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The Effects of Forward- Versus Backward-Looking Wage Indexation on Price Stabilization Programs

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Abstract

A standard open-economy model is used to show that price stabilization programs are more likely to succeed if labor contracts specify forward-looking wage indexation. Compared with contracts specifying backward-looking wage indexation or wages based on static expectations, such contracts will result in a greater reduction in inflation with lower output costs, smaller misalignment of real wages, smaller outflows of reserves, smaller disruptions caused by policy announcements, and a reduced impact of some shocks during price stabilization programs. These results are generally true whether or not capital is mobile and whether or not expectations are rational.

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SUMMARY

Labor contracts in high-inflation countries generally specify, or are negotiated on the basis of, backward-looking wage indexation, whereby the nominal increase in wages is equal to the increase in the general price level during the previous contract period, plus any real wage increase employers agree to. During periods of unchanging inflation, this type of contract has benefits for labor negotiations and for the economy as a whole because it causes actual real wages to equal targeted real wages.

Under programs to reduce inflation, however, backward-looking wage indexation has several undesirable effects. It makes inflation more persistent, increases the output loss caused by the program, causes a misalignment of real wages, and may lead to a worsening of the external current account position. It also causes the announcements of price stabilization programs to create larger real disturbances in the economy and increases the severity of some types of shocks. If wages are not indexed, but are negotiated on the basis of static expectations about inflation (e.g., that inflation will not change), the effects will be the same.

Forward-looking wage indexation, where nominal wages increase at the rate of increase of the general price level during the period of the wage contract, plus any real wage increase that is agreed upon, does not have these drawbacks and may improve the viability of price stabilization programs. Additionally, because it leads to more stable real wages, it should be politically feasible to introduce. This paper presents a model to illustrate these assertions. The model describes an open economy with wage indexation and expectations about inflation and exchange rates. In this model, forward-looking wage indexation is compared with backward-looking wage indexation to determine the relative effects on prices, output, real wages, and the external current account balance. The comparison is made using the assumption of perfectly mobile and, alternatively, immobile capital.

I. INTRODUCTION

Many countries with persistent high or moderate inflation have experienced the emergence of various types of indexation, including the indexation of the rate of return on financial instruments, a crawling peg exchange rate regime, and pervasive wage indexation (see Dornbusch and Fischer (1991), and Sargent (1982)). While all types of indexation are likely to contribute to perpetuating inflation, wage indexation may bear a greater share of the responsibility, as the most common type of wage indexation is backward-looking indexation (e.g., such that annual wage increases are set equal to the previous year's inflation rate), and wages represent a large share of aggregate expenditure. Backward-looking indexation--whether it is full or partial--makes inflation more difficult to eradicate by increasing the momentum of labor cost increases. It prolongs the period of high inflation and increases the real costs of adjustment. This paper presents a general analysis of the benefits of making wage indexation forward-looking instead of backward-looking during price stabilization programs, and offers some suggestions on how to make wage indexation more forward-looking.

Backward-looking indexation may be beneficial when there is no attempt to lower inflation, because it will facilitate labor negotiations and will stabilize nominal wage increases, which would, in turn, stabilize the level of inflation. Aguedulo and Carrasquilla (1992) note that a sharp increase after 1970 in the stability of inflation in Colombia (the case which provided the motivation for this paper) coincided with an increase in the prevalence of indexation. Stability of the level of inflation is a benefit to risk-averse policy makers in the absence of an anti-inflation program, because without it changes in inflation are as likely to be positive as negative. Stability of inflation also improves forecasts of real price levels and hence may remove an obstacle to long-term decision-making by economic agents. Finally, stability of inflation results in a greater response of real variables to macroeconomic policy, affording responsible policy makers more scope for beneficial adjustments.

When the authorities are actively trying to reduce inflation, however, factors that promote stickiness of inflation obstruct their goal. They increase the costs associated with reducing inflation, including output losses, disequilibrium real wage levels, and losses of foreign exchange reserves under fixed or managed exchange rate regimes. If the stabilization program is exchange rate-based and is not fully credible because the inflation is seen as persistent, it may cause a boom-bust cycle (Kiguel and Liviatan (1992), Veigh (1992)). This may be caused by the fact that the stickiness of inflation leads to a temporary decline in real interest rates (Rodriguez (1982)), to temporary fiscal deficits following a reduction in the inflation tax (Helpman and Razin (1987)), or to a temporary reduction in the cost of holding money and therefore of the cost of consumption (Calvo (1986), and Reinhart and Veigh (1992)). Dornbusch and Fischer (1986) explain the phenomenon that hyperinflations can be abruptly stopped as resulting from a change in attitudes; hyperinflation is recognized as highly costly to policymakers and therefore enhances the credibility of price stabilization efforts and increases workers' willingness to give up wage indexation.

Changing or eliminating wage indexation structures can present political difficulties because wage indexation is a convenient method of contractually specifying nominal wage increases that protect against inflationary erosion of real wages; workers would strongly object to any new wage arrangement that resulted in a lower rate of increase in their nominal wages, unless they were convinced that a lower rate of inflation was imminent (see Grey (1976)). A failed stabilization program could lead to a large reduction in real wages, for example if wages were indexed to a targeted level of inflation that was exceeded ex-post. Public sector employees, who recognize that the demand for their labor is less elastic with respect to the wage rate than the demand for private sector labor, might object particularly strongly to any program that would risk lowering real wages.

Replacing fully backward-looking wage indexation with wages based on fully static expectations (e.g., based on the assumption that inflation will be the same this year as last year) would have no effect on the economy since such wage setting behavior would be identical. Even rational expectations-based wages agreed on ahead of time would suffer from limitations on information.

Making wage indexation forward-looking, however, would diminish the persistence of inflation and the costs of reducing it, while also providing real wage stability. This paper presents a model comparing the effects of forward and backward-looking wage indexation on four endogenous variables, namely: (1) the inflation rate; (2) the growth rate of real income; (3) the growth rate of real wages; and (4) the growth rate of the current account balance. The inflation rate measures the success of a price stabilization program. The growth rate of real income measures the overall economic costs of a stabilization program. The growth rate of real wages affects the political support--particularly by workers--the change in indexation might receive; and the growth rate of the current account balance is relevant to the sustainability of exchange rate-based price-stabilization programs because large current account deficits cause reserve losses.

The model examines the effects of changes in the nominal exchange rate or the money supply, announcements of price stabilization programs, and shocks on these four variables. A spectrum of expectations, from fully static to fully rational, is incorporated. The analysis is performed under two alternative extreme assumptions of capital mobility--perfectly mobile and fully immobile--with the understanding that the situation for most countries would lie somewhere in between. Finally, suggestions are made as to how wage indexation may be made more forward-looking.

II. THE MODEL

The following model is adapted from Fischer (1986). The model, which is static, is put into a dynamic framework, and the specification of wages incorporates backward-looking indexation. First the model is presented with the assumption of perfect capital mobility:

$$m_t - p_t = y_t - a\, i_t \tag{1}$$

$$y^s_t = b_1(q_t - w_t) + b_2(q_t - e_t) + \mu_t \tag{2}$$

$$y^d_t = -c_1 r_t + c_2(e_t - q_t) + \nu_t \tag{3}$$

$$x_t = -d_1 y_t + d_2(e_t - q_t) \tag{4}$$

$$p_t = \lambda q_t + (1 - \lambda)\, e_t \tag{5}$$

$$i_t = r_t + E_t(p_{t+1}) \tag{6}$$

$$i_t = r^*_t + E_t(e_{t+1}) \tag{7}$$

Most lowercase variables with time subscripts represent percent changes from the previous period. For example, p_t, indicating general prices, represents the percent deviation of the price level in period t from the price level in period t-1--the level of inflation in period t. The other variables whose percent changes are included in the model are: m_t, money supply; y_t, real income; y^s_t, aggregate supply; q_t, price of domestically produced goods; w_t, nominal wage rate; e_t, exchange rate denominated in local currency per unit of foreign currency; y^d_t, aggregate demand; x_t, external current account balance; E_t, expectations operator; and μ_t and ν_t, which are disturbance terms assumed to be mutually and serially uncorrelated. Variables that are represented as rates are i_t the nominal interest rate; r_t the real interest rate; and r^*_t the real world interest rate.

Equation (1) is a quantity of money equation with the change in velocity depending on the interest rate and money growth being determined endogenously. In this section of the paper the model assumes perfect capital mobility, so money growth is ultimately determined by the exchange rate crawl, which is the primary policy variable examined here. Equation (2) specifies aggregate supply as increasing in response to domestic price increases and decreasing in response to higher real wages and local currency denominated import costs (and assumes constant inflation abroad, although changes in inflation abroad would have exactly the same effect as changing e). Equation (3) specifies aggregate demand as increasing in response to a higher price of import substitutes and decreasing in response to higher domestic prices and interest rates. Equation (4) specifies current account growth; equation (5) defines the overall inflation rate as a linear combination of home and foreign inflation rates; equation (6) specifies the change in the domestic nominal interest rate and equation (7) equates world and domestic nominal rates of return under the assumption of perfect capital mobility. The model implicitly assumes for presentational purposes that the world inflation rate is zero and hence that $r^*_t = i^*_t$.

This assumption can be eliminated simply by replacing r^*_t with I^*_t throughout the paper and no results would be affected.

Combining equations (2) and (3) yields the growth of prices of domestically produced goods:

$$q_t = \frac{(b_t + c_t)\, e_t + b_1 w_t + c_1 r_t + \epsilon_t}{b_1 + b_2 + c_2} \tag{8}$$

where, $\varepsilon_t = \nu_t - \mu_t$

Combining equations (5) and (8) yields:

$$p_t = (1 - \theta b_1)\, e_t + \theta b_1 w_t - \theta c_1 r_t + \theta \varepsilon_t \tag{9}$$

where, $$\theta = \frac{\lambda}{b_1 + b_2 + c_2}$$

To proceed further the rule for determining wage growth and the behavior of expectations of prices and the exchange rate must be specified.

III. Wage Contracts, Expectations, Announcements, and Credibility

If there is no expectation of a change in exchange rate policy, we would anticipate that $E_t(e_{t+1}) = e_t$ However, different factors might cause the expected rate in the next period to differ from the currently prevailing rate; for example, the government may make announcement of a change in e_t. If the public has confidence that the government will do what they say the expected rate in the next period, $E_t(e_{t+1})$, will be equal to the new, announced rate, not to the currently prevailing rate. We can describe expectations of changes in the exchange rate with a variable α defined as $\alpha_t = 1 - E_t(e_{t+1})/e_t$. α is a measure of the public's expectation that e is going to change. In a steady-state ($e_{t-1} = p_{t-1} = e_{t-2} = e_{t-3}$) the most likely event that would make α different from zero would be an announcement by the government that they will change e. If an announcement if a steady-state of a change in e_t has no credibility at all (no one believes that the government is going to change e_t in spite of what they say they will do) α will be zero; otherwise α will differ from zero (will be greater than zero if a reduction in the rate of devaluation is expected). We can rearrange the definition of α to get:

$$E_t(e_{t+1}) = (1 - \alpha_t)\, e_t \tag{10}$$

Similarly, the public will have expectations about inflation. If the current rate of inflation is expected to prevail then $E_t(p_{t+1}) = p_t$, but often this will not be the case. We can describe expectations of changes in the inflation rate with a variable β defined as $\beta_t = 1 - E_t$

$(p_{t+1})/p_t$. β is a measure of the public's expectation that inflation is going to change. If inflation is not expected to change β will be zero, otherwise it will be different. If, in a steady-state, the government makes an announcement of a price stabilization program that has no credibility at all (no one believes that inflation will change), β will be zero. We can rearrange the definition of β to get:

$$E_t (p_{t+1}) = (1 - \beta_t) p_t \tag{11}$$

If the rates of inflation and devaluation are not expected to change, then:

$$r_t = r^* \tag{12}$$

Equations 10 and 11 also show that in a steady state (where $p_t = e_t$), β_t will be equal to α_t, and hence that equation 12 is true, if a reduction in the rate of crawl of the exchange rate is announced and the public has full confidence that this reduction will translate quickly and fully into an equivalent reduction in the rate of inflation (in other words if $E_t (p_{t+1}) = E_t (e_{t+1})$) . In many cases, however, β_t will be smaller than α_t, since there will be doubts that the overall economy will fully adjust to the new rate of crawl; an announcement of a reduction in the rate of crawl of the exchange rate of 10 percent may result in a belief by the public that inflation will go down by only 5 percent. Combining equations 6, 7, 10 and 11 yields the relationship between domestic and world real interest rates:

$$r_t = r^*_t + (1 - \alpha_t) e_t - (1 - \beta_t) p_t \tag{13}$$

A. Forward-Looking Versus Backward-Looking Wage Indexation

To complete the specification of the model the determination of wage growth must be defined. Three possible specifications are considered: backward-looking indexation, where the increase in the wage rate is equal to the previous period's inflation; forward-looking indexation, where wages increase at the rate of inflation prevailing in the current period; and non-indexed or expectations-based wages, where the increase in the wage rate is equal to the previous period's expectation of the current period's inflation. If there is no policy change or shocks expected or if expectations are static, $E_{t-1}(p_t) = p_{t-1}$ so there is no difference between a wage rule that uses backward-looking indexation, such that $w_t = p_{t-1}$, and expectations-based wages, e.g. $w_t = E_{t-1} (p_t)$. If wages are expectations-based and expectations are rational, such that $w_t = (1-\beta_{t-1}) p_{t-1}$, there will be minor differences which are described later.

Forward-looking wage indexation, however, such that $w_t = p_t$, will have different results. The following wage rule allows for a linear combination of forward-looking and backward-looking indexation or static expectations-based wages:

$$w_t = \delta p_{t-1} + (1 - \delta) p_t \tag{14}$$

where δ is the degree of backwardness of the wage indexation.

Equation (14) is used to derive expressions (presented in the appendix) for inflation, income growth, real wage growth and current account growth. The following effects are described for each of these variables: first, the effect of increasing δ; secondly, the impact of changes in expectations caused by an announcement of a price stabilization program on the variable--in the absence of shocks or policy measures--regardless of whether the announced program is actually implemented (e.g. $e_t = p_{t-1}$ and $r_t = \mu_t = \nu_t = 0$), and finally how backward-looking indexation affects that impact. In some cases, there is an elaboration on how an announcement would affect the variables' sensitivity to shocks and world interest rate fluctuations and whether backward-looking wage indexation, which also affects these variables' sensitivities to shocks and world interest rate fluctuations, would affect these sensitivities differently after an announcement has been made.

B. Rational Expectations-Based Versus Backward-Looking Wage Indexation

In the period after an announcement of a new effort to reduce inflation, wages set according to rational expectations will reflect the new expectations generated by the announcement. Hence $E_{t-1}(p_t) = (1 - \beta_{t-1})\, p_{t-1}$, and there is a difference between backwardly indexed wages and wages that are negotiated according to the previous period's inflationary expectations. The expression for the unindexed, rational-expectations rate wage growth is:

$$w_t = \delta p_{t-1} + (1 - \delta) E_{t-1}(p_t) = (1 - \beta_t (1-\delta))\, p_{t-1} \qquad (15)$$

In equation (9) it can be seen that when wages depend only on p_{t-1}, which has already been determined, changing δ will have no effect on any of the coefficients of the determinants of inflation, income growth, real wage growth, or current account growth, except for the coefficients on the past inflation rate. Thus, when wages are determined more in line with the previous period's level of inflation than with the previous period's expectations of current inflation, the previous period's level of inflation will have a greater impact on the economy--in particular there will be greater persistence of inflation--but there will be no other changes in the effects that other variables have on the economy. Changing the rate of crawl of the exchange rate, for example, will change inflation by the same amount, regardless of δ, the degree of indexation. Hence, wages based on rational expectations will result in less persistence of inflation than backwardly indexed wages, but will fail to provide the positive effects on other variables that are experienced when wage indexation is forward-looking.

IV. Results of the Model

A. Effects of Making Wage Indexation More Backward-Looking

Making wage indexation more backward-looking has several effects that are detrimental to a price stabilization program. These effects are qualitatively the same whether

or not the policies are anticipated and whether capital is mobile or not. The **first** effect is that the stickiness of nominal wages will cause inflation to be stabilized. It will react less to changes in the growth of the money supply, the exchange rate, the world interest rate, and to supply and demand shocks. When no price stabilization program is being undertaken this may be desirable, since it hinders inflation from increasing, lowers uncertainty about future price levels, and increases the responsiveness of real aggregates to macroeconomic policy; however, backward-looking indexation will interfere with efforts to lower inflation. A **second** effect is that backward-looking wage indexation increases the impact of past inflation on the economy. This introduces a large, uncontrollable inertial component into the effects of any policy.

A **third** effect is that backward-looking wage indexation destabilizes real wages, which may be undesirable for workers. Increasing the likelihood that the prevailing real wage will differ from the long-run equilibrium real wage would reduce the welfare of risk-averse workers, even before taking into account the increased possibility of unemployment as a result of rising real wages. Workers would therefore be expected to favor forward-looking indexation. During a price stabilization program the real wage will most likely rise, however, so there may be workers, particularly public servants who have relatively secure jobs, who would favor backward-looking indexation.

Real income growth and current account growth react more negatively both to money-based (lower m) and to exchange rate-based (lower e) stabilization programs, as wage indexation becomes more backward-looking and hence aggregate supply responds less to policy measures.[2] Since inflation is less sensitive to changes in the exchange rate crawl, a given exchange rate-based reduction in inflation will have a more negative impact on real income growth and current account growth. Many price stabilization programs fail when current account deficits cause reserve losses that lead to unsustainability of the exchange rate regime; this risk is lessened when the reaction of the current account growth to changes in the exchange rate crawl is minimized.

Finally, greater backward-looking wage indexation stabilizes the current account growth with respect to all shocks and world interest rate changes, and it stabilizes income with respect to supply shocks, but destabilizes it with respect to changes in world interest rates and demand shocks.

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[2]As capital becomes less mobile, however, the current account growth reaction to an exchange rate-based stabilization will diminish and perhaps even change sign. Also when capital is not mobile, while the income growth reaction to an exchange rate-based stabilization will become more negative, it is a positive reaction when indexation is mostly forward-looking, and therefore some backward-looking wage indexation could stabilize income after an announcement of an exchange rate-based program.

B. Effects of Announcements and Credibility

In a steady state, if capital is perfectly mobile, wage indexation is fully forward-looking, and an announcement of a price stabilization program is fully credible (in that the reduction in the growth of the exchange rate is expected to translate fully into a reduction in inflation and wage rate growth), the announcement will have no effect on inflation before the policy is implemented. However, if capital is perfectly mobile, but wage indexation is not fully forward-looking, or the announcement is not fully credible, it will increase inflation as an expected real appreciation of the currency will lead to lower real interest rates. If capital is immobile, expectations about the changes in the exchange rate crawl or the growth of the money supply have no effect on inflation, while expectations of a reduction in inflation, regardless of how drastic a stabilization policy may be needed to achieve it, will reduce inflation. Thus, in all situations, an announcement of a price stabilization program is always less inflationary or more disinflationary when it is more credible. Backward-looking wage indexation always reduces the beneficial effect of credibility, not to mention the fact that it also weakens credibility itself.

Fully credible announcements of price stabilization programs have no effect on income. If an announcement is not fully credible it will be expansionary when capital is fully mobile, but recessionary when it is not mobile. These effects are augmented by increasing backward-looking wage indexation. Thus, the model predicts that when there is backward-looking wage indexation an announcement of a price stabilization program would cause an expansion, while the implementation of the program would cause a recession, consistent with the observation in many countries of boom-bust cycles, where inflation programs result in expansion followed by recession.

When wage indexation is fully forward-looking the real wage never changes. When wage indexation is not fully forward-looking, real wage growth increases in response to announcements under zero capital mobility, but decreases in response to announcements under perfect capital mobility. In both cases this instability is aggravated by making wage indexation more backward-looking, and also in both cases increasing credibility has a positive effect on real wage growth.

With perfect capital mobility, any announcement with a credibility gap will cause current account growth to decrease in response to an expected appreciation of the currency. More backward-looking wage indexation reduces this impact. With imperfectly mobile capital, announcements will lead to increases in current account growth by reducing inflation and depreciating the growth of the real exchange rate. In this case, however, more backward-looking wage indexation increases this impact. Thus, backward-looking wage indexation always causes announcements to have more positive or less negative effects on current account growth.

If capital is mobile and there is an expectation that a price-stabilization program will be abandoned (e.g. that the rate of crawl of the exchange rate will return to its previous level),

inflation will fall faster and eventually reach a lower level as compared with a situation in which there is no expectation that the program would be abandoned; income growth will fall by more and subsequently rise to a level below zero, and the growth rates of the real wage and the current account will rise by more and subsequently fall to a value greater than zero. All of these effects would be enhanced by greater degrees of backward-looking indexation. If capital is immobile, such an expectation will have exactly the opposite effects of an announcement of a reduction in the rate of crawl of the exchange rate.

The following table summarizes the effects of making wage indexation more backward-looking. Each cell represents the effect that an exogenous variable, shown in the column headings, has on an endogenous variable, shown in the row headings. In the four left columns a "+" or a "-" indicates the direction of the effect of making wage indexation more backward-looking. For example, the "+"in the cell in the row labeled "p_t" and the column labeled "Lower m_t" indicates that making wage indexation more backward-looking would result in the inflation rate (p) being more positive (or less negative) than it would otherwise have been in response to a reduction in m_t. The columns to the right, on the other hand, indicate whether making wage indexation more backward-looking increases or decreases the impact of the exogenous variable on the endogenous variable. A "+" in the cell in the row labeled "p_t" and the column labeled "Lower r_t" indicates that the effect of the changes in the real interest rate on inflation are made stronger (whether that be more positive or more negative) by making wage indexation more backward-looking, while a "-" indicates that the effects are made weaker. A "?" indicates that the effect may be made either stronger or weaker, depending on parameter values.

Effects of More Backward-looking Indexation (higher δ) on the Impact of Policies and Past Inflation

Perfect Capital Mobility

		Lower e_t	Higher p_{t-1}	Policy announce-ment*	Change in impact of: r_t	u_t	v_t
p_t		+	+	?	-	-	-
Y_t	m is	-	-	+	+	-	+
$w_t - p_t$	endogenous	+	+	-	+	+	+
x_t		-	-	?	-	-	-

Imperfect Capital Mobility

	Lower m_t	Lower e_t	Higher P_{t-1}	Policy announce-ment**	Change in impact of:	u_t	v_t
p_t	+	+	+	+		-	-
Y_t	-	-	-	-	r has no	-	+
$w_t - p_t$	+	+	+	+	effect	+	+
x_t	?	?	?	?		-	?

* Assumes $\alpha_t > \beta_t$, $e_t = p_t$ *and* $r_t = \mu_t = \nu_t = 0$.

** Assumes $m_t = e_t = p_{t-1}$ *and* $\mu_t = \nu_t = 0$.

V. Price-Stabilization Scenarios

This section presents the results of four scenarios concerning a price stabilization effort. These cases are considered using the perfect-capital-mobility model and in each case the program consists of reducing the rate of crawl of the exchange rate to half of its present value. The world interest rate is assumed to be stable and supply and demand shocks are assumed to be zero.

The first scenario looks at an unannounced reduction in period t in the rate of crawl of the exchange rate with no wage indexation. The results of this action, shown in Figure 1, are that inflation and the interest rate will both decline by the same amount as the rate of crawl, while nominal wages adjust immediately to the new policy and hence all real variables remain unchanged. α and β are always equal to zero because the only changes that take place are the ones in period t which are unexpected. If the action had been announced ahead of time, the results would have been exactly the same except that the nominal interest rate would have declined one period sooner; without the announcement, borrowers end up paying an excessively high interest rate ex-post in period t-1 because they have an incorrect expectation of inflation in the period before the action.

Scenario 2, shown in Figure 2, also looks at an unannounced reduction in the rate of crawl in period t, but this time with some significant degree of backward-looking wage indexation. In this scenario inflation adjusts only partly to the new exchange-rate crawl in period t--since the incomplete adjustment of wages prevents full adjustment and reduces aggregate supply--and declines asymptotically thereafter. Income growth, which is zero in the long-run equilibrium, declines initially as a result of the increased real rate of appreciation of the currency, then gradually rises back to zero as inflation declines to the rate of crawl of the exchange rate. The nominal interest rate falls with the exchange rate crawl in accordance with the assumed equal rates of return across countries, and the real interest rate falls in period t and gradually rises back to its original level as inflation falls. α is always zero because the exchange rate policy is unannounced, while β rises to a permanent value between zero and 1 in period t reflecting the public's understanding that inflation will be partly reduced in each period.

Scenario 3, shown in Figure 3, is the same as scenario 2 in that there is a reduction in the exchange rate crawl in period t and there is backward-looking wage indexation, but in this scenario the program is announced in or prior to period t-1. In this case inflation increases in period t-1 as the expected real appreciation of the currency leads to a reduction in real interest rates, then falls along a path that is similar to the one in scenario 2, but higher. Low interest rates also cause income to rise in period t-1, but in the next period income decreases, and to less than its period t level in scenario 2 in line with the higher inflation. Thereafter it rises asymptotically back to its old level along a path that is below its scenario 2 path. α and β behave as in scenario 2 except that, because of the announcement, α has a value of 1.0 in period t-1 and β increases one period sooner.

Figure 1

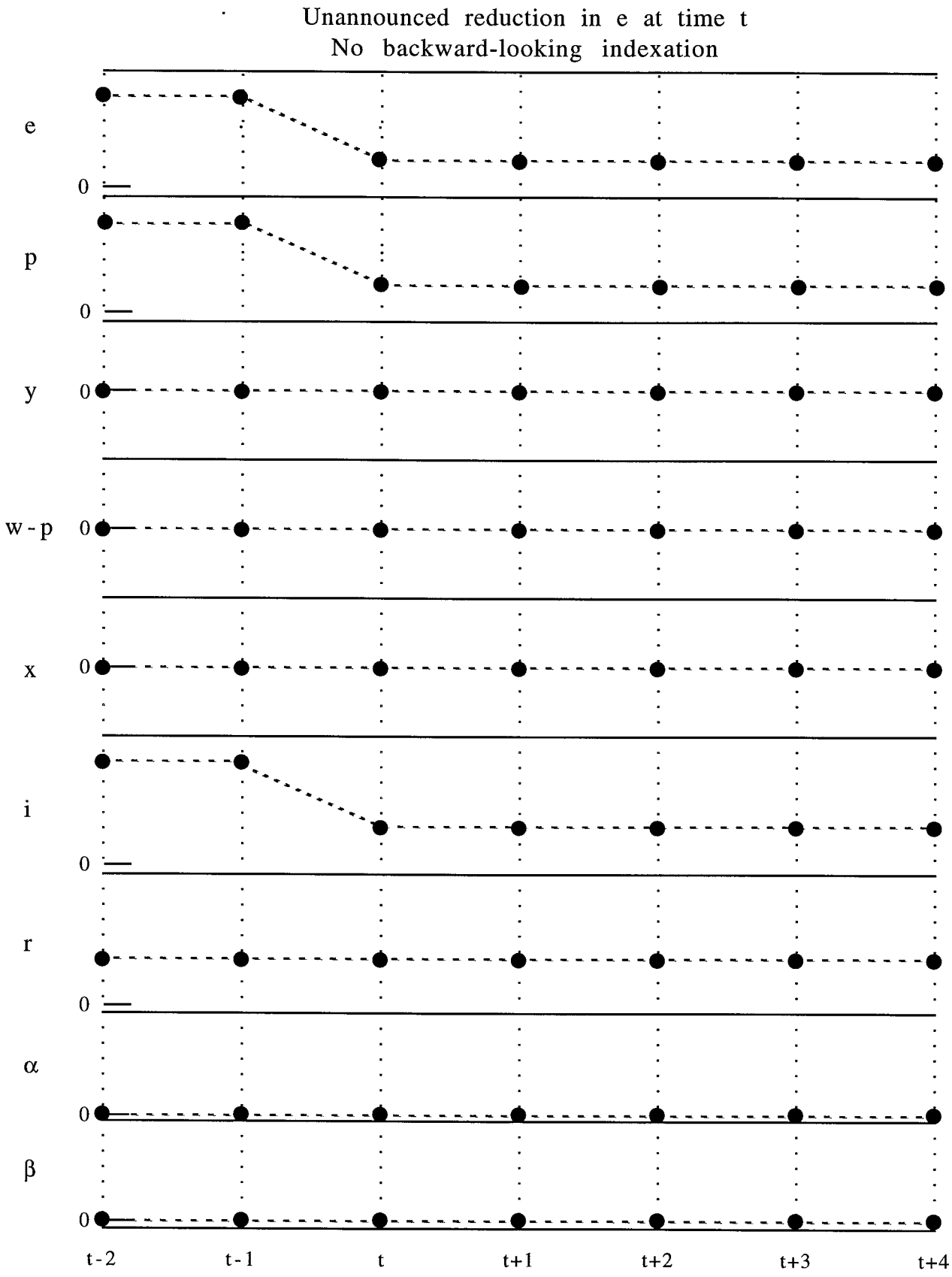

Unannounced reduction in e at time t
No backward-looking indexation
e
0
p
0
y
0
w - p
0
x
0
i
0
r
0
α
0
β
0
t-2
t-1
t
t+1
t+2
t+3
t+4

Figure 2

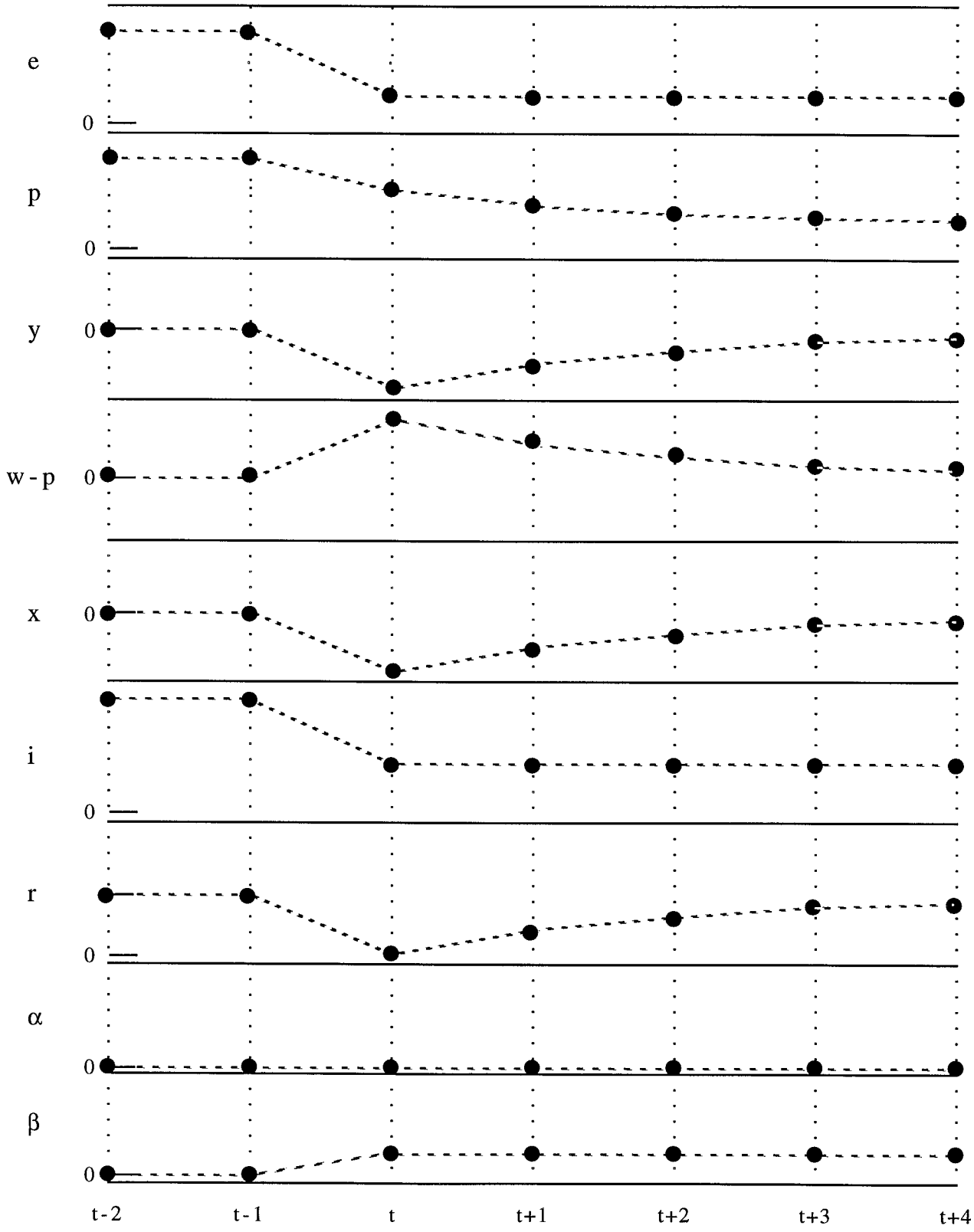
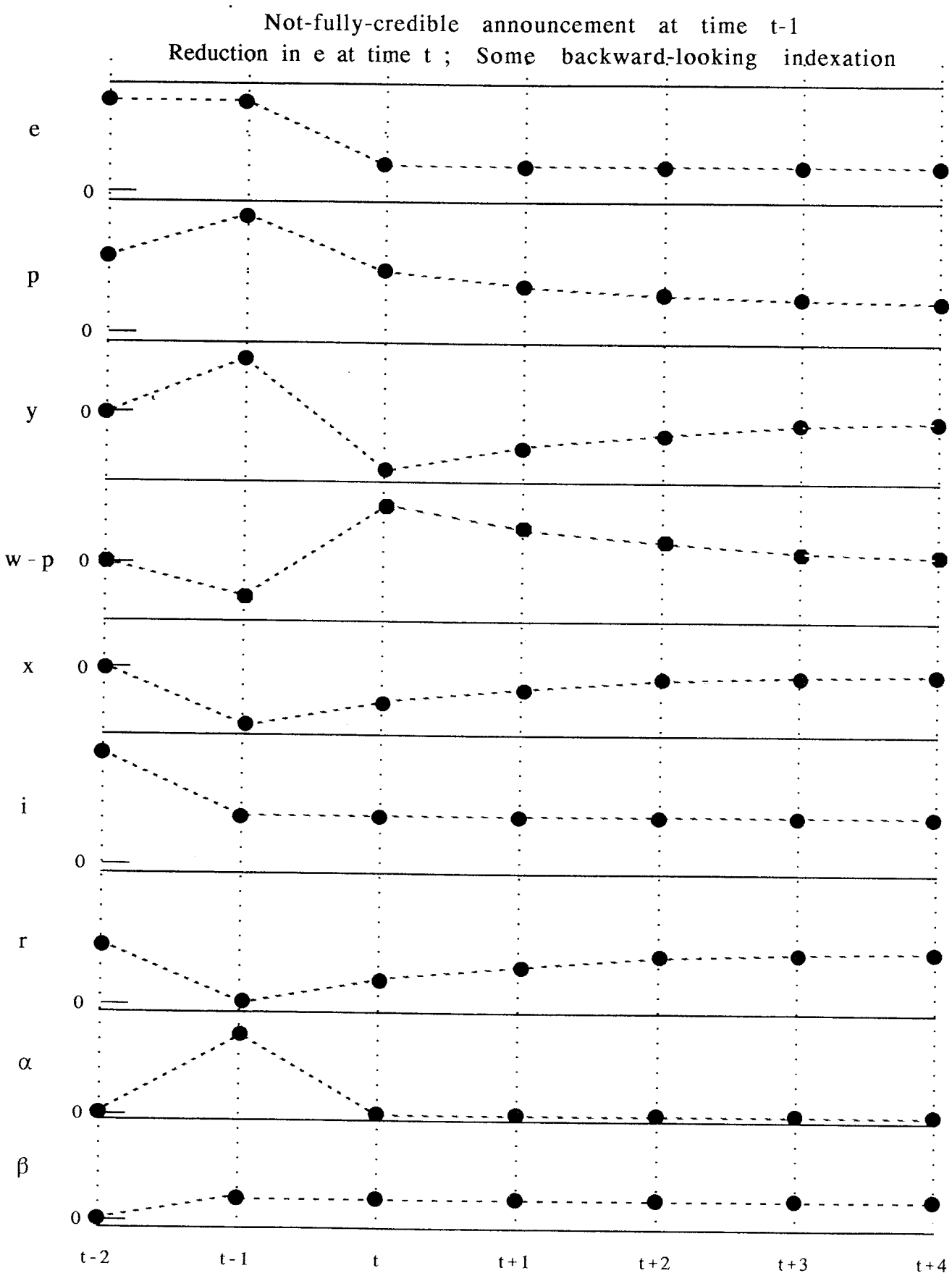

Unannounced reduction in e at time t
Some backward-looking indexation
e
0
p
0
y
0
w - p
0
x
0
i
0
r
0
α
0
β
0
t-2
t-1
t
t+1
t+2
t+3
t+4

Figure 3


Not-fully-credible announcement at time t-1
Reduction in e at time t ; Some backward-looking indexation
e
0
p
0
y
0
w - p
0
x
0
i
0
r
0
α
0
β
0
t-2
t-1
t
t+1
t+2
t+3
t+4

Scenario 4, shown in Figure 4, considers the possibility that the price stabilization effort lacks credibility because of doubts surrounding the authorities commitment to continuing with the program (see Dornbusch (1991)). In this scenario, as in scenario 2, there is backward-looking wage indexation and an unannounced reduction in the rate of crawl of the exchange rate in period t. It is then believed in period t+1, and in every period thereafter, that the reduction in income growth will force the authorities to abandon the program and increase the rate of crawl of the exchange rate to its original (period t-1) level. In periods t-2 and t-1 scenarios 2 and 4 are identical. In period t, however, when the exchange rate expectation changes, the real interest rate will rise in anticipation of the devaluation. Compared with the scenario in which there are no expectations of a reversal of the price-stabilization program, inflation will fall more quickly and will fall to a level that is lower than the new crawl rate. Income growth will fall by more initially and will then rise to a level that remains below zero, as long as the expectations of a policy reversal persist. α and β will both fall.

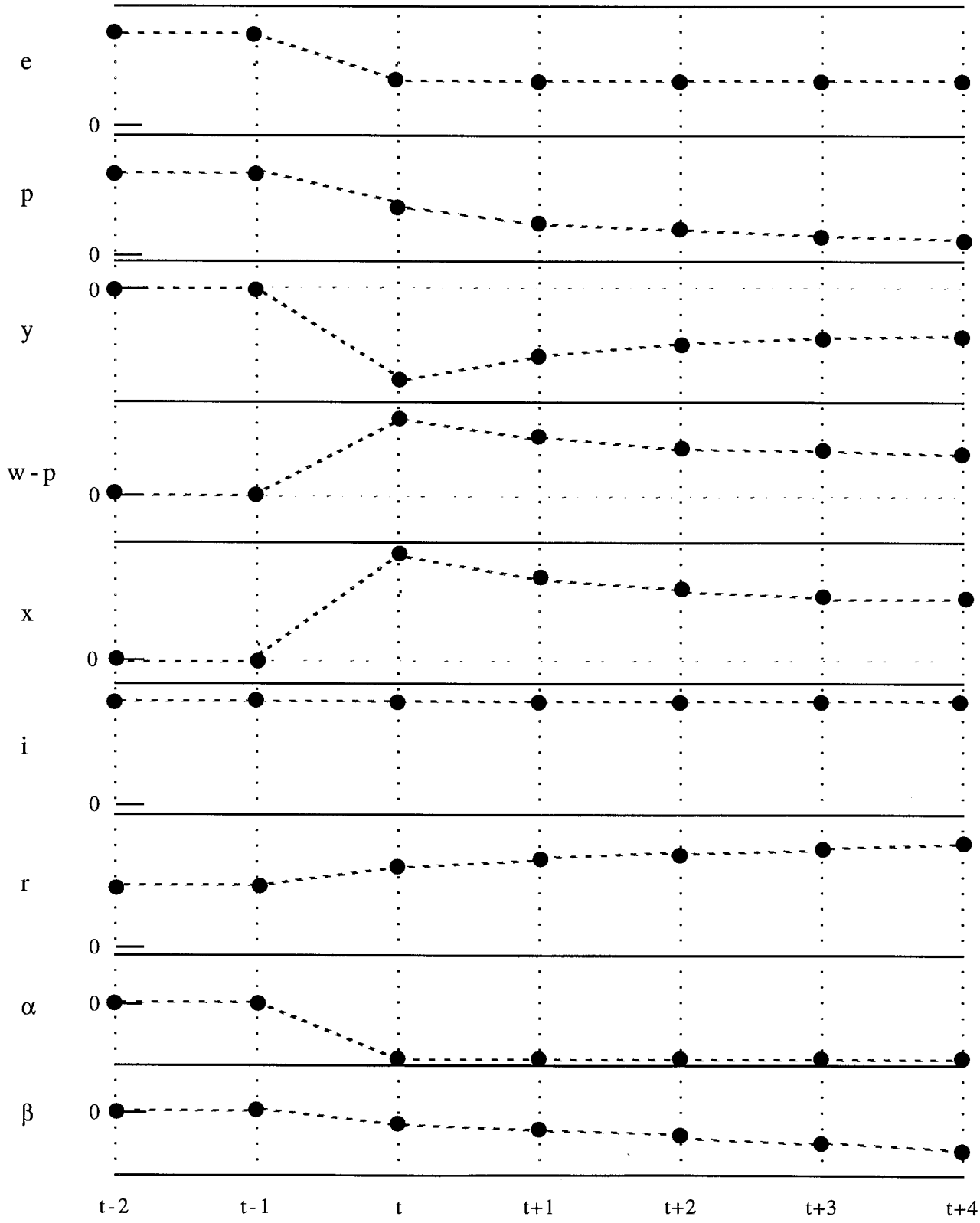
VI. Policy Implications

Backward-looking indexation may provide benefits at times of unchanging policies, but during price-stabilization programs it has a range of effects that are detrimental. Also during such a program, backward-looking indexation would lead to greater stability of real wages, so political resistance to eliminating it might be minimal.

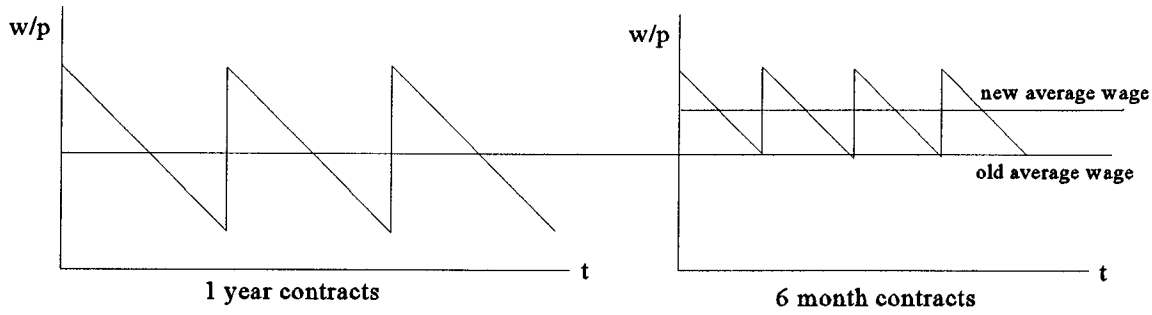
It should be noted that the scenario of forward-looking wage indexation is idealized in that prices and wages are determined simultaneously. In reality bargaining processes take place only once per period , but simultaneity can be approximated. One way to approximate forward-looking indexation would be to shorten labor contract periods. In the public sector the authorities could simply announce more frequent wage indexation. The private sector could be encouraged to go along with the reasoning that it would reduce real wage and employment instability during a period of rapid price adjustments. To truly make wage indexation fully forward-looking during a stabilization program, the government could grant low wage increases in line with the price-stabilization targets, but could offer to protect real wages by guaranteeing that in the event of higher-than-targeted inflation it would make compensatory payments. For example the government might target 10 percent inflation and offer 10 percent wage increases to public sector employees. If the stabilization were not completely successful and inflation turned out to be 15 percent, wages would immediately be adjusted upwards by 5 percent and workers would be paid a lump sum representing the additional wages plus interest they would have earned since the beginning of the contract had their wages initially been indexed to reflect 15 percent inflation. It should be noted that in practice most labor contracts do not begin on the exact starting date of the stabilization program and that the contracts would have to be adjusted accordingly. It should also be noted that to be completely precise the additional contingency wage payments made in period t would have to be large enough to compensate for the fact that paying them would cause a further increase in the price level in that period.

Figure 4

Unannounced reduction in e, at t but it is expected to return to its original level at t+1 and in all periods thereafter; $\delta > 0$.



It should also be kept in mind that when wages are adjusted more frequently, the first adjustment must be delayed or reduced if average wages are to be maintained at the same level. Consider the case where inflation is steady and the contract period is reduced from a year to six months. The real wage at the end of the first six month period will be equal to the average real wage prevailing over the past years. If wages are adjusted upwards by the increase in prices over the last six months, real wages will then be above their historical average for the next six months and, if the indexation occurs every six months thereafter, the new average real wage will be higher than it was before the change. Thus, if the prevailing average real wage is to be maintained, the first indexation after the new contract length is introduced must be smaller or later than might be expected. This could lead to political difficulties as the logic of it might not be widely understood. The following diagram illustrates the behavior of the real wage when contract periods are shortened and no one-time adjustment is made in the first period.



Again, in the public sector the government could simply announce this policy, and try to convince the private sector through moral suasion to follow the same policy. A campaign to promote the benefits of the change would help minimize political resistance from the public sector, increase private sector participation, and enhance the credibility of the program.

In addition to making wage indexation more forward-looking, this policy would have other benefits. Even if contract lengths remained at one year, any wage increases and adjustment payments that might be needed could be paid as soon as reliable data became available, potentially smoothing the fluctuation of real wages that occurs during the year as real wages start out at an above average level after the indexation adjustment, and steadily decline for twelve months to below their average level, until they are adjusted again. Also the government would have a greater incentive to ensure the success of the program in order to avoid making the adjustment payments. The probability of success of the program would be increased both by this incentive and because the knowledge of the existence of this incentive would improve the credibility of the program.

Fiscal restraint is usually a necessary condition for price stability. During a price-stabilization program, seignorage revenue would have to be replaced, putting added pressure on the fiscal budget (see Friedman (1971)), and the authorities would have to be mindful that the fiscal situation would be watched closely by all economic agents for any signs of relaxation

that could spark self-fulfilling inflationary expectations. If the program included guarantees of payments to compensate for any inflation beyond the targeted rate, and if there were higher-than-targeted inflation, these payments would have to be financed, creating further inflationary pressure in the event of a program lapse. For this reason it should be noted that while a program that included such guarantees might have a greater likelihood of success, it might also have a higher cost of failure. See Edwards (1993) for a discussion of political expectations.

To include government spending in the model would simply require an additional term that would have the same effect as the demand shock. Thus, more backward-looking wage indexation would cause greater fiscal spending to have a greater effect on income as opposed to prices, a greater effect on the real wage, and an effect on the current account which would be less pronounced under perfect capital mobility, but ambiguous under imperfect capital mobility. Government revenues would simply appear as a negative term that would have the same effect as the demand shock, except that it would have to be adjusted by a marginal propensity to consume term.

In conclusion, reducing inflation is easier and less painless when economic variables adjust quickly to the new price level. Forward-looking wage indexation causes wages to adjust more quickly to new price levels than under backward-looking wage indexation. In addition, forward-looking wage indexation gives policymakers more control over macroeconomic variables because of the feedback that occurs between prices and wages when wage indexation is forward-looking. These results hold under different assumptions about capital mobility. Politically feasible methods of making wage indexation more forward-looking exist and should be introduced before price-stabilization programs are undertaken.

MATHEMATICAL DERIVATIONS OF RESULTS

This appendix derives the impact on the endogenous variables of changes in the exogenous variables, under alternative assumptions about capital mobility

A1. Perfect capital mobility

Combining equations 9, 13 and 14 we get an expression for inflation:

$$p_t = \frac{b_1 (1 - \lambda) + b_2 + c_2 + \lambda c_1(\alpha_t - 1)}{b_1 (1 - \lambda + \lambda\delta) + b_2 + c_2 + \lambda c_1(\beta_t - 1)} e_t \qquad (16)$$

$$+ \frac{\delta\lambda b_1}{b_1 (1 - \lambda + \lambda\delta) + b_2 + c_2 + \lambda c_1\beta} p_{t-1}$$

$$+ \frac{\lambda c_1}{b_1 (1 - \lambda + \lambda\delta) + b_2 + c_2 + \lambda c_1(\beta_t - 1)} r_t^*$$

$$+ \frac{\lambda}{b_1 (1 - \lambda + \lambda\delta) + b_2 + c_2 + \lambda c_1(\beta_t - 1)} \epsilon_t$$

When δ=0 and either expectations are static ($\alpha_t = \beta_t = 0$) or the stabilization program is fully credible ($\alpha_t = \beta_t$), the coefficient of the exchange rate crawl is equal to 1 and changes in the exchange rate crawl are translated fully into changes in the inflation rate. As wage indexation becomes more backward-looking (as δ increases), however, the coefficient on the exchange rate crawl decreases, so to achieve a given reduction in inflation a greater reduction in the crawl is needed. The coefficient of p_{t-1} becomes greater, so the persistence of inflation is increased. Inflation is stabilized with respect to changes in the world interest rate and with respect to supply and demand shocks. The effects of increasing δ are diminished somewhat as β increases.

In a steady state (where $e_t = e_{t-1} = p_{t-1}$) with no external shocks. the change in inflation caused by changes in expectations as a result of an announcement in the absence of other policy measures or shocks is equal to the steady state rate of crawl of the exchange rate times the change (caused by the announcement) in the sum of the coefficients on the exchange rate and on past inflation. More simply, let the sum of the coefficients on the exchange rate and on past inflation be equal to a coefficient Z_t. Then:

$$Z_t = \frac{b_1 (1 - \lambda + \delta\lambda) + b_2 + c_2 + \lambda c_1(\alpha_t - 1)}{b_1 (1 - \lambda + \delta\lambda) + b_2 + c_2 + \lambda c_1(\beta_t - 1)} \qquad (17)$$

An announcement in a steady state will cause inflation to change by: $(Z_t - Z_{t-1})\, e_t$.

As seen in equation (17), in a steady state ($p_t = e_t = p_{t-1}$) a fully credible announcement of a price stabilization program ($\alpha_t = \beta_t$) in the absence of shocks has no effect on inflation since Z is always equal to one. When the program lacks full credibility ($\alpha_t > \beta_t$), however, inflation will increase, since Z_{t-1} equals one but Z_t is greater than one.[4] If wages are at all backwardly indexed ($\delta > 0$) the coefficient of the exchange rate crawl is less than one and inflation will include a component that depends on past inflation which is unaffected by the price stabilization program. Assuming that the public is aware of this fact, β_t will be smaller than α_t as the public will expect inflation to fall by less than the reduction in the rate of crawl of the exchange rate.[5] Thus, *when backward-looking wage indexation prevails, any announcement of a price stabilization policy will be inflationary.*

To solve for real income growth we combine 3, 5 and 15:

$$y_t = A_1 e_t - B_1 p_{t-1} - C_1 r^{*t} + D_1 v_t + F_1 \mu_t \qquad (18)$$

where ,

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[4]The program might also lack credibility in a different way; it could be believed that a recession would cause the authorities to abandon the price stabilization effort and increase the rate of crawl of the exchange rate ($\alpha < 0$). This possibility is examined later in the section where different scenarios of price stabilization efforts are presented.

[5]Not explicitly modeled here is the fact that changing δ will reduce β, in other words increasing the backwardness of indexation will reduce expectations of any reduction in inflation. The exact response of β to δ will depend on how knowledgeable the public is about how the rate of inflation is determined. The limiting case is the one where the public has full information about all coefficients in the model and about the probability density functions of the shocks, in which case β will be between zero and α. If β reacts strongly to changes in δ, the effects of changing δ on the coefficients may be greater than in the case of static expectations.

$$A_1 = \delta b_1 \frac{c_2 + \lambda c_1(\beta_t - 1)}{b_1 (1 - \lambda + \lambda\delta) + b_2 + c_2 + \lambda c_1(\beta_t - 1)}$$

$$+ c_1 (\alpha - \beta) \frac{b_1(1 - \lambda + \delta\lambda) + b_2}{b_1(1 - \lambda + \delta\lambda) + b_2 + c_2 + \lambda c_1(\beta_t - 1)}$$

$$B_1 = \delta b_1 \frac{c_2 + \lambda c_1(\beta_t - 1)}{b_1 (1 - \lambda + \delta\lambda) + b_2 + c_2 + \lambda c_1(\beta_t - 1)}$$

$$C_1 = c_1 \frac{b_1 (1 - \lambda + \delta\lambda) + b_2}{b_1 (1 - \lambda + \delta\lambda) + b_2 + c_2 + \lambda c_1(\beta_t - 1)}$$

$$D_1 = C_1/c_1$$

$$F_1 = 1 - D_1 = \frac{c_2 + \lambda c_1(\beta_t - 1)}{b_1 (1 - \lambda + \delta\lambda) + b_2 + c_2 + \lambda c_1(\beta_t - 1)}$$

A_1 will increase, so greater backward-looking indexation means that exchange rate policy, which as mentioned above will have less effect on inflation, will have more effect on income growth. This means that backward-looking wage indexation causes policies that reduce inflation by a given amount to have a more recessionary effect. B_1 and C_1 will increase, so demand shocks and changes in world interest rate growth will have greater effects on income, and D_1 will decrease, so supply shocks will have smaller effects on income.

The change in income growth caused by changed expectations resulting from an announcement in the absence of other policy measures or shocks is therefore equal to the steady state rate of crawl of the exchange rate (= the steady state inflation rate) times the change in A_1 - B_1 that is caused by the announcement. More simply, let :

$$Z_t = A_1 - B_1 = c_1 (\alpha_t - \beta_t) \frac{b_1 (1 - \lambda + \delta\lambda) + b_2}{b_1 (1 - \lambda + \delta\lambda) + b_2 + c_2 + \lambda c_1(\beta_t - 1)} \qquad (19)$$

An announcement in a steady state will cause income growth to change by: $(Z_t - Z_{t-1})\, e_t$.

As seen in equation 19, a fully credible announcement of a price stabilization program ($\alpha_t = \beta_t$) will have no direct effect on income growth since Z will always be equal to zero, but if the announcement is not fully credible ($\alpha_t > \beta_t$), it will have an expansionary effect since Z_{t-1} will be zero but Z_t will be greater than zero. Credible announcements will stabilize income

with respect to changes in the world interest rate and demand shocks, but will destabilize it with respect to supply shocks. Increasing the backwardness of indexation will increase the expansionary effect of announcements that lack full credibility.

Combining 14 and 15 yields the growth of the real wage:

$$w_t - p_t = - \delta \left(\frac{b_1 (1 - \lambda) + b_2 + c_2 + \lambda c_1(\alpha_t - 1)}{b_1(1 - \lambda + \lambda\delta) + b_2 + c_2 + \lambda c_1(\beta_t - 1)} \right) e_t \qquad (20)$$

$$+ \delta \left(\frac{b_1(1 - \lambda) + b_2 + c_2 + \lambda c_1(\beta_t - 1)}{b_1(1 - \lambda + \delta\lambda) + b_2 + c_2 + \lambda c_1(\beta_t - 1)} \right) p_{t-1}$$

$$+ \frac{\delta\lambda c_1}{b_1(1 - \lambda + \lambda\delta) + b_2 + c_2 + \lambda c_1(\beta_t - 1)} r_t^*$$

$$- \frac{\delta\lambda}{b_1(1 - \lambda + \lambda\delta) + b_2 + c_2 + \lambda c_1(\beta_t - 1)} \epsilon_t$$

As can be seen from equation (20), the coefficient of the previous period's inflation rate increases as δ increases, so backward-looking indexation increases the inertia of real wage growth. Greater backward indexation also leads to a greater impact of the exchange rate crawl, interest rate changes, and supply and demand shocks, and hence it is destabilizing to real wage growth in all ways.

The change in real wage growth caused by changed expectations resulting from an announcement in the absence of other policy measures or shocks is therefore equal to the steady state rate of crawl of the exchange rate (= the steady state inflation rate) times the change (caused by the announcement) in the sum of the coefficients of the exchange rate crawl and past inflation. More simply, let Z_t = the coefficient of the exchange rate crawl plus the coefficient of past inflation. Then:

$$Z_t = \frac{\delta\lambda c_1 (\beta_t - \alpha_t)}{b_1(1 - \lambda + \lambda\delta) + b_2 + c_2 + \lambda c_1(\beta_t - 1)} \qquad (21)$$

An announcement in a steady state will cause wage growth to change by $(Z_t - Z_{t-1}) e_t$.

As can be seen in equation (21), an announcement of a price stabilization program will have no effect on real wages in the absence of other policy measures or shocks either if it is

fully credible ($\alpha_t = \beta_t$), or if there is no backward-looking wage indexation, meaning in either case that Z is always equal to zero. If the policy is not fully credible and there is backward-looking wage indexation, however, real wages will decline (since $Z_t < 0$), and the decline will be greater as δ is larger. Announcements with any degree of credibility ($\beta_t > 0$) will reduce the impact of world interest rate changes and shocks; the reduction will be more substantial if δ is larger.

Combining 3, 4, 5, 13 and 15 yields the growth of the current account balance:

$$x_t = A_2 e_t - B_2 p_{t-1} + C_2 r^*_t - D_2 v_t + F_2 \mu_t \qquad (22)$$

where,

$$A_2 = \frac{(d_2 - d_1(c_2 + \lambda c_1(\beta_t - 1)))\ (\delta b_1 - c_1(\alpha_t - (\beta_t - 1)))}{b_1(1 - \lambda + \delta\lambda) + b_2 + c_2 + \lambda c_1(\beta_t - 1)} - d_1 c_1(\alpha_t - \beta_t)$$

$$B_2 = \delta b_1 \frac{d_2 - d_1(c_2 + \lambda c_1(\beta_t - 1))}{b_1(1 - \lambda + \delta\lambda) + b_2 + c_2 + \lambda c_1(\beta_t - 1)}$$

$$C_2 = d_1 c_1 \frac{b_1(1 - \lambda + \delta\lambda) + b_2 + d_2/d_1}{b_1(1 - \lambda + \delta\lambda) + b_2 + c_2\ \lambda c_1(\beta_t - 1)}$$

$$D_2 = C_2/c_1$$

$$F_2 = C_2 - d_1 = \frac{d_2 - d_1(\lambda c_1(\beta_t - 1) + c_2)}{b_1(1 - \lambda + \delta\lambda) + b_2 + c_2 + \lambda c_1(\beta_t - 1)}$$

As δ increases, in other words when indexation becomes more backward-looking, and assuming that $d_2/d_1 < c_2 + \lambda c_1 (\beta_t - 1)$ [6] the coefficients will be affected as follows:

A_2 will increase, so exchange rate-based price stabilization programs will have more negative effects on the growth of the current account. Since increasing δ also diminishes the effect of the exchange rate crawl on the inflation rate, it means that reducing inflation by a

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[6]It is most likely true that $d_2/d_1 < c_2 + \lambda c_1(\beta_{t+1} - 1)$ since otherwise the indirect effect the growth of the exchange rate has on the growth of the current account by affecting income growth would be larger than the direct effect it has by the changing relative price growth of exports and imports. This would also be contrary to the experience of countries that have used exchange rate-based stabilization programs.

given amount entails a greater worsening of the current account and therefore increases the likelihood that the price stabilization effort will be unsustainable because of reserve losses. B_2 and D_2 will decrease, so supply and demand shocks will have less impact on the current account, and C_2 will decrease, lessening the impact of world interest rate fluctuations. Thus, backward-looking indexation will stabilize the current account in the absence of inflation reduction programs.

Because A2 contains a factor of $(\alpha_t - \beta_t)$, a perfectly credible announcement of a price stabilization program made in the absence of other policy measures or shocks will have no effect on current account growth. However if the announcement lacks credibility $(\alpha_t > \beta_t)$ there will be a decrease in current account growth in response to capital inflows caused by an expected future real appreciation of the currency. As wage indexation becomes more backward-looking the impact of an announcement will be more negative. Announcements with any degree of credibility $(\beta_t > 0)$ lower the impact of world interest rate fluctuations and demand shocks on current account growth, the impact of supply shocks becomes ambiguous.

The change in the growth of the current account balance in the absence of other policy measures or shocks caused by changed expectations resulting from an announcement is therefore equal to the steady state rate of crawl of the exchange rate (= the steady state inflation rate) times the change in $A_2 - B_2$ that is caused by the announcement. More simply, if $Z_t = A_2 - B_2$, then:

$$Z_t = -c_1(\alpha_t - \beta_t) \frac{d_2 + d_1(b_1(1 - \lambda + \delta\lambda) + b_2)}{b_1(1 - \lambda + \delta\lambda) + b_2 + c_2 + \lambda c_1(\beta_t - 1)} \qquad (23)$$

An announcement in a steady state will cause current account balance growth to change by $(Z_t - Z_{t-1})\, e_t$. If the announcement is fully credible there will be no change in the current account since Z_t will always be zero.

A2. **Imperfect capital mobility**

The assumption of equal international rates of return based on perfect capital mobility may not be accurate for many countries (see Reinhart and Reinhart (1995)), so an alternative scenario of zero capital mobility is presented. To model this assumption, international interest rates are assumed to have no effect on the economy; equation 7 is removed from the analysis and equation 1 is no longer a rule for endogenously determining money supply growth, but rather a condition according to which the growth of the money supply, which is now an exogenous policy instrument, influences the interest rate. Price expectations still follow the same rule:

$$E_t p_t = (1 - \beta_t)\, p_t \qquad , \qquad \textit{hence: } i_t = r_t + (1-\beta_t)\, p_t$$

α_t has no effect on economic variables in an imperfect capital mobility framework. The impact of an announcement on variables is calculated from a steady state (e.g. that $m_t = e_t = m_{t-1} = e_{t-1} = p_{t-1}$) and assuming that there are no shocks (e.g. $\mu_t = \nu_t = 0$).

Combining equations 1, 2, 3, 5 and 6 yields the following expression for inflation:

$$p_t = D_3^{-1}(A_3 m_t + B_3 e_t + b_1 \delta p_{t-1} + C_3 \nu_t - \mu_t) \tag{24}$$

where:

$$A_3 = \frac{c_1}{a + c_1}$$

$$B_3 = \frac{ac_2}{\lambda(a + c_1)} + b_1\left(\frac{1 - \lambda}{\lambda}\right) + \frac{b_2}{\lambda}$$

$$C_3 = \frac{a}{a + c_1}$$

$$D_3 = \frac{ac_2/\lambda + c_1(1 + a(\beta_t - 1))}{a + c_1} + b_1\left(\frac{1 - \lambda}{\lambda} + \delta\right) + \frac{b_2}{\lambda}$$

The response of inflation to increases in δ is qualitatively unaffected by the change in the assumption about capital mobility. Increasing δ increases the persistence of inflation, and reduces the effect of money supply growth, the exchange rate crawl and shocks. An announcement of a price stabilization program in a steady state and in the absence of other policy measures or shocks will reduce inflation and reduce the impact of shocks (since it will lower β and there fore lower D_3, the only coefficient that is not constant), but both of these benefits are mitigated if δ increases (since increasing δ dilutes the effects of increasing β).

Solving for inflation also yields an expression for income growth:

$$y_t = A_4 m_t - B_4 e_t - C_4 p_{t-1} + D_4 \nu_t - E_4 \mu_t \tag{25}$$

where:

$$A_4 = \frac{c_1}{a + c_1}\left(\frac{\gamma}{\chi + \gamma}\right)$$

$$B_4 = \frac{c_1(1 + a(\beta_t - 1))}{(a + c_1)}\left(\frac{\gamma}{\chi + \gamma}\right) - \delta b_1\left(\frac{\chi}{\chi + \gamma}\right)$$, may be < 0 for large δ.

$$C_4 = \delta b_1\left(\frac{\chi}{\chi + \gamma}\right)$$

$$D_4 = 1 - \left(\frac{a}{a + c_1}\right)\left(\frac{\chi}{\chi + \gamma}\right)$$

$$E_4 = \frac{\chi}{\chi + \gamma}$$

and:

$$\chi = \frac{ac_2 + c_1\lambda(1 + a(\beta_t - 1))}{a + c_1}$$

$$\gamma = b_1(1 - \lambda + \delta\lambda) + b_2$$

Similar to the case of perfect capital mobility, increasing δ increases the impact of money growth on income growth by decreasing γ. Since it also reduces the effect of money supply growth on inflation, a given reduction in inflation achieved with a monetary stabilization program will have a greater recessionary impact. It will reduce the effect of supply shocks and will increase the persistence of inflation and the impact of demand shocks. Increasing δ will also reduce the absolute value of the coefficient of the exchange rate crawl, but when δ is large compared with the other parameters this coefficient may be either positive or negative so it is not clear whether this will increase or decrease the impact of exchange rate

policy on income.[7] Hence, depending on parameter values, increasing δ may stabilize or destabilize income during exchange-rate-based stabilization programs.

In the absence of other policy measures or shocks, increasing β has an overall recessionary effect on income which is equal to:

$$\frac{\partial y}{\partial \beta_t} = \frac{\partial \left(A_4 - B_4 - C_4 \right)}{\partial \beta_t} m_t = \left(\frac{ac_1}{a + c_1} \right) \frac{\partial}{\partial \beta_t} \left(\frac{\gamma}{\chi + \gamma} \right) m_t \tag{26}$$

Higher δ will increase the recessionary effect of announcements. Increasing β_t will also reduce the impact of demand shocks, but will increase the impact of past inflation and supply shocks.

Real wage growth is given by:

$$w_t - p_t = \delta p_{t-1} - \delta p_t \tag{27}$$

When indexation is fully forward-looking real wage growth is constant; otherwise it is not. Since announcements reduce inflation, they will increase the real wage, and this increase will be greater when δ is greater. Announcements also increase the impact of shocks on the real wage.

Using 4, 20 and 21, the current account is given by:

$$x_t = -A_5 m_t + B_5 e_t + C_5 p_{t-1} - D_5 v_t + E_5 \mu_t \tag{28}$$

where:

$$A_5 = \left(\frac{c_1}{a + c_1} \right) \left(\frac{\gamma d_1 + d_2}{\chi + \gamma} \right)$$

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[7]Specifically, when

$$\delta > \frac{c_1 \left(1 + a \left(\beta_{t+1} - 1\right)\right)}{b_1 \left(a + c_1\right)} \left(\frac{\gamma}{\chi} \right)$$

the coefficient will be negative.

$$B_5 = \frac{c_1(1 + a(\beta_t - 1))}{(a + c_1)}\left(\frac{\gamma d_1 + d_2}{\chi + \gamma}\right) - \delta b_1\left(\frac{\chi d_1 - d_2}{\chi + \gamma}\right)$$

$$C_5 = \delta b_1\left(\frac{\chi d_1 - d_2}{\chi + \gamma}\right)$$

$$D_5 = d_1 - \left(\frac{a}{a + c_1}\right)\left(\frac{\chi d_1 - d_2}{\chi + \gamma}\right)$$

$$E_5 = \frac{\chi d_1 + d_2}{\chi + \gamma}$$

B_5 may be negative when $\delta > 0$, depending on parameter values, although this would be inconsistent with the experience of countries that have used exchange rate-based stabilization programs. Assuming B_5 is positive, increasing δ will have the following effects:

A_5 will increase if and only if $d_2/d_1 < \chi$. The effect is not terribly important since the coefficient is negative, meaning that monetary stabilization programs are not threatened by outflows of reserves. B_5 may increase or decrease, depending on parameter values. The adverse effects of indexation on the response of current account growth to exchange rate based stabilization programs is reduced as capital mobility decreases. C_5 increases in absolute value, so the effects of past inflation are greater. The effect on D_5 is uncertain. E_5 decreases, so current account growth is stabilized with respect to supply shocks.

The overall effect on the current account of an announcement that increases β_t is that there will be an increase given by:

$$\frac{\partial CA}{\partial \beta} = \frac{\partial\left(-A_5 + B_5 + C_5\right)}{\partial \beta_t} m_t = \left(\frac{ac_1}{a + c_1}\right)\frac{\partial}{\partial \beta_t}\left(\frac{\gamma d_1 + d_2}{\chi + \gamma}\right) m_t \qquad (29)$$

Increasing δ may increase or decrease this effect, depending on parameter values. Announcements reduce the impact of demand shocks, but increase the impact of supply shocks.

If any action were taken in the period of the announcement, the effects of higher δ would generally be the same whether expectations were rational or static. The effects of an announcement would generally be to reduce the impact of all coefficients, with the following

exceptions. Under perfect capital mobility the impact of the exchange rate crawl on inflation, income growth and the real wage, and the impacts of past inflation and supply shocks on past inflation will be increased, while under imperfect capital mobility the impact of the exchange rate on income growth and on current account growth and of the world interest rate on current account growth will be uncertain, while the impacts of world interest rates and supply shocks on current account growth will increase.

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