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Macroeconomic Performance Under Alternative Exchange Rate Regimes: Does Wage Indexation Matter?

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Abstract

This paper reexamines the macroeconomic effects of wage indexation in an open economy under alternative exchange rate regimes. The main finding is that, once the lags in actual indexation rules are considered, wage indexation affects output behavior substantially less than posited in the previous academic literature. This result implies that the academic view that wage indexation makes a flexible exchange rate generally preferable is unwarranted and suggests that the choice of exchange rate regime with and without wage indexation depends on similar factors. The analysis also reveals that the net effects of wage indexation on macroeconomic stability are ambiguous.

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Summary

This paper reexamines the macroeconomic effects of wage indexation in an open economy hit by aggregate shocks under alternative exchange rate regimes. The central innovation is that wage indexation is modeled as a clause in long-term contracts that grants periodic wage adjustments according to lagged inflation. The effects of wage contracts with and without this clause are studied in a standard open-economy model, solved for plausible parameters by numerical simulation.

The main finding is that wage indexation affects output behavior substantially less than posited in the previous academic literature. In particular, it is found that wage indexation does not invalidate or modify the Mundell-Fleming results that a monetary shock destabilizes output when the exchange rate floats, and that a shock to the demand for goods destabilizes output more when the exchange rate is fixed than when it floats. Similarly, wage indexation does not appear to blur the behavior of output across exchange rate regimes. In general, the response of output to a variety of shocks tends to be qualitatively similar and of the same order of magnitude regardless of the type of contracts prevailing in the economy.

These results imply that the academic view that wage indexation makes a flexible exchange rate generally preferable is unwarranted and suggest that the choice of exchange rate regime in economies with and without wage indexation depends on similar factors. The results also imply that the net effects of wage indexation on output stability when the economy is open are ambiguous, depending on the type of shocks impinging upon the economy, the exchange rate regime in place, the type and length of the wage contracts being compared, and the structural parameters of the economy.

I. INTRODUCTION

What advice on macroeconomic analysis and policy can be given in the case of an open economy with widespread wage indexation? Consider, for instance, the case of Chile. Typical wage contracts in that country last for two years and contemplate every six months a wage adjustment equal to 100 percent of cumulated inflation.[2] Should one expect the aggregate behavior of the Chilean economy to be different from the aggregate behavior of economies that have wage contracts without indexation clauses? And if those differences exist, what are their implications on output stability and on the level and variability of inflation? Furthermore, do they have any implications regarding exchange rate policy?

To answer these questions it is first necessary to understand the behavior of the economy with and without wage indexation. If labor contracts specify a socially optimal level of output regardless from the wage set in these contracts, the presence or absence of wage indexation is irrelevant for the aggregate behavior of the economy. As Fischer (1985) and others have noted, however, a careful examination of actual labor contracts suggests that they determine wages and leave output to be decided by the firms. This empirical observation opens the possibility for alternative types of wage rules to have significantly different effects on macroeconomic behavior.

The behavior of an open economy with labor contracts that only specify wages (wage contracts hereafter) is well understood for the case in which these wages are not indexed. The basic principles are contained in the Mundell-Fleming results, according to which a monetary shock destabilizes output when the exchange rate floats but does not affect it when the exchange rate is fixed, while a shock to the demand for goods destabilizes output more when the exchange rate is fixed than when it floats. More generally, there is a consensus that in such an economy the response of output and other macroeconomic variables to aggregate shocks depends crucially on the exchange rate regime in place.[3]

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[2]This stylized fact has been documented and tested by Jadresic (1992, 1995), Maturana (1992), and Garcia (1995).

[3]The seminal references are Fleming (1962), Mundell (1963), and Dornbusch (1976). A useful survey of the related literature can be found in Marston (1985). For an analysis with a representative agent framework, see Obstfeld and Rogoff (1996).

The academic literature maintains that the behavior of an open economy is very different from the above when wage contracts include indexation clauses.[4] The sharpest contrast would arise under *full wage indexation*, in which case nominal wages are assumed to move proportionally with the current price level and the real wage is thus deemed fixed. As in standard models a fixed real wage makes the level of output independent of nominal variables, it follows that in this case the Mundell-Fleming results would cease to hold: monetary shocks would not affect output even if the exchange rate is flexible, while shocks on the demand for goods would affect output identically under a fixed or a floating exchange rate. More generally, full wage indexation would make the exchange rate regime totally irrelevant for output behavior.

When the academic literature refers to *partial wage indexation*, the contrast with the conventional predictions is less acute, but qualitatively the differences remain. In this case, nominal wages are taken to move less than proportionally to the current price level, but the real wage is still assumed to be more rigid than without wage indexation. In standard models, this increased real wage rigidity lessens the effects of monetary shocks on output when the exchange rate is flexible, and dampens the effect of shocks in the demand for goods on output when the exchange rate is fixed. The general proposition is that the larger the degree of wage indexation, the smaller the differences of output behavior across exchange rate regimes.[5]

These propositions are important by themselves, but also because other main results of the indexation literature hinge on them. For instance, the previous academic literature has concluded that under *optimal wage indexation*, benchmark case in which the degree of indexation is chosen to minimize the deviations between the actual and the frictionless level of output, a flexible exchange rate regime should generally be preferred over a fixed exchange

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[4]Surveys on the wage indexation literature have been provided by Carmichael, Fahrer and Hawkins (1985), Aizenman (1987), Devereux (1994), and Van Gompel (1994). On the effects of wage indexation in open economies, also see Genberg (1989), Argy (1990), and Turnovsky (1995). The seminal papers on wage indexation are Gray (1976) and Fischer (1977).

[5]The propositions in this and the previous paragraph were explicitly enunciated by Marston (1982) and Turnovsky (1983), but they are implicit in almost all the open economy models used in the academic literature on wage indexation (two exceptions are Morandé, 1985, and Fischer, 1988, who considered some special types of lagged indexation rules).

rate regime.[6] It is easy to see that this conclusion crucially depends on the premise that wage indexation lessens the effects of monetary shocks on output when the exchange rate is flexible. If true, such an effect obviously diminishes the value of fixing the exchange rate as a device to stabilize output in the face of monetary shocks. Furthermore, such an effect also diminishes the value of fixing the exchange rate as a credibility device in order to counter the possible inflationary bias in the economy due to a policymaker with time-inconsistent preferences. This is because, to the extent that wage indexation protects output from monetary shocks, wage indexation also reduces the policymaker's incentives to create inflationary surprises.

Disturbingly, these and other central propositions of the indexation literature are based on the assumption that wages are indexed to the current price level: without the increased real wage rigidity implied by this assumption, it does not obviously follow that wage indexation protects output from monetary shocks when the exchange rate is flexible, nor, more generally, that wage indexation blurs the differences in the behavior of output under alternative exchange rate regimes. This is troublesome because it is well known that actual indexed wage contracts adjust wages infrequently to the evolution of prices and with a lag, so that typical cost of living adjustments are determined according to lagged inflation rather than current inflation.[7] As this implies that actual wage indexation defines a nominal rather than a real type of wage rigidity, its effects need not resemble those implied by the assumption of contemporaneous wage indexation. To be sure, I have shown elsewhere that, in a closed economy, the effects of wage indexation on the cost of disinflation and on macroeconomic stability can be very different when the lags in actual indexation rules are taken into account.[8]

This paper reexamines the macroeconomic effects of wage indexation in an open economy hit by aggregate shocks under alternative exchange rate regimes. The central innovation is that wage indexation is modeled as a clause in long-term contracts that grants a cost of living adjustment in every period according to the inflation rate in the previous period. The behavior of the economy with contracts including this clause is compared with

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[6]Flood and Marion (1982) showed that, with optimal wage indexation, output with a floating exchange rate is more stable than with a fixed exchange rate. Aizenman and Frenkel (1985a, 1985b, and 1986) confirmed this result and showed that, around the optimal degree of indexation, a higher degree of indexation increases the optimal degree of exchange rate flexibility. Rasmussen (1993) showed that, even if the policymaker could credibly fix the exchange rate in order to ensure low inflation, a flexible exchange rate generally dominates a fixed exchange rate when wage indexation is optimal. He used an open-economy version of Barro and Gordon's (1983) well known model of discretionary policy.

[7]Since Gray (1976) introduced the assumption that wage indexation to the price level is contemporaneous, many authors have emphasized that actual wage indexation is lagged, including Fischer (1977 and 1988) and Simonsen (1983).

[8]Jadresic (1996a and 1996b).

the behavior of the economy with long-term contracts that specify preset time-varying wages during the life of each contract, and alternatively, with the behavior of the economy with short-term contracts that specify fixed wages during the life of each contract. For simplicity and comparability of results, the remainder of the model corresponds to a standard Mundell-Fleming economy. The model is solved for plausible parameters by numerical simulation.

The paper is organized as follows. Following this introduction, Section II presents the basic elements of the model and the alternative types of wage determination considered in the analysis. Section III uses this framework to examine the effects of wage indexation on the response of output to alternative shocks, providing the basic results of the paper. Section IV uses these and other results to discuss some of the macroeconomic implications of wage indexation, including its effects on output stability, the choice of exchange rate regime, and the level and variability of inflation. Section V summarizes the main conclusions.

II. An Open Economy with Alternative Wage Contracts

To prepare the stage for the analysis, this section presents a simple model of an economy that is open to trade and financial transactions. As in most of the related literature, the basic components of the model are along the lines of Fleming (1962), Mundell (1963) and Dornbusch (1976). The analytical innovation is on the modeling of wages, which stems from considering alternative types of indexed and nonindexed wage contracts.

A. Basic Components of the Economy

We consider an economy characterized by a domestic and a foreign good that are imperfect substitutes, and by a domestic and a foreign bond that are perfect substitutes. The notation for the variables in this economy is the following: y_t measures the rate of growth of aggregate domestic output; p_t and q_t are the rates of change of the price of the domestic and foreign goods in terms of domestic currency respectively; π_t denotes the inflation rate; i_t represents the nominal interest rate yield by the domestic bond; m_t is the rate of growth of domestic money supply; s_t indicates the rate of devaluation of the domestic currency; and w_t is the rate of change of the aggregate nominal wage. Unless explicitly pointed out, variables are measured in log terms, with lowercase letters representing their first differences and capital letters their levels.

The following relationships hold in this economy:

$$y_t = -\beta(1-L)(i_t - E_t\pi_{t+1}) + \gamma(q_t - p_t) + u_t^d, \quad (1)$$

$$m_t - \pi_t = y_t - \delta(1-L)i_t - u_t^m, \quad (2)$$

$$p_t = w_t - u_t^y + \alpha (y_t - u_t^y), \tag{3}$$

$$\pi_t \equiv \epsilon p_t + (1-\epsilon) q_t + u_t^{\pi}, \tag{4}$$

where

$$q_t = s_t, \tag{5}$$

$$i_t = E_t s_{t+1}, \tag{6}$$

and α, β, γ, δ, and ϵ are nonnegative parameters. In these equations, L is the standard lag operator, and E_t the mathematical expectations operator given information about variables realized up to period t.

Equation (1) represents the principle of effective demand in the market for the domestic good. It establishes that changes in aggregate domestic output are determined by changes in aggregate demand for the domestic good, which depends negatively on the expected real interest rate ($i_t - E_t\pi_{t+1}$) and positively on the real exchange rate (defined as the price of the foreign good in terms of the domestic good, Qt-Pt). Changes in the demand for the domestic good depend also on a shock u_t^d, which will be identified below as a "demand" shock for short. This can be interpreted, for instance, as an unexpected and permanent increase in the level of public expenditures on the domestic good: one that is not fully compensated by a parallel reduction in domestic private or foreign demand for the domestic good. The shocks u_t^d, as well as all other shock terms introduced below, are assumed to be independent and identically distributed, with zero mean and fixed variance.

Equation (2) is the money market equilibrium condition, establishing that changes in real money supply equal changes in real money demand. The latter depends positively on the changes in aggregate domestic output (with unit elasticity) and negatively on the changes in the nominal interest rate. It also depends on a monetary shock u_t^m. This shock can be interpreted as an unexpected and permanent reduction in the level of money demand (or increase in the level of money supply).

Equation (3) is the pricing equation for the domestic good, according to which the price of the domestic good is proportional to the aggregate domestic wage, and depends positively on the rate of change of domestic output and negatively on a productivity shock u_t^y. Given the form of the equation, the latter can be interpreted as an unexpected and permanent positive shift in the underlying production function, given the level of employment. This equation can be derived from a marginal cost equal marginal revenue condition for the firms producing the domestic good.

Equation (4) defines inflation as a weighted average of the rate of change of the price of domestic and foreign goods in domestic currency. It also includes a price shock u_t^{π}, which can be interpreted, for instance, as a permanent and unexpected increase in a general sales tax. This shock is assumed not to affect the steady-state level of output.

Finally, equations (5) and (6) correspond to the uncovered interest parity condition for the domestic and the foreign bond, and to the law of one price for the foreign good, respectively. In these equations, the interest rate on the foreign bond and the price of the foreign good are assumed to be constant in terms of foreign currency and are set equal to zero in log terms without loss of generality.

B. Alternative Wage Contracts

The structure of the model is completed by specifying the aggregate wage as an average of individual wages determined according to one of three alternative types of contracts (as in Jadresic, 1996b). The first type are "indexed wage contracts," which contain a clause that grants a cost of living adjustment in every period according to the inflation rate in the previous period. The second type are "preset time-varying wage contracts," which are nonindexed but specify a sequence of nominal wages during the life of each contract. The third type are "short-term fixed wage contracts," which specify a fixed nominal wage during the life of each contract, and are assumed to have a duration half as long as the duration of the other contracts. In order to keep the analysis as simple as possible, the indexed and preset time-varying wage contracts are taken to have a duration of two periods, while fixed wage contracts have a duration of one period.[9] As mentioned in the introduction, the consequences of wage indexation are studied below by comparing the behavior of the economy under these alternative types of contracts.

We assume that the contracts are revised periodically with a uniform distribution of negotiations, and settled on the basis of the information available at the end of the previous period. To maximize the sharpness of the results, we also assume that the degree of indexation stipulated in the indexed wage contracts is 100 percent of lagged inflation.

Using hereafter the superscripts I, P, and S to denote variables associated with the indexed, preset time-varying and short-term fixed wage contracts respectively, the rate of change of the aggregate wage at period t for each type of contract can thus be written as

$$w_t^I = \frac{1}{2}\,\pi_{t-1} + \frac{1}{2}\,{}_{t-1}x_t^I, \tag{7}$$

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[9]Two-period fixed wage contracts are not considered because, in practice, fixed wage contracts tend to be shorter in duration than indexed and preset time-varying wage contracts.

$$w_t^P = \frac{1}{2}\left({}_{t-1}x_t^P + {}_{t-2}x_t^P \right), \tag{8}$$

$$w_t^S = {}_{t-1}x_t^S, \tag{9}$$

where ${}_{t-s}x_t^I$, ${}_{t-s}x_t^P$ and ${}_{t-s}x_t^S$ represent wage increases other than the automatic cost of living adjustments, which have been agreed for period t in contracts settled with information available at the end of period (t-s) for contract types I, P and S, respectively.

To model the wage increases that do not stem from the indexation clause, we assume that for any given contract wage setters target a real wage that is equiproportional to the expected level of aggregate domestic output. Intuitively, this specification for the target real wage captures the notion that the real wage tends to increase when the labor market becomes tighter and when the economy becomes richer. Formally, this specification is consistent both with the theory and empirical evidence on wage determination. Indeed, from a theoretical point of view, the implicit assumption that wage setters target a real wage can be seen as the outcome of a maximization process in which wage setters maximize a quadratic function of the real wage, goal which can be seen as a second order approximation to the true objective function. The additional assumption that the target real wage depends on the level of output, in turn, is consistent with a *supply wage relation* linking the real wage negatively with the rate of unemployment. Such a relationship is implied by all the main modern approaches to wage determination, including the *matching approach,* the *efficiency wage approach,* and the *competitive approach* (Blanchard and Katz, 1997).

From an empirical point of view, treating the target real wage as equiproportional to the expected level of output is consistent with the extensive empirical evidence on the *wage-curve* compiled by Blanchflower and Oswald (1995).[10] Moreover, by expressing the target real wage in terms of the domestic good, as we do below, this assumption ensures that the rate of unemployment and the functional distribution of income in the model are constant in the steady state. Both features conform with the long-term evidence on these variables.

To derive the values for ${}_{t-s}x_t^I$, ${}_{t-s}x_t^P$, and ${}_{t-s}x_t^S$ implied by this specification, we also assume that wage setters are concerned with the average level of output during the life of each contract in the case of indexed wage contracts, and with period-specific levels of output in the

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[10]Blanchflower and Oswald's (1995) central finding from data for a number of regions and periods is that a 1 percent increase in the unemployment rate typically reduces the real wage by about 0.1 percent. Indeed, with standard estimates for the Okun's Law Coefficient (between 2 and 3; for instance, see Adams and Coe, 1990), and for an unemployment rate around 5 percent, their finding implies that a 1 percent increase in aggregate output would raise the real wage by the order of 1 percent.

case of preset time-varying wage contracts. In the case of short-term fixed wage contracts, wage setters are taken to target the single expected level of output during the life of each contract.

With these elements, and taking into account the specific structure of each type of contract, it is possible to obtain expressions for ${}_{t-s}x_t^I$, ${}_{t-s}x_t^P$ and ${}_{t-s}x_t^S$ as functions of past and current expectations about output and inflation on different dates, and of past inflation (for an example, see Jadresic, 1996a). Replacing these expressions in equations (7), (8) and (9) yields:

$$w_t^I = \pi_{t-1} + \frac{1}{2}(1-L^2)\,E_{t-1}\left[\frac{Y_t+Y_{t+1}+P_t-\Pi_t+P_{t+1}-\Pi_{t+1}+\pi_t+\pi_{t+1}}{2}\right], \qquad (10)$$

$$w_t^P = \frac{1}{2}(E_{t-1}+E_{t-2})\,[y_t+p_t] + \frac{1}{2}(1-E_{t-3})\,[y_{t-1}+y_{t-2}+p_{t-1}+p_{t-2}], \qquad (11)$$

$$w_t^S = p_{t-1} + (1-L)\,E_{t-1}\,[Y_t+p_t], \qquad (12)$$

where Y_t, P_t, and Π_t are the level of domestic output, the price of the domestic good and the weighted average price level respectively.

As equations (10), (11) and (12) are at the center of the analysis of the following sections, it is worthwhile to examine them in certain detail.

Equation (10) shows that aggregate wage behavior when wage contracts are indexed can be characterized by two components. The first one is purely inertial and stems from the indexation rule that links current wage adjustments to previous period inflation and a catch-up adjustment in the case of wages recently negotiated to compensate for the inflation observed in the previous period. The second component measures the aggregate effect of the recent wage negotiations above or below past inflation. This effect depends on the wage setters' expectations about the average output, the real price of domestic goods, and inflation during the life of the new contracts, compared with the expectations of the same variables that they held when the contracts just ended were signed.

Equation (11) states that aggregate wage behavior when contracts stipulate preset time-varying wages also is determined by two components. The first one contains the adjustment of current wages stemming from the change in expected prices and output, according to the information available when the different vintages of current contracts were signed. The second component captures the effect of the updating of wages in the recently negotiated contracts, which depends on the discrepancy between the inflation rates and target real wages forecasted in the previous negotiation with respect to their actual values.

Equation (12) indicates that aggregate wage behavior with short-term fixed wage contracts can also be characterized by two components. As in the case of indexed contracts, the first one is inertial, while the second component measures the effect of the most recent wage negotiations above or below past inflation. However, in this case the inertial component originates fully from a catch-up wage increase that compensates for the depreciation of the real value of the wages while they were fixed. The second component, in turn, depends exclusively on the output and inflation rate expected for period t, as compared with the output and inflation rate expected one period earlier.

C. Solving the Model

To study the effects of wage indexation, below we evaluate output fluctuations with respect to their distance from the frictionless level of output. We define the latter as the level of domestic output that would be observed if wages were fully flexible and all current shocks were observable, which in our model moves with the level of productivity.[11] In other words, we focus on an output gap (Gap_t), which fluctuates according to:

$$Gap_t - Gap_{t-1} = y_t - u_t^y. \qquad (13)$$

To complete the model, Section III considers the cases of a floating and a fixed exchange rate, with $m_t=0$ and $s_t=0$ respectively. Section IV also consider the case of an indexed exchange rate, with $s_t=\pi_{t-1}$. Given any of these regimes, equations (1) to (6) and (13), plus equation (10), (11) or (12), provide one system of equations for each type of contract. To solve them, we assume that agents have rational expectations; i.e., that agents know the policy regime and the structure of the economy. As this assumption makes it hard to obtain analytical solutions in all the cases considered, we focus on the results of numerical simulations.[12] The base case presented below assume the parameter values: $\alpha=0$, which captures the stylized fact that output does not have strong effects on prices, given wages (Blanchard and Fischer, 1989, pp. 464-7), and $\beta=0.5$, $\gamma=0.3$, $\delta=0.5$, $\epsilon=0.7$, which are comparable in order of magnitude with those considered by Fischer (1988) and Henderson and McKibbin (1993). The analysis also considers alternative parameter values.

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[11]With fully flexible wages and perfect information, wage setters would set $w_t = p_t + y_t$. From equation (3) it follows that the rate of change of the frictionless level of output is u_t^y.

[12]I was able to reduce the systems of equations to linear difference equations on inflation, with most of these equations including the expectations at t-1 of inflation at t, t+1, t+2, the same expectations lagged twice, actual inflation at t, t-1, and t-2, and a set of current and lagged shock terms. While in principle it could be possible to find analytical solutions for all these equations, finding and interpreting them for all the cases considered was ineffectual. For a review of the techniques for solving rational expectations equations, see Pesaran (1987) and Broze, Gouriéroux and Szafarz (1990).

III. Wage Indexation and Output Behavior

We now study the effects of wage indexation on the behavior of output with a fixed and a floating exchange rate. For this purpose, we examine in the above the response of output to unit monetary, demand, productivity, and price shocks. The analysis refers to positive shocks, but the conclusions are obviously more general.

A. Monetary Shock

Consider first the case of a monetary shock under a floating exchange rate. The behavior of output for the base case is shown in the top box of Figure 1. Output tends to expand temporarily whatever the type of contracts prevailing in the economy. The basic reason is familiar. First, the monetary shock reduces nominal interest rates and raises expected future inflation, cutting down expected real interest rates. Second, the shock depreciates the value of the domestic currency, which with predetermined wages, increases the competitiveness of the economy. Both effects tend to boost demand and output.

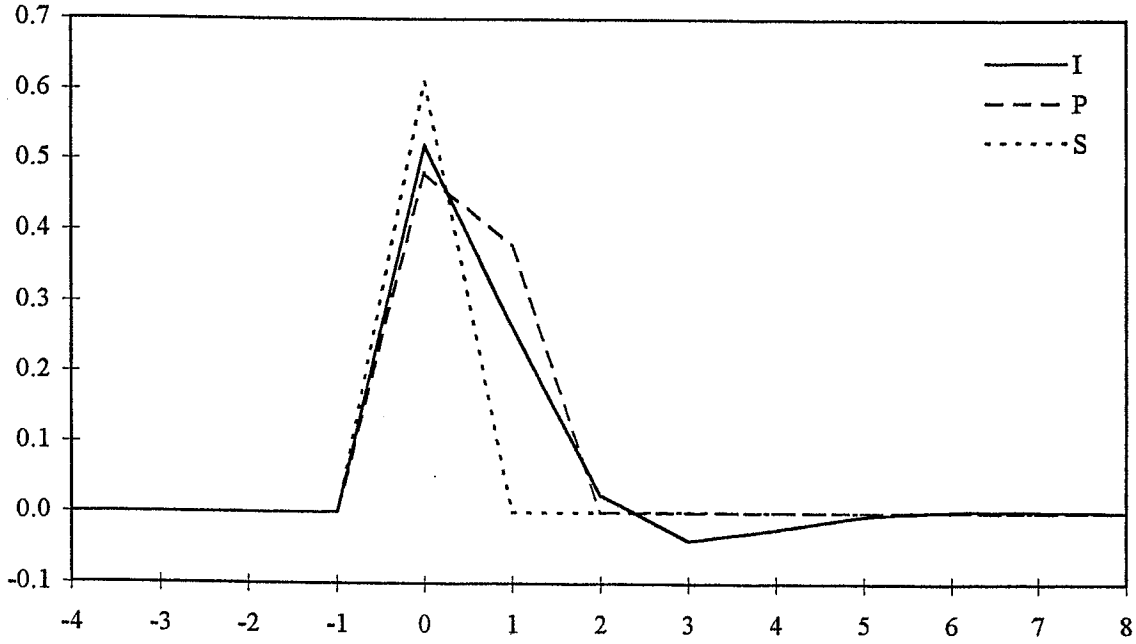
That these effects hold even when wage contracts are indexed contrasts sharply with the conclusions of the previous academic literature. It should be recalled that, according to this literature, wage indexation reduces the effects of a monetary shock on output, and under full wage indexation, a monetary shock has absolutely no effects on output. This is because, under the standard assumption that wage indexation is with respect to current prices, the effect of the depreciation of the domestic currency on prices is immediately transmitted into wages and then back into prices, with the only viable equilibrium being the one in which the real wage and the level of output are the same as the ones previous to the shock. In contrast, the top box of Figure 1 shows that, once one the lags in actual indexation rules are taken into account—and even if the degree of indexation is 100 percent—the effects of a monetary shock on output with and without wage indexation are similar.

This result is partly explained by the fact that, with wage indexation to lagged inflation, the depreciation of the domestic currency caused by the monetary shock affects future wages but does not affect current wages. Because of this initial predetermination of wages, the temporary rise in the competitiveness of the economy, as well as the temporary reduction in expected real interest rates, occur despite the existence of wage indexation.

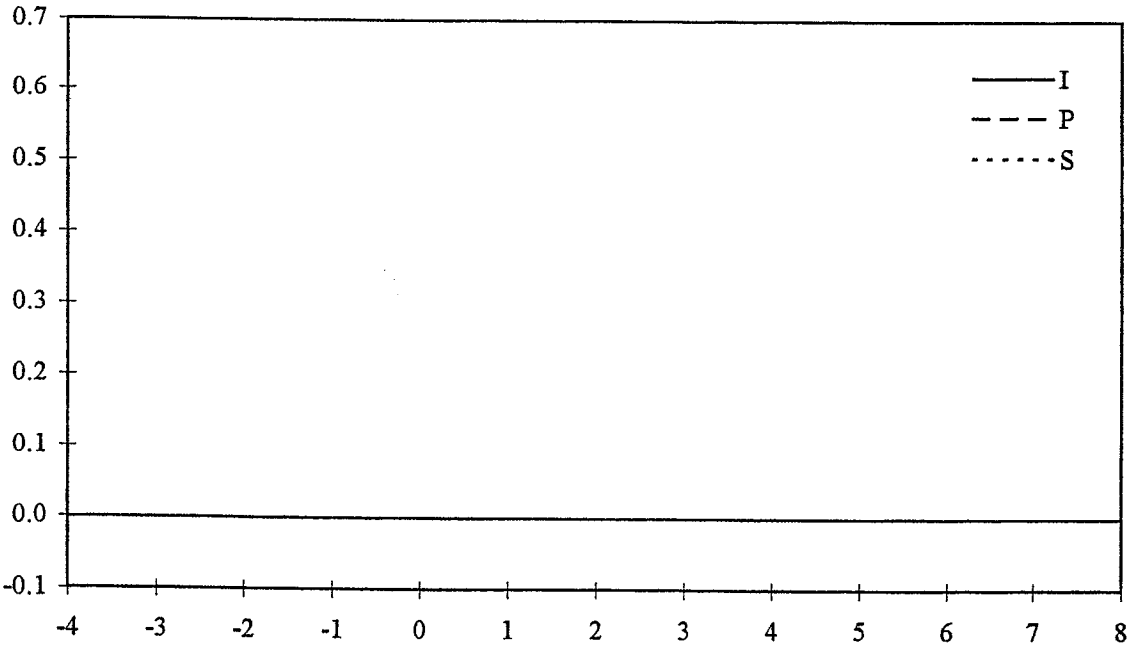
In principle, however, the evolution of indexed and nonindexed wages following the period of the shock could be sufficiently different as to alter substantially the behavior of output, both after and at the time of the shock. On this regard, the top box of Figure 1 shows that, even when one considers fully the different dynamics associated to the alternative type of contracts, the differences in the behavior of output across contracts do make some differences. Not surprisingly, the adjustment of output to its steady state level takes longer with indexed contracts than with short-term fixed wage contracts—a natural result due to the differences in the lengths assumed for both type of contracts. Also, output with indexed

Figure 1. Effects of a Unit Monetary Shock on the Output Gap
(log deviations from steady state output)

Floating Exchange Rate



Fixed Exchange Rate



contracts does not stabilize completely once all contracts have been revised—it rather converges cyclically to the steady state level. But it is clear from the figure that in all cases the overall response of output to the monetary shock is qualitatively similar, and that the order of magnitude of the effects are comparable.

These results are robust when considering alternative parameter values for the economy. Table 1 reports the variance of the output gap implied by the alternative type of contracts for a variety of situations. As shown in the table, in all cases the order of magnitude of the effects caused by the monetary shock comparable. Also, an examination of the results associated to the alternative simulations indicated that the response of output to the monetary shock was always qualitatively similar to the one already described for the base case.

While wage indexation to lagged inflation does not seem to make a substantial difference on the response of output to a monetary shock, does it at least help to reduce somewhat its variability? As shown by the simulation results reported in Table 1, the answer depends on the specific characteristics of the economy. The ambiguity is closely related to the size of the depreciation of the domestic currency due to the monetary shock and of its initial impact on prices and inflation. If these effects are large enough, the indexation clauses imply a relatively large adjustment of wages in the period after the shock occurs, and indexed wage contracts can contribute to accelerate the process of adjustment of wages, prices, and output. However, if these effects are small—for instance, because the weight of foreign goods in the CPI is low, or because aggregate demand is very sensitive to the real interest rate or the real exchange rate—then indexed contracts can destabilize output. This is because, as indexed wage contracts automatically feedback part the initial increase in wages and inflation to subsequent periods, they tend to reduce expected real interest rates and thus make the initial expansion of output more persistent. In addition, in later periods indexed contracts tend to generate excessive cumulated inflation, which elevates nominal and real interest rates, reduces competitiveness, and can drive output below its steady state level. Both effects work to increase the variability of output.[13]

Finally, note that when the exchange rate is fixed, the monetary shock is fully accommodated through a change in international reserves and thus has no effect on output, regardless of the type of wage contracts prevailing in the economy (bottom box of Figure 1). As this result is standard in models of open economies with perfect capital mobility, including those that assume wage indexation to current prices, it deserves no further attention here.

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[13]That wage indexation can increase output instability following a monetary shock has already been shown in Jadresic (1996a), who shows that, in a closed economy similar to the one considered by Gray (1976) and Fischer (1977), wage indexation to lagged inflation tends to raise output instability regardless of whether shocks are real or nominal .

Table 1. Output Gap Variance in Response of a Unit Monetary Shock

(Sum of squared log-deviations from steady-state output)

Policy Regime	Parameters 1/	Type of Wage Contracts I	P	S
Floating Exchange Rate	Base Case 2/	0.34	0.38	0.37
	α=0.5	0.21	0.23	0.14
	α=1	0.14	0.16	0.07
	β=0	0.12	0.17	0.09
	β=1	0.56	0.57	0.63
	β=2	0.89	0.88	1.00
	γ=0	0.16	0.17	0.21
	γ=0.5	0.61	0.64	0.60
	γ=1.5	1.18	1.15	1.10
	δ=0.1	0.40	0.44	0.37
	δ=1	0.31	0.34	0.35
	δ=5	0.24	0.26	0.32
	ϵ=0.5	0.19	0.22	0.22
	ϵ=0.9	0.63	0.63	0.61
	ϵ=1	0.86	0.82	0.77
	n=4	0.35	0.50	0.35
	γ=0, δ=0, ϵ=1	1.38	1.25	1.00
Fixed Exchange Rate	Any	0.00	0.00	0.00

1/ In each case only the indicated parameter values differ from those in the base case.
2/ Base case is α=0, β=0.5, γ=0.2, δ=0.5, ϵ=0.7, n=2.

B. Demand Shock

Consider now the case of a shock in the demand for the domestic good. The effect of this type of shock on output for the base case parameters is shown in Figure 2. Given the nominal rigidity introduced by the wage contracts, the increase in demand causes a temporary boom in output. Moreover, in line with the Mundell-Fleming results, the magnitude of this boom is significantly smaller when the exchange rate floats than when the exchange rate is fixed. The reason is that the long-term real appreciation required by the economy in order to accommodate the demand shock is attained differently depending on the exchange rate regime. With a fixed exchange rate, the real appreciation is achieved through an increase in wages and inflation in the periods following the shock. This process reduces temporarily expected real interest rates and achieves the real appreciation only gradually, effects which work to destabilize output during the period of adjustment. With a floating exchange rate, in turn, most of the required real appreciation is attained through a nominal appreciation at the time of the shock. This nominal appreciation helps to stabilize output, both by shifting demand out of the domestic good more quickly, and by putting less pressure on wages and inflation as vehicle for adjustment, which helps to stabilize expected real interest rates.

For our purposes, the most important result is that the order of magnitude of the output boom caused by the demand shock does not depend on the whether wages are indexed or not. While the alternative type of wage contracts under consideration do imply some differences in the behavior of output during the adjustment process, those differences are relatively minor. In particular, they do not change the fact that a floating exchange rate moderates substantially the response of output to the shock.

This result contrasts with the conclusion of the previous academic literature that wage indexation blurs the behavior of output across exchange rate regimes, with the response of output to a demand shock being exactly the same under a floating and a fixed exchange rate regime when indexation is full. The relatively small effect of wage indexation on output behavior is again partly due to the fact that, regardless of the type of wage contracts prevailing in the economy, wages at the time of the shock are predetermined. However, Figure 2 and Table 2 shows that, even when one considers fully the different dynamics associated to the alternative type of contracts, the differences in the behavior of output across contracts are minor.

Nonetheless, the question remains whether wage indexation narrows at least somewhat the differences in the response of output to the demand shock. In other words, does wage indexation have any tendency to destabilize output when the exchange rate floats and to stabilize it when the exchange rate is fixed?

The top box of Figure 2 and Table 2 indicate that wage indexation does tend to destabilize output when the exchange rate floats. In this case, and for almost all parameter values considered, the variance of output with indexed wage contracts is larger than with preset time-varying wage contracts and with short-term fixed wage contracts. The reason

Table 2. Output Gap Variance in Response of a Unit Demand Shock

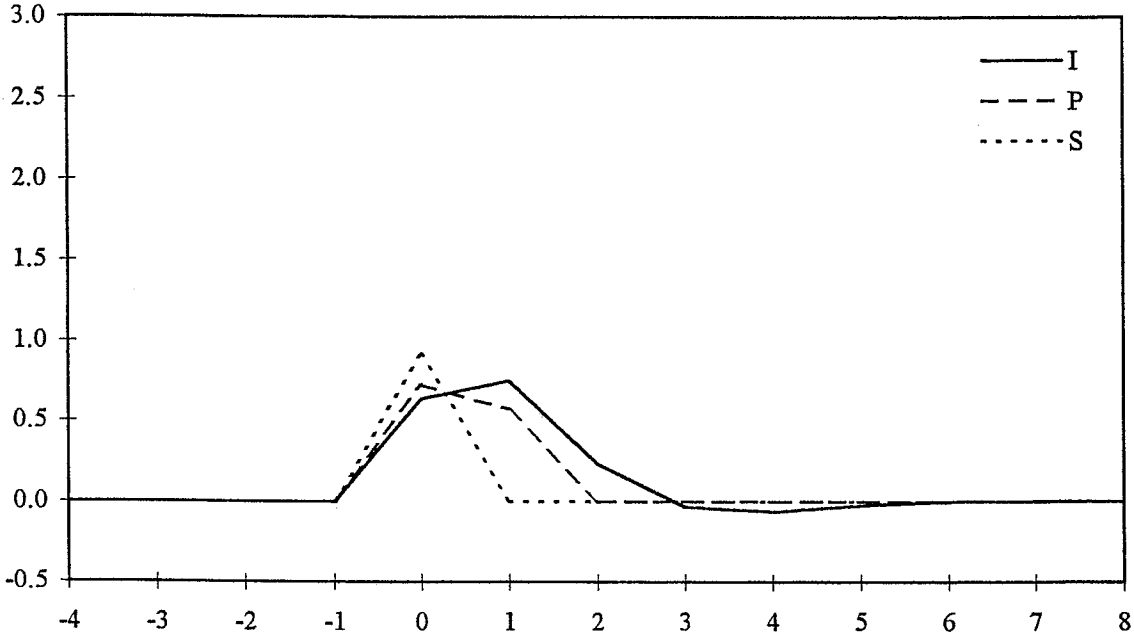
(Sum of squared log-deviations from steady-state output)

Policy Regime	Parameters 1/	Type of Wage Contracts		
		I	P	S
Floating	Base Case 2/	1.03	0.85	0.84
Exchange	α=0.5	0.63	0.52	0.49
Rate	β=0	0.53	0.38	0.20
	β=1	1.61	1.29	1.42
	γ=0.1	2.81	2.47	2.62
	γ=1	0.12	0.09	0.08
	δ=0.1	1.20	0.99	0.91
	δ=1	0.92	0.75	0.80
	ϵ=0.5	1.50	1.39	1.35
	ϵ=1	0.00	0.00	0.00
	n=4	1.80	1.12	0.80
Fixed	Base Case 2/	5.47	5.78	7.56
Exchange	α=0.5	3.8	3.97	4.65
Rate	β=0	1.69	1.69	1.00
	β=1	13.5	12.7	20.3
	γ=0.1	12.3	14.0	20.3
	γ=1	1.90	1.77	1.82
	δ=0.1	5.47	5.78	7.56
	δ=1	5.47	5.78	7.56
	ϵ=0.5	3.90	4.33	5.06
	ϵ=1	8.73	8.36	12.3
	n=4	5.38	5.75	5.09

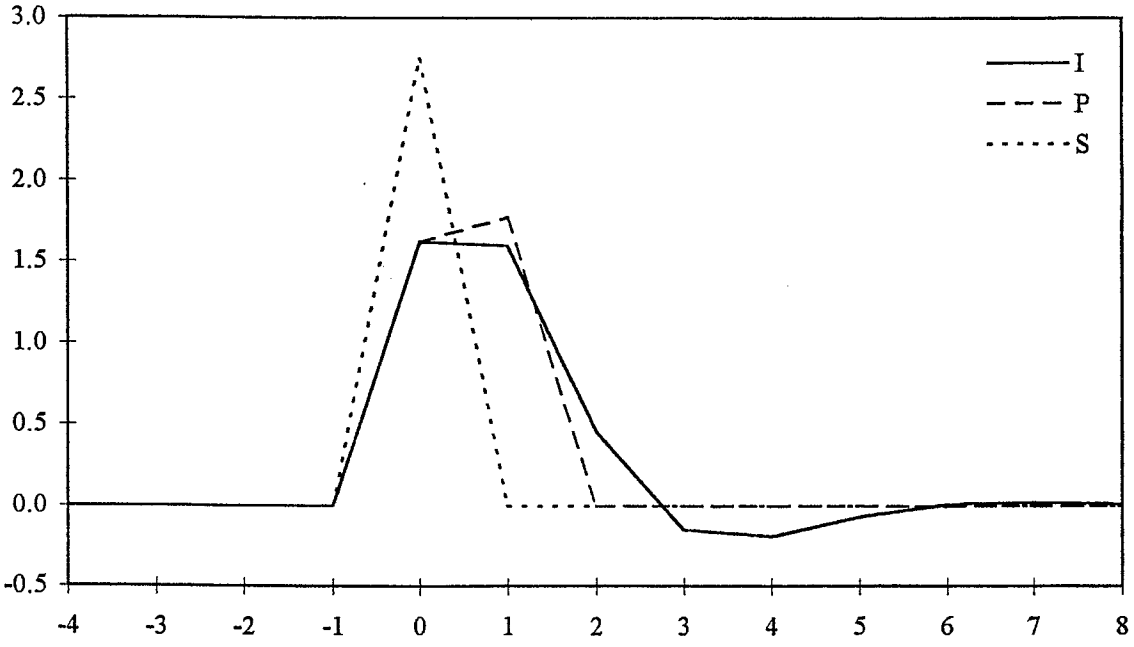
1/ In each case only the indicated parameter value differs from those in the base case.
2/ Base case is α=0, β=0.5, γ=0.2, δ=0.5, ϵ=0.7, n=2.

Figure 2. Effects of a Unit Demand Shock on the Output Gap
(log deviations from steady state output)

Floating Exchange Rate



Fixed Exchange Rate



is that, in the periods immediately after the shock occurs, the indexation clauses quickly feedback into wages the lower inflation due to the initial appreciation, tending to curb or even reduce them. This effect works first to moderate the magnitude of the real appreciation and then to reduce the expected real interest rate, as demanders anticipate that wages and inflation will have to accelerate in the future in order to compensate the unnecessary cutback of current wages. Consequently, with a floating exchange rate, the output boom caused by the shock in demand tends to persist for longer when contracts are indexed, which destabilizes output.[14]

In the case of a fixed exchange rate, instead, the simulation results reported in Table 2 indicate that wage indexation has no clear cut effect on the output response to a demand shock. Two parameters that are especially important in determining whether wage indexation raises or reduce this response are the elasticities of the demand for the domestic good with respect to the expected real interest rate and with respect to the real exchange rate. This is because wage indexation slows down the adjustment of wages and inflation, which tends to moderate the initial fall in expected real interest rates but to reduce the speed of the real appreciation required to reestablish equilibrium. While the former effect is stabilizing, the latter is destabilizing. Depending on the specific elasticities of the demand for the domestic good, wage indexation can either stabilize or destabilize output.

C. Productivity Shock

To further explore the consequences of wage indexation, consider the response of output to a productivity shock.[15] As shown in Figure 3, a positive productivity shock implies a negative output gap, with the size of this gap being larger when the exchange rate is fixed. The output gap is negative because, in the absence of a direct effect of this shock on demand, the reduction of aggregate prices induced by the productivity shock is smaller than the amount needed to increase demand to its new steady state level.[16] The output gap is larger when the exchange rate is fixed because in this case all the burden of the adjustment is put on wages and prices, which leads to higher expected real interest rates and a slower real depreciation during the process of convergence to the new steady state. Both factors tend to destabilize output

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[14]In 2, the only exception to this result is when the weight of import prices in the CPI is nil. In this case, the initial appreciation of the domestic currency has no effect on inflation and thus the indexation clauses have no consequences.

[15]The assumption of a pure productivity shock is somewhat artificial because it assumes that the shock is not paralleled by a shock in demand--which is the most likely case if the owners of the production factors are domestic. Nonetheless, it is helpful to focus on the supply side effects of a productivity shock, as the effects of shocks in demand were analyzed above.

[16]In the absence of a direct increase in demand, a real depreciation is needed to increase demand and thus to accommodate the increase in productivity.

While the type of exchange rate regime in place makes a significant difference on the response of output to the productivity shock, Figure 3 indicates that wage indexation makes relatively little difference on the same response. This is confirmed by the numbers reported in Table 3, which shows that, given the exchange rate regime, the variance of the output gap across type of contracts is always of the same order of magnitude. Furthermore, there is no clear tendency for indexed wage contracts to either raise or reduce this variance, so that the effects of wage indexation are not only relatively minor, but also ambiguous.

D. Price Shock

Finally, consider the case of a price shock.[17] As shown in Figure 4, the effects of a price shock on output depend on the exchange rate regime. With a floating exchange rate, a positive price shock is recessionary. This is because the price shock increases money demand, elevates interest rates, and appreciates the value of the domestic currency; with the adjustment process requiring a reduction in wages to restore competitiveness.

With a fixed exchange rate, in turn, output remains untouched if wages are nonindexed, while it fluctuates in a boom-recession cycle if they are indexed. In this case there is no tendency for the price shock to be recessionary because the endogeneity of money supply ensures that the increase of money demand at the time of the shock is fully accommodated. The differences in the behavior output across type of contracts arise because, if wage contracts are indexed, the indexation clauses transmit automatically part of the price shock to subsequent periods, effect which first reduces expected real interest rates, and later leads to excessive cumulated inflation.

The charts and numbers in Figure 4 and Table 4 indicate that wage indexation is destabilizing when a price shock impinges on the economy. The underlying reason is the automatic feedback from the price shock to wages in subsequent periods introduced by the indexation clauses. In the context of a floating exchange rate regime, in which the adjustment process requires a downward adjustment in wages, this feedback effect first prevents a faster restoration of competitiveness and latter increases expected real interest rates; as a result, the recession turns out to be longer. In the context a fixed exchange rate regime, as noted in the previous paragraph, this feedback effect leads to a boom-recession cycle.

This destabilizing effect of wage indexation is consistent with the common perception that wage indexation is particularly damaging when price shocks occur. Note, however, that the order of magnitude of the variances of the output gap across type of wage contracts are comparable, at least in the case of a floating exchange rate. Also, it is still the case that the overall effects of the shock on output depend much more on the exchange rate regime than on the type of wage contracts in the economy.

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[17]For instance, this could correspond to the case of an increase in indirect taxes, in which the additional tax revenues are distributed neutrally across agents.

Table 3. Output Gap Variance in Response of a Unit Productivity Shock

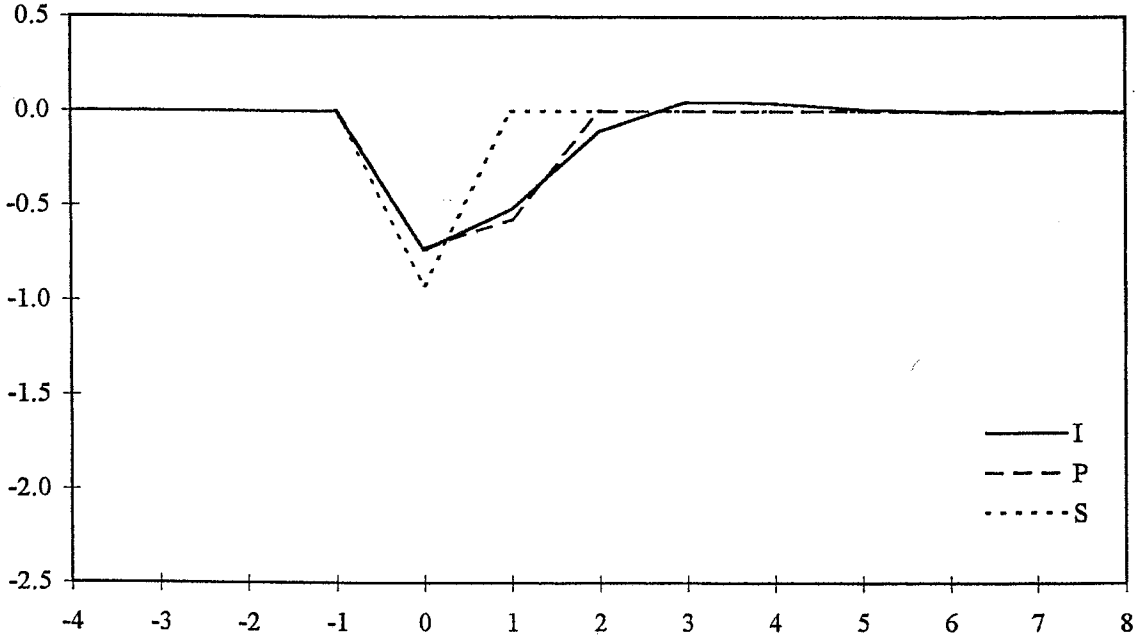
(Sum of squared log-deviations from steady-state output)

Policy Regime	Parameters 1/	Type of Wage Contracts I	P	S
Floating	Base Case 2/	0.82	0.85	0.84
Exchange	α=0.5	0.50	0.52	0.49
Rate	β=0	0.36	0.38	0.20
	β=1	1.31	1.29	1.42
	γ=0.1	2.49	2.47	2.62
	γ=1	0.12	0.09	0.08
	δ=0.1	0.96	0.99	0.91
	δ=1	0.72	0.75	0.80
	ϵ=0.5	1.29	1.39	1.35
	ϵ=1	0.15	0.00	0.00
	n=4	0.96	1.32	0.80
Fixed	Base Case 2/	3.46	3.70	4.84
Exchange	α=0.5	2.45	2.54	2.98
Rate	β=0	0.95	1.08	0.64
	β=1	8.69	8.11	13.0
	γ=0.1	9.95	11.3	16.4
	γ=1	0.14	0.00	0.00
	δ=0.1	3.46	3.70	4.84
	δ=1	3.46	3.70	4.84
	ϵ=0.5	2.45	2.77	3.24
	ϵ=1	5.62	5.35	7.84
	n=4	3.10	2.57	3.26

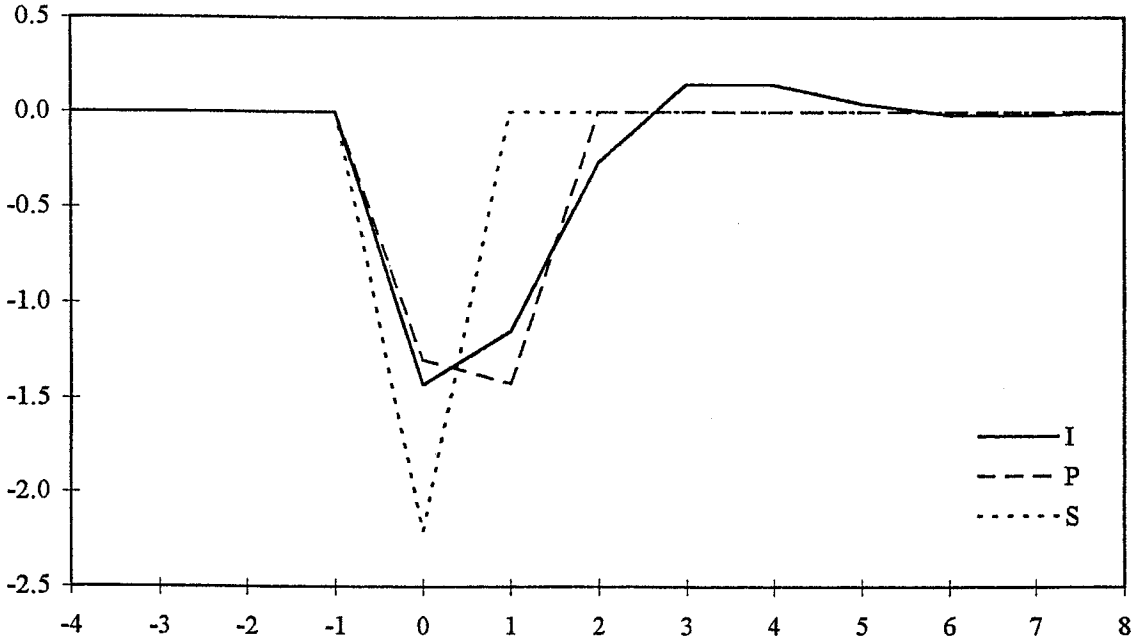
1/ In each case only the indicated parameter value differs from those in the base case.
2/ Base case is α=0, β=0.5, γ=0.2, δ=0.5, ϵ=0.7, n=2.

Figure 3. Effects of a Unit Productivity Shock on the Output Gap
(log deviations from steady state output)

Floating Exchange Rate



Fixed Exchange Rate



IV. Wage Indexation and Macroeconomic Stability

This section discusses the implications of the above results on the macroeconomic effects of wage indexation, briefly reporting on some related results when appropriate. It refers to the effects of wage indexation on output stability, the choice of exchange rate regime, and the level and variability of inflation.

A. Output Stability

The results of the previous section imply that, once the lags in actual indexed contracts are taken into account, wage indexation affects output behavior substantially less than posited in the previous academic literature. In particular, the widespread indexation of wage contracts does not appear to invalidate or modify the Mundell-Fleming results that monetary shocks destabilize output when the exchange rate floats, and that shocks in the demand for goods destabilize output more when the exchange rate is fixed than when it floats. Similarly, wage indexation does not appear to blur the behavior of output across exchange rate regimes. In general, the response of output to a variety of shocks tends to be qualitatively similar and of the same order of magnitude regardless of the type of contracts prevailing in the economy.

Nonetheless, there is still the issue of what are the net effect of wage indexation on output stability. For a closed economy, this issue was first addressed by Gray (1976) and Fischer (1977), whose main conclusion was that wage indexation destabilizes output when shocks are mainly real but stabilizes output when shocks are mainly nominal. Recently, this issue was reexamined by Jadresic (1996a), who found that in a closed economy similar to the one considered originally by Gray and Fischer, wage contracts indexed to lagged inflation tend to destabilize output regardless of whether shocks are real or nominal. The analysis of the previous section permits to consider the effects of indexation to lagged inflation in the case of an open economy rather than in the case of Gray and Fischer's closed-economy model.

From the analysis of the previous section, it is clear that in an open economy affected by a variety of shocks the sign of the overall effect of wage indexation on output stability is ambiguous. Indeed, with the assumption that these shocks are independent and serially uncorrelated, the total variance of the output gap in such an economy is a linear combination of the variances of each type of shock, with weights equal to the variances of the output gap

Table 4. Output Gap Variance in Response of a Unit Price Shock

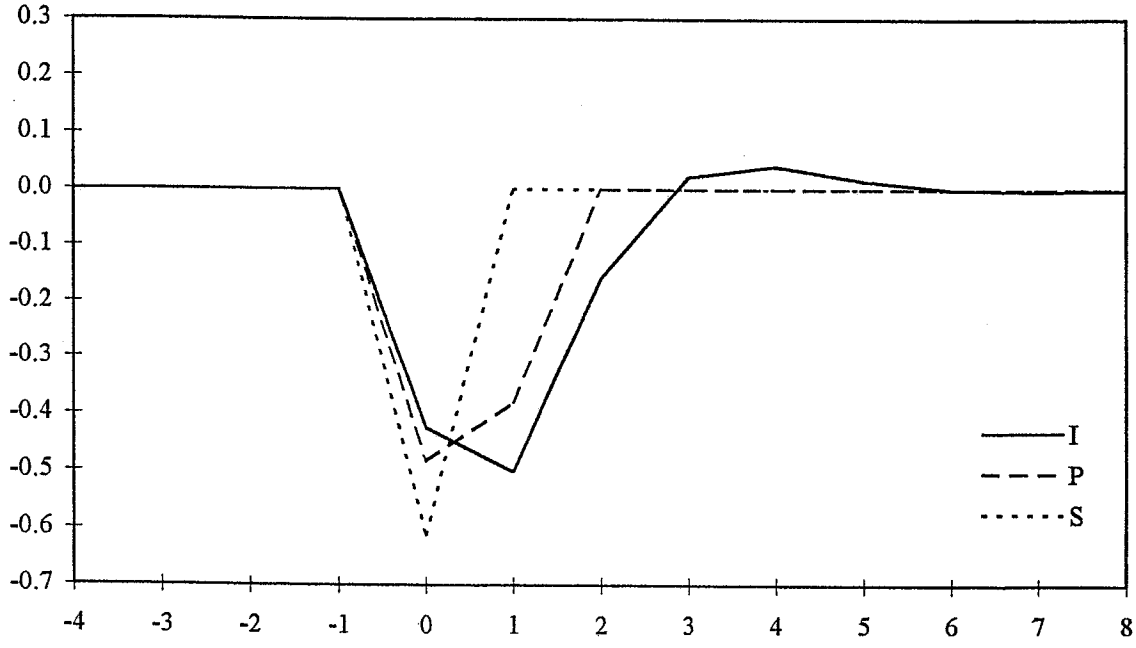
(Sum of squared log-deviations from steady-state output)

Policy Regime	Parameters 1/	Type of Wage Contracts I	P	S
Floating	Base Case 2/	0.46	0.38	0.37
Exchange	α=0.5	0.28	0.23	0.22
Rate	β=0	0.24	0.17	0.09
	β=1	0.71	0.57	0.63
	γ=0.1	0.31	0.27	0.29
	γ=1	1.34	0.95	0.89
	δ=0.1	0.53	0.44	0.41
	δ=1	0.41	0.34	0.35
	ϵ=0.5	0.24	0.22	0.37
	ϵ=1	1.27	0.82	0.37
	n=4	0.80	0.50	0.35
Fixed	Base Case 2/	0.09	0.00	0.00
Exchange	α=0.5	0.06	0.00	0.00
Rate	β=0	0.03	0.00	0.00
	β=1	0.22	0.00	0.00
	γ=0.1	0.08	0.00	0.00
	γ=1	0.29	0.00	0.00
	δ=0.1	0.09	0.00	0.00
	δ=1	0.09	0.00	0.00
	ϵ=0.5	0.07	0.00	0.00
	ϵ=1	0.13	0.00	0.00
	n=4	0.31	0.00	0.00

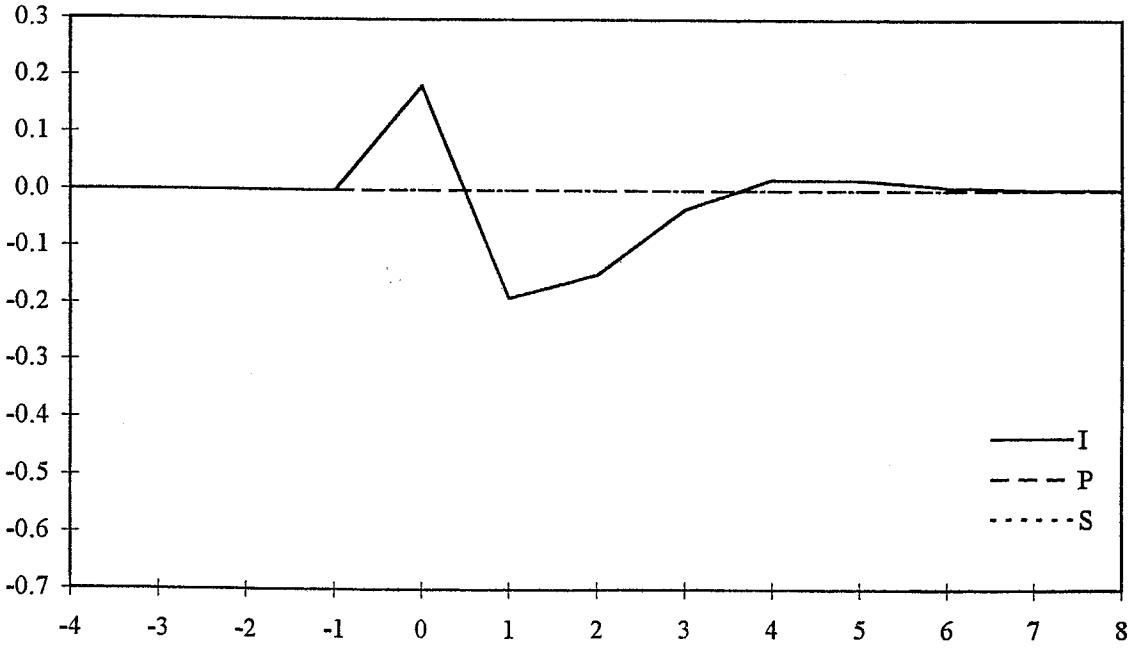
1/ In each case only the indicated parameter value differs from those in the base case.
2/ Base case is α=0, β=0.5, γ=0.2, δ=0.5, ϵ=0.7, n=2.

Figure 4. Effects of a Unit Price Shock on the Output Gap
(log deviations from steady state output)

Floating Exchange Rate



Fixed Exchange Rate



in response of unit shocks—the variances estimated above.[18] Because of the ambiguous results obtained in the previous section, it follows that, depending on the relative variances of the shocks, as well as on the specific parameter values of the economy, the overall output variance in an economy with indexed wage contracts can be either larger or smaller than in an economy with nonindexed contracts.

The analysis above provides some clues regarding the conditions under which wage indexation can either raise or reduce output stability. Knowing the sources of the shocks to the economy can be very helpful. If the economy is hit mainly by price shocks, wage indexation is likely to destabilize output. The same is bound to happen if the economy is hit mostly by shocks in the demand for goods and there is a floating exchange rate. However, if the economy is hit mainly by monetary or productivity shocks, or if it is hit mainly by demand shocks and there is a fixed exchange rate, the net effects of wage indexation are ambiguous.

Having information on some of the parameter values of the economy can also help to solve some of the ambiguities. For instance, wage indexation is likely to destabilize output when the economy is hit mainly by monetary shocks (and the exchange rate floats) if the demand for the domestic good is relatively inelastic, or if the CPI has a small foreign component. More generally, however, solving the ambiguity of the net effects of wage indexation on output stability requires specifying the type of shocks impinging upon the economy, the exchange rate regime in place, the type and length of the wage contracts being compared, and the structural parameters of the economy.

B. The Choice of Exchange Rate Regime

Building on models where wage indexation is with respect to current prices, the indexation literature has inferred that wage indexation would be a powerful reason to prefer a flexible exchange rate regime over a fixed exchange rate regime. As noted in the introduction, the crux of the argument is that wage indexation helps to protect output from monetary shocks regardless of the exchange rate regime in place. If this effect is true, wage indexation makes a fixed exchange rate unnecessary to deal with monetary shocks and reduces the incentives to create inflationary surprises.

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[18]The solution for the output gap in the model being considered is of the form $Gap_t = \Sigma\Sigma\phi_{is}u^i_{ts}$, with the sums defined over I=m, d, y, π, and s=0 ...∞, respectively. Using the assumption that the shocks are independent and serially uncorrelated, it follows that the unconditional variance of the output gap is $Var(Gap)=\Sigma\ (\Sigma\phi_{is}^2)Var(u^i)$, with the sums defined over I and s as above. With a little algebra, it is easy to show that the sum $\Sigma\phi_{is}^2$ (defined over s=0 ...∞) is exactly the same number as the total variance of the output gap in response to a unit shock of type I.

Despite the faultless logic of the argument, the results of the previous section indicate that the proposition that wage indexation makes a flexible exchange rate generally preferable is unwarranted. Indeed, the above results show that the premise that wage indexation protects output from monetary shocks is unfounded, at least as a general or substantial proposition. In consequence, there is no a priori reason why wage indexation would be a good substitute for fixing the exchange rate when those shocks occur, nor why it would eliminate the incentives to create inflationary surprises.

If the basic insight on the effects of wage indexation on the choice of exchange rate regime provided by the previous literature is of little use once one takes into account the lags in actual indexation rules, what alternative insight can be learned from the above analysis?

From this more constructive perspective, possibly the main implication of the above analysis is that the choice of exchange rate regime when wages are indexed is likely to depend on the same type of factors that affect the choice of exchange rate regime when wages are not indexed. To provide a concrete example, the results of the previous section imply that under the traditional criterion of maximizing output stability, the choice between a fixed and a floating exchange rate regime tends to be independent of the type of wage contracts in the economy; namely, a fixed exchange rate should be preferred when shocks are mainly nominal (monetary or price shocks), while a floating exchange rate should be preferred when shocks are mainly real (demand or productivity shocks). The relevance of this result is not what are the conditions under which one or the other regime maximizes output stability, which are well-known, but rather the fact that it holds despite the existence of wage indexation.[19]

Another example is provided by the relationship between wage indexation and the choice to index the exchange rate to lagged inflation. As shown in Table 5 for the base case parameter values, the effects of such a regime on output and real exchange rate stability are broadly similar to those of presetting the path for the exchange rate, with wage indexation making an indexed exchange rate slightly preferable. However, the order of magnitude of these improvement is clearly minor, and in the end, with or without wage indexation, the main distinctive consequence of an indexed exchange rate regime is its well-known adverse effect on inflation stability (for instance, see Adams and Gros, 1986).

While the framework used in this paper is not sufficient to show that for any criteria the choice of exchange rate regime with and without wage indexation tends to be alike, the broad similarity in the behavior of the economy with and without wage indexation suggests that in most cases such would indeed be the case. For instance, wage indexation seems unlikely to be able to alter significantly the possible tradeoff between credibility in low inflation and flexibility in dealing with aggregate shocks that part of the literature attributes

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[19]The results reported in Table 5 for the base case parameters suggest that, if the goal is to minimize inflation variability or real exchange rate variability, then the choice between a fixed and a floating exchange rate regime is similar to the one that maximizes output stability.

Table 5. Variance of the Output Gap, Inflation, and the Real Exchange Rate in Response of Unit Shocks 1/
(Sum of squared log-deviations from steady-state output, initial inflation, and steady-state real exchange rate)

Policy Regime	Type of Shock	Type of Variance and Wage Contracts								
		Output Gap			Inflation			Real Exchange Rate		
		I	P	S	I	P	S	I	P	S
Floating Exchange Rate	Monetary	0.34	0.38	0.37	0.33	0.36	0.56	1.78	2.21	1.23
	Demand	1.03	0.85	0.84	1.21	1.29	2.00	22.5	22.7	25.0
	Productivity	0.82	0.85	0.84	0.38	0.48	1.00	23.2	22.7	25.0
	Price	0.46	0.38	0.37	0.54	0.57	0.89	3.25	2.21	1.23
Fixed Exchange Rate	Monetary	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Demand	5.47	5.78	7.56	5.79	6.64	12.3	37.9	35.8	36.1
	Productivity	3.46	3.70	4.84	4.29	4.74	8.33	29.9	28.5	30.4
	Price	0.09	0.00	0.00	1.20	1.00	1.00	0.36	0.00	0.00
Indexed Exchange Rate	Monetary	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Demand	5.09	5.78	7.56	infinite	infinite	infinite	33.1	35.8	36.1
	Productivity	3.26	4.07	4.84	"	"	"	26.6	29.6	30.4
	Price	0.00	0.18	0.00	"	"	"	0.00	0.42	0.00

1/ For base case parameter values.

to the choice between a fixed and a flexible exchange rate. The bottom line is that, while considering the existence of wage indexation does not seem to help to solve the long standing problem of which is the optimal exchange rate regime, it also does not appear to be a crucial factor on deciding which is that regime.

C. The Level and Variability of Inflation

Whether and how wage indexation affects the level of inflation depends on the factors that determine monetary policymaking. In the previous literature, this issue has been typically analyzed in the context of Barro and Gordon's (1983) well-known model, under the assumption that the monetary authority has time-inconsistent preferences and cannot commit credibly to maintain low inflation. Because of the standard presumption that wage indexation stabilizes output when shocks are nominal, previous research has implied opposing views on the effects of wage indexation on the level of inflation. On the one hand, authors such as Fischer and Summers (1989), Milesi-Ferretti (1994), and Crosby (1995) have presumed that, by reducing the incentives to create nominal surprises, wage indexation helps to curb the level of inflation. On the other hand, Ball and Cecchetti (1991) have argued that this anti-inflationary effect of wage indexation is more than compensated by the fact that wage indexation mitigates the cost of inflation, which reduces the willingness to fight inflation and thus tends to raise average inflation.

The finding above that indexed wage contracts do not protect output from monetary shocks, at least not significantly, provides more support to the view that, under time-inconsistent policymaking, wage indexation raises the level of inflation. On the one hand, if indexed wage contracts increase the responsiveness of output to monetary shocks, it follows that wage indexation augments the incentives for the policymaker to create nominal surprises. If the policymaker has time-inconsistent preferences and there is no firm commitment to maintain low inflation, the implication is that wage indexation raises the level of inflation. On the other hand, even if such effect is not important or under certain circumstances has the opposite sign, there is still the inflationary effect of wage indexation due to the fact that, by diminishing the cost of inflation, wage indexation tends to reduce the will to fight inflation.

Regarding the variability of inflation, Gray (1976) and Fischer (1977) claimed that wage indexation in a closed economy increases price variability, result which at least in their basic models also implied larger inflation variability. In contrast, the result in Jadresic (1996a) for a similar economy, but with wage indexation to lagged inflation, was that the effects of wage indexation are ambiguous. These effects where found to depend on the type of shocks impinging on the economy, the type of contracts being compared, and the policy regime.

The results of the simulations performed for the analysis in the previous section confirm that wage indexation can reduce rather than increase the variability of inflation. As shown in Table 5, for the base case parameter values, the variance of inflation with contracts

indexed to lagged inflation is always smaller than with nonindexed wage contracts when the exchange rate floats. Also, unless the shocks impinging upon the economy are mainly price shocks, a similar result holds when the exchange rate is fixed. For alternative parameter values, however, there is no guarantee that these results also hold.

VI. Concluding Remarks

This paper reexamined the macroeconomic effects of wage indexation in an open economy hit by aggregate shocks under alternative exchange rate regimes. Unlike the previous related literature, it explicitly modeled wage indexation as a clause in long-term contracts that grants periodic wage adjustments according to lagged inflation. The paper explored the effects of wage contracts with and without this clause in a conventional open economy model, solved for plausible parameters by numerical simulation.

The main finding that emerged from the analysis is that, once the lags in actual indexation rules are taken into account, wage indexation affects output behavior substantially less than posited by the previous academic literature. In particular, wage indexation does not appear to invalidate or modify the Mundell-Fleming results nor to blur the behavior of output across exchange rate regimes. Rather, the response of output to a variety of shocks appears to be qualitatively similar and of the same order of magnitude regardless of the type of contracts prevailing in the economy.

These findings put into question the relevance of the results of the previous academic literature on the effects of wage indexation in open economies. In particular, the finding that wage indexation does not protect output from monetary shocks under a flexible exchange rate implies that the academic view that wage indexation makes a flexible exchange rate generally preferable is unwarranted. From a more constructive perspective, the similarities found in this paper on the behavior of the economy with and without wage indexation suggest that the choice of exchange rate regime when wages are indexed depends on the same type of factors that affect the choice of exchange rate when wages are not indexed.

The paper also addressed the Gray-Fischer question whether wage indexation stabilizes or destabilizes output. In contrast to the results obtained in Jadresic (1996b) for a closed economy, it was found that the net effects of wage indexation on output stability when the economy is open are ambiguous and depend on the type of shocks impinging upon the economy, the exchange rate regime in place, the type and length of the wage contracts being compared, and the structural parameters of the economy. Thus a definite evaluation of the net effects of wage indexation on output stability in the open economy requires a precise specification of the economy under consideration. This issue is left for future research.

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