 blz. **(91/263)**

PLASMANS J. en H. PAUWELS, Modelling and forecasting Belgian stock market prices, December 1991, 59 blz. **(91/264)**

ITO Y., PLASMANS J., DE ZEEUW A., CERVIO PINHO A. & A. MARKINK, Hierarchical optimal control for policy evaluation using econometric models for the European Community, November 1991, 48 blz. **(91/265)**

JENNES G. en G. DIERICKX, Belastingstelsels en belastingbeleid (1955-1988). Een vergelijkende analyse, januari 1992, 51 blz. **(92/266)**

JENNES G. en G. DIERICKX, Het belastingbeleid in 15 OESO-landen (1955-1988) : alternatieve verklaringen, januari 1992, 103 blz. **(92/267)**

DE BORGER B., KERSTENS K., MOESEN W. en J. VANNESTE, Explaining differences in productive efficiency : an application to Belgian unicipalities, February 1992, 27 blz. **(92/268)**

DE GRAEVE D., HUYBRECHTS K., DESSERS L. & J. HEYRMAN, Laboratory testing in the general practitioner's office : economic consequences, February 1992, 29 blz. **(92/269)**

BRUGGEMAN A. & F. HEYLEN, Indicators of the stance of monetary and fiscal policy - A pragmatic approach for the OECD countries in the 1980s, March 1992, 37 blz. **(92/270)**

HUYBRECHTS K., Economische evaluatie van antibioticaprofylaxis bij de implantatie van een heupprothese, maart 1992, 26 blz. **(92/271)**

MEERSMAN H. & I. VANNESTE, Statusverschillen van mannelijke en vrouwelijke UFSIA-TEW-ALUMNI, maart 1992, 60 blz. **(92/272)**

NONNEMAN W., Rendabiliteit van onderwijs in België, april 1992, 32 blz. **(92/273)**

ERREYGERS G., On the uniqueness of square cost-minimizing techniques, May 1992, 36 blz. **(92/274)**

JANSSENS I., De vraag naar distributiewater : huishoudelijk en niet-huishoudelijk verbruik, juni 1992, 53 blz. **(92/275)**

DE BORGER B., KERSTENS K., MOESEN W. & J. VANNESTE, A NON-PARAMETRIC NON-CONVEX APPROACH TO TECHNICAL EFFICENCY : An illustration of radial efficiency measures and some sensitivity results, June 1992, 31 blz. **(92/276)**