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## *Indexación de salarios, inercia inflacionaria y el costo de la desinflación*

Javier Gómez\*

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### **Resumen**


*Cuáles son las consecuencias de las negociaciones salariales sobre la política monetaria en un país en transición a un menor nivel de inflación? Mostramos que la indexación de los salarios a la inflación esperada, la mayor credibilidad del banco central y la mayor frecuencia de los ajustes salariales puede aumentar el efecto de la política monetaria y reducir el costo de la desinflación. Importantes ganancias en términos de bienestar pueden obtenerse por medio del mejor cumplimiento de las metas de inflación y de la mayor precisión en los pronósticos de inflación pues esto aumenta la credibilidad del banco central. Políticas salariales como la propuesta por la Corte Constitucional de Colombia pueden tener importantes consecuencias negativas en términos de producto y salarios reales.*

**Palabras clave:** *indexación, contratos salariales, desinflación, tasa de sacrificio, credibilidad.*

**Clasificación JEL:** E1; E17; E52; E27; J30.

# *Wage Indexation, Inflation Inertia, and the Cost of Disinflation*

Javier Gómez\*



*What are the consequences of wage negotiations on monetary policy in a country that is in transition to lower inflation? We show that wage indexation to expected inflation, increased central bank credibility and a higher frequency of wage adjustments can increase the effect of monetary policy and can decrease the cost of disinflation. Important welfare gains can be obtained with the best possible performance in the pursuit of inflation targets and with the highest possible precision in inflation forecasts since these actions increase central bank credibility. Wage policies like the one proposed by the Colombian Constitutional Court can have important negative consequences on output and real wages.*

**Keywords:** wage indexation, disinflation, sacrifice ratio, staggered wage contracts, credibility.

**JEL Classification:** E1; E17; E52; E27; J30

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\* The views in this paper are those of the author and not necessarily those of the Banco de la República (Central Bank of Colombia) or its Board of Directors. The author thanks, with no implication, the comments of two anonymous referees.

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## I. INTRODUCTION

What are the characteristics of wage negotiations and what are their consequences on monetary policy in a country in transition to lower inflation? We study the effect of forward looking wage indexation, central bank credibility and wage contract length on the cost of disinflation. Using two models of the wage price system calibrated for the case of Colombia, we conclude that credibility yields high returns, that negotiations based on past inflation can lead to high costs in terms of output and that the frequency of wage negotiations can also explain why Chile stabilized inflation quickly and easily while Colombia stabilized inflation slowly and at a high cost in terms of economic activity.

Can the cost of disinflation be decreased by incorporating forward looking features in wage contracts? Does the cost of disinflation depend on the frequency of wage negotiations? Does an increase in central bank credibility decrease the cost of disinflation via wage setting practices? These questions are motivated by the statement of the Colombian Constitutional Court:

*“(...) wage increases must correspond at least to the amount of past inflation because this is the only way to adequately accomplish the constitutional mandate of maintaining the real power of the worker’s wages.”* (Constitutional Court, Statement C-1422/2000, our translation).

We analyze the implications of the Court’s statement from the point of view of dynamic macroeconomics and conclude that under the disinflation program Colombia is undertaking, backward looking indexation may lead to output losses, and hence to real wage losses.

The implied wage rule in the Court’s statement is:

$$(1) \quad W_{t+1} - W_t = P_t - P_{t-1}$$

where  $W_t$  is the (log of the) nominal wage during year  $t$ , and  $P_t$  is the (log of the) CPI and the end of year  $t$ . The core of the paper studies the effect of backward looking indexation on the cost of disinflation. Other considerations about rule (1) can however be advanced.

In rule (1) real wages do not change according to supply and demand in the labor market. Given wage rigidity, changes in supply and demand must adjust via quantities: increased employment in expansions, increased unemployment in recessions.

Wage indexation to past inflation increases real wage variability. It is like the driver who looks back and drives forward. If the road is a straight line, the drive would be a complete success. Any deviation from a straight line, however, would hurt either workers or employees; surprise increases in inflation would decrease real wages, surprise decreases in inflation would hurt employers since they have to pay higher real wages.

The rule also leads to real wage squeezing whenever inflation increases. As food items in Colombia are about 30% of the CPI, changes in the price of food cause high variability to CPI inflation. A supply shock originated in an increase in potato crops would lead to low food inflation, low CPI inflation and low wage increases for the following year. But good crops are usually followed by bad crops and high inflation. Small wage adjustments are then met with high inflation; real wages fall.

This raises the question whether wage negotiations should be defined on past inflation that includes past supply shocks or on the inflation target that takes into account future forecasted supply shocks. It is the periodic task of the central bank to forecast all shocks that may affect CPI inflation. Banco de la República (the central bank of Colombia) also produces a survey of inflation expectations. Why are or are not inflation expectations taken into account in wage negotiations? Do labor unions buy the Banco de la República's Inflation Report? Inflation stickiness may give some logic to a backward looking rule of thumb like (1), but given the structural change to lower inflation and the profound consequences of supply shocks on CPI inflation, large gains could be obtained in wage stability and in the cost of disinflation if inflation expectations and the inflation forecast were taken into account in wage negotiations.

A large part of the literature seems to have focused on explaining that indexation increases the cost of disinflation compared to the case of no indexation and on how indexation makes disinflation less costly compared to the particular case of the United States where wage contracts specify preset time varying wages (Gray (1983), Simonsen (1983), Ball and Cecchetti (1991), Jadresic (1996)). We focus on what benchmark to use in wage indexation.

We follow Taylor in giving the wage-price system the central role in the determination of wage and price rigidities:

*"The (...) model I present (...) places considerable emphasis on the institutional detail of wage and price setting. In fact, the wage and price sector looms large and tends to dominate the rest of the model. Wage and price setting is responsible for much of the dynamics of the model."* (Taylor 1993, p. 32).

A different modeling strategy is the one followed by Whelan (1997). He posits behavioral equations for both real and nominal wages and derives their implications on the evolution of prices, that is, for the Phillips curve. We instead follow Taylor (1993) and Bank of England (2000) by postulating behavioral equations for prices and nominal wages and by checking whether the behavior of real wages is reasonable, that is, pro cyclical.

The paper has four sections including this introduction. The second section presents a model that studies the effect of backward and looking considerations in wage contracts on the cost of disinflation. The third section presents a model that studies the effect of the length of wage contracts on the sacrifice ratio. Finally section four concludes.

## **II. DISINFLATION, FORWARD LOOKING INDEXATION AND CENTRAL BANK CREDIBILITY**

### *A. THE MODEL*

The first model consists of a wage price block, a real block and a forward looking interest rate rule. It has been simplified as much as possible so as to focus on one specific question of the paper, the effect of different specifications of wage indexation on the cost of disinflation.

The model has Keynesian features in the short run and neoclassical ones in the long run. In the short run monetary policy is not neutral, in the long run it is neutral and super neutral. Neutrality and super neutrality hold because the long run solution of the real variables is independent of the price level and of the inflation rate. These properties are achieved by imposing static homogeneity in the wage-price system.

Super neutrality is an important property for a model that seeks to reproduce a disinflation. It implies that in the long run the output gap converges to zero. In a model that is not super neutral monetary policy has permanent effects on output and it would be possible to permanently increase output with monetary policy, but this cannot be achieved but by increasing supply, that is, inputs and productivity.

The short run dynamics of the nominal variables is given by the coefficients of lagged and expected inflation in the Phillips curve and wage equation, that is, in wage price system. The higher the weight of the forward looking components, the lower inflation stickiness. The higher the weight of the backward looking components, the higher inflation

stickiness. Gómez and Julio (2000) show for the case of Colombia that the higher weight of backward looking expectations in the Phillips curve, the higher inflation inertia, the lower effect of monetary policy, and the higher cost of disinflation. We show that even maintaining the Phillips curve unchanged, higher wage inertia results in higher inflation inertia.

Following Fischer (1977, 1986), Simonsen (1983), Sahinbeyoglu (2000), Bank of England (2000), we postulate a rule of thumb for wage adjustments:

$$(2) \quad \omega_t = c_1 \pi_{t+4|t}^4 + c_2 \pi_t^4 + c_3 \pi^* + 0.25c_4 (y_{t+3|t} + y_{t+2|t} + y_{t+1|t} + y_t) - c_5(W_{t-1} - V_{t-1}) + \varepsilon_t^1$$

where  $\omega_t = 4(W_t - W_{t-1})$  is the quarterly increase in the (log of the) nominal wage  $W_t$  at an annual rate,  $\pi_t^4 = P_t - P_{t-4}$  is the annual inflation rate,  $P_t$  is the (log of the) price level,  $x_{t+k|t}$  is the expectation of variable  $x$   $k$  periods ahead given information at time  $t$ ,  $\pi_t^*$  is the inflation target,  $y_t$  is the output gap,  $V_t = P_t + Y_t - L_t$  is the (log of the) value of average output per worker,  $Y_t$  is (the log of) output,  $L_t$  is (the log of) labor.

In Equation (2) wage adjustments first depend on inflation expectations, past inflation, and the inflation target. Different specifications of the  $c_1$ ,  $c_2$  and  $c_3$  weights correspond to different inflation expectations and trigger different dynamics on the short run evolution of wages. Different calibrations of these weights will help us analyze the implications of different specifications of wage indexation on inflation inertia and the cost of disinflation.

In Equation (2), nominal wages also depend on the expected output gap. This is meant to capture that wage negotiations depend on economic conditions expected to prevail during the live of the contract.

Finally Equation (2) states that in the long run nominal wages converge to the value of average output, the last term of the equation.

Inflation is determined by the Phillips curve:

$$(3) \quad \pi_t = c_6 \pi_{t+1} + c_7 \pi_{t-1} + c_8 y_t - c_9(P_{t-1} - C_{t-1}) + \varepsilon_t^2$$

where  $C_t = W_t + L_t - Y_t$  is unit labor cost.

This is a simplified version of the Phillips curve that focuses on the salient features that are relevant during disinflation, namely, the relative importance of forward and backward

looking expectations, the effect of the output gap on inflation (the inverse of the sacrifice ratio), and a well defined long run. This Phillips curve abstracts from other features or transmission channels that are less relevant for the disinflation experiment of the paper such as the pass-through, and supply shocks in agriculture.

The real sector of the economy is given by the aggregate demand equation, Equation (4), the production function that for simplicity uses a single input, Equation (5), and the definition of the output gap, Equation (6):

$$(4) \quad y_t = c_{10}y_{t-1} - c_{11}r_t + \varepsilon_t^3$$

$$(5) \quad Y_t^p = gt + L_t + \varepsilon_t^4$$

$$(6) \quad Y_t = y_t + Y_t^p$$

where  $r_t = i_t - \pi_t^4$  is the real interest rate,  $i_t$  is the nominal interest rate,  $Y_t^p$  is (the log of) potential output,  $Y_t$  is (the log of) output,  $g$  is the growth of technology, and  $t$  is the time trend.

The reaction function depicts the behavior of the central bank as an inflation targeter that moves interest rates as a feedback to the deviation of the inflation forecast from target:

$$(7) \quad i_t = \bar{r} + \pi_t^4 + c_{12}(\pi_{t+k|t} - \pi_{t+k}^*) + \varepsilon_t^5$$

where  $r$  is a long run equilibrium real interest rate.

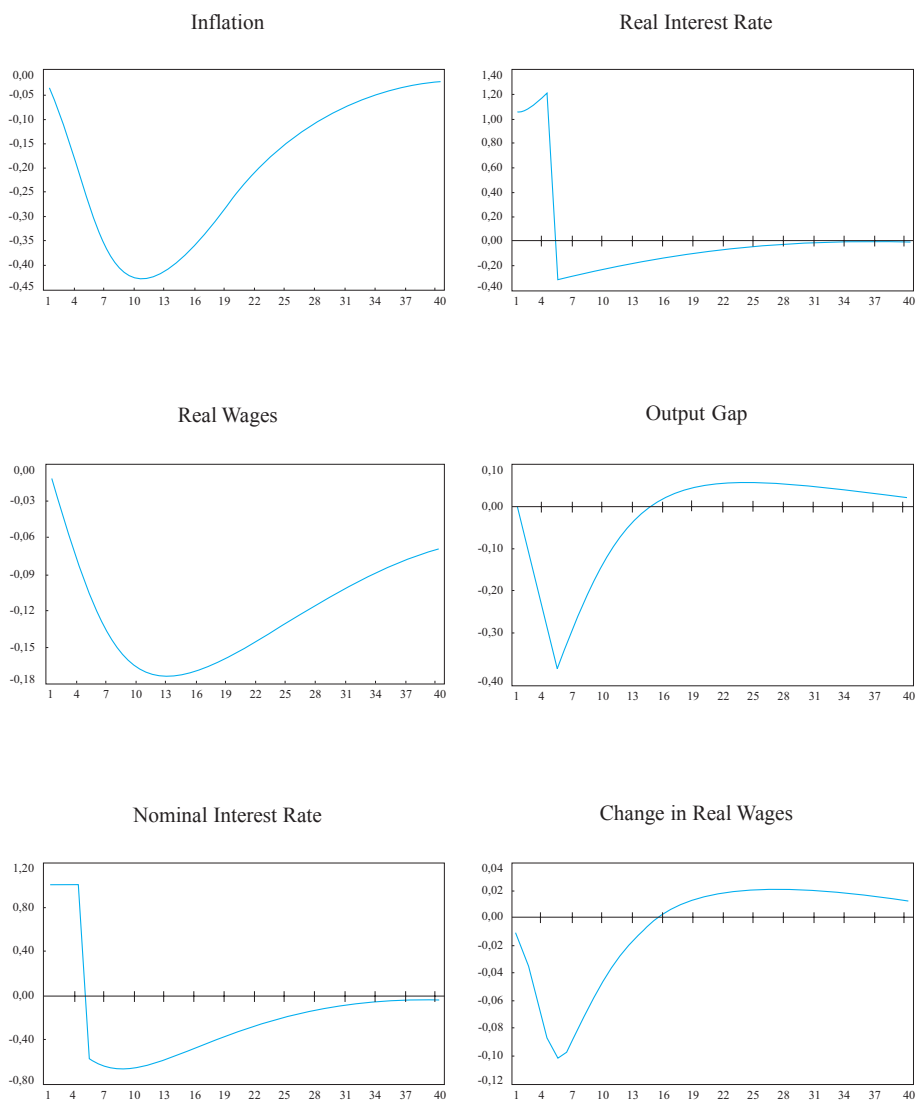
### B. CALIBRATION

The model was calibrated to obtain two properties. The first one, a reasonable effect of monetary policy on economic activity and inflation. The second one, a pro cyclical behavior of (the change in) real wages.

On the effect of monetary policy on the economy, the model was calibrated so that an increase in interest rates had an effect on output gap in one year and on inflation in two years. Experience in policy analysis in Colombia led to take 0.4 as a reasonable magnitude for the effect of a 100 bp increase in nominal interest rates on the output gap and also on inflation (Figure 1).



Figure 1  
A Shock to Monetary Policy in the Rule of Thumb Model



Source: Calculations by the author.

Given the high volatility of interest rates during the nineties in Colombia, a standard shock like the one in Figure 1 can be regarded as relevant empirically. The increase in interest rates was then also used as the relevant shock for the analysis of the pro cyclical behavior of real wages. We did not find the level of real wages pro cyclical but the change in real wages with the following results:

$$(8) \quad \Delta(W_t - P_t) = 0.013 + 0.262y_t + \varepsilon_t^6$$

(0.002) (0.075)

Estimation method: OLS. Sample: 1983:3 2002:4.  $R^2 = 0.137$ ,  $SE = 0.019$ ,  $DW = 1.760$ .

Wages are for white collar workers (“empleados”) in the industrial sector, deflated by the producer price index in the same sector. We use wages in the industrial sector because there is data available since the beginning of the eighties, and for white collar workers because these wages seem more market sensitive than wages for blue collar workers (“obreros”). By deflating by producer prices in the industrial sector, real wages are relevant from the point of view of supply.

The model obtains an effect of 0.3 of the output gap on the change in real wages, an effect that is of the same sign and order of magnitude than the estimated effect of 0.262.

The calibrated coefficients are:  $c_1 = 0.25$ ,  $c_2 = 0.75$ ,  $c_3 = 0$ ,  $c_4 = 0.5$ ,  $c_5 = 0.02$ ,  $c_6 = 0.4$ ,  $c_7 = 0.6$ ,  $c_8 = 0.1$ ,  $c_9 = 0.02$ ,  $c_{10} = 0.9$ ,  $c_{11} = 0.1$ ,  $c_{12} = 0.75$ ,  $k = 6$ .

### C. RESULTS

The effect of backward and forward looking indexation on the sacrifice ratio is summarized in Table 1. A positive sign is an output loss. A decreasing weight of backward looking indexation ( $c_2$ ) decreases the output sacrifice. With high weights of inflation expectations or central bank credibility ( $c_1$  or  $c_3$ ) the cost of disinflation decreases and may even be negative, that is, an output gain.

The disinflation experiments are also reported in Figures 2, 3 and 4. The inflation target permanently falls by one percentage point. The fall in the inflation target (by the policy rule (7)) increases the nominal and real interest rates. The tight stance leads output into recession. The nominal interest rate increases but then decreases in line with the inflation rate. Nominal wage adjustments decrease along with inflation.

Table 1  
The Sacrifice Ratio Under Different  
Specifications of Wage Indexation

C1	C2	C3	Sacrifice Ratio	
<b>Backward and Forward Looking Expectations</b>				
0	1	0	0,675	
1/4	3/4	0	0,308	Figure 2, green line
1/2	1/2	0	-0,012	
3/4	1/4	0	-0,342	Figure 2, black line
1	0	0	-0,662	
<b>Backward Expectations and the Inflation Target</b>				
0	1	0	0,675	
00-Ene	3/4	1/4	0,092	Figure 3, green line
0	1/2	1/2	-0,163	
0	1/4	3/4	-0,296	Figure 3, black line
0	0	1	-0,372	
<b>Backward Expectations and Combination of Forward Looking Expectations and the Inflation Target</b>				
0	1	0	0,675	
1/8	3/4	1/8	0,182	Figure 4, green line
1/4	1/2	1/4	-0,119	
3/8	1/4	3/8	-0,316	Figure 4, black line
1/2	0	1/2	-0,450	
<b>One Year and Half Year Wage Contracts</b>				
	One year contracts		0,233	Figure 6, green line
	Half year contracts		0,100	Figure 6, black line

With backward looking wages, the output gap is in a longer recession (figures 2, 3 and 4, black line). With forward looking wages after a shorter recession there is a boom. A similar boom was also found by Jadresic (1996) in a model with money. In our model the boom arises with forward looking wages out of an overshooting of the inflation target. The overshooting leads to a period of expansionary monetary policy (real interest rates below their long run). The output boom that follows the recession decreases the total cost of disinflation.

Compared to wages indexed to inflation expectations (Figure 2), when wages are indexed to the inflation target (Figure 3) the boom after the recession is larger and takes place sooner. As the inflation target is overshoot by a higher margin, monetary policy has to create a larger boom. Disinflation does not entail net output losses but an output gain.

Figure 4 presents the case where wage indexation is a mix of the inflation target, and forward and backward looking expectations. Also in this case, after the recession there is a boom, the net effect being that disinflation entails an output gain.

### III. DISINFLATION AND THE LENGTH OF WAGE CONTRACTS

#### A. THE MODEL

The Chilean economy seems to be more indexed than the one of Colombia. Cost of living adjustments are granted every six months, and house rents automatically increase every quarter according to past inflation. In Colombia both adjustments typically take place once a year<sup>1</sup>.

Does a shorter contract length decrease inflation inertia and the cost of disinflation? In this section we use a different model where contract length matters for the sacrifice ratio, it closely follows Taylor (1993).

In contrast to the previous model, price and wage equations determine the *level* not the change of the variables. In the base specification, wages are determined according to one year staggered contracts:

$$(9) \quad X_t = 0.25 (W_t + W_{t+1|t} + W_{t+2|t} + W_{t+3|t}) + 0.25c_{13}(y_t + y_{t+1|t} + y_{t+2|t} + y_{t+3|t}) + \varepsilon_t^7$$

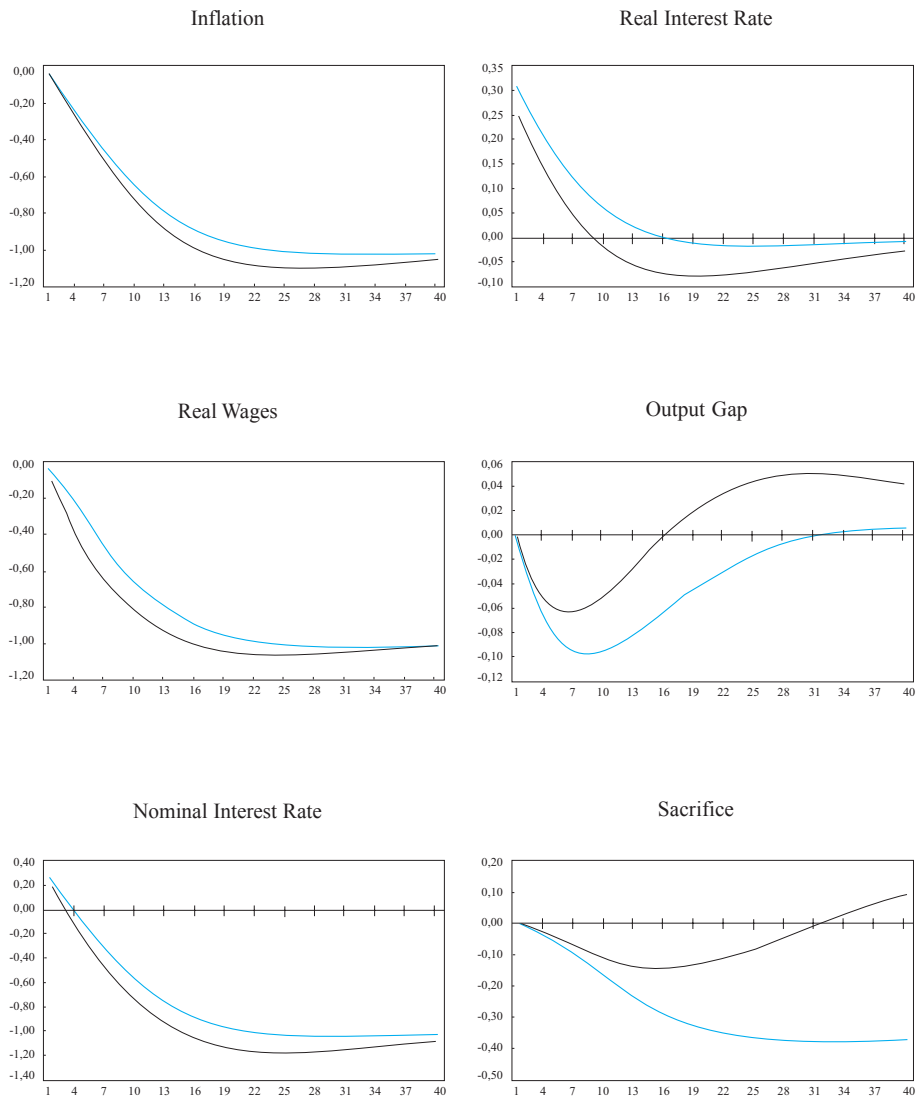
$$(10) \quad W_t = (X_t + X_{t-1} + X_{t-2} + X_{t-4})$$

where  $W_t$  is the (log of the) nominal wage, and  $X_t$  is the (log of the) contract wage. Wages enter Equation (9) with a weight of 0.25. This weight indicates the percentage of workers that sign their contract every given quarter. For simplicity, we assume uniform staggering, that is, all coefficients are 0.25 and all contracts last four quarters.

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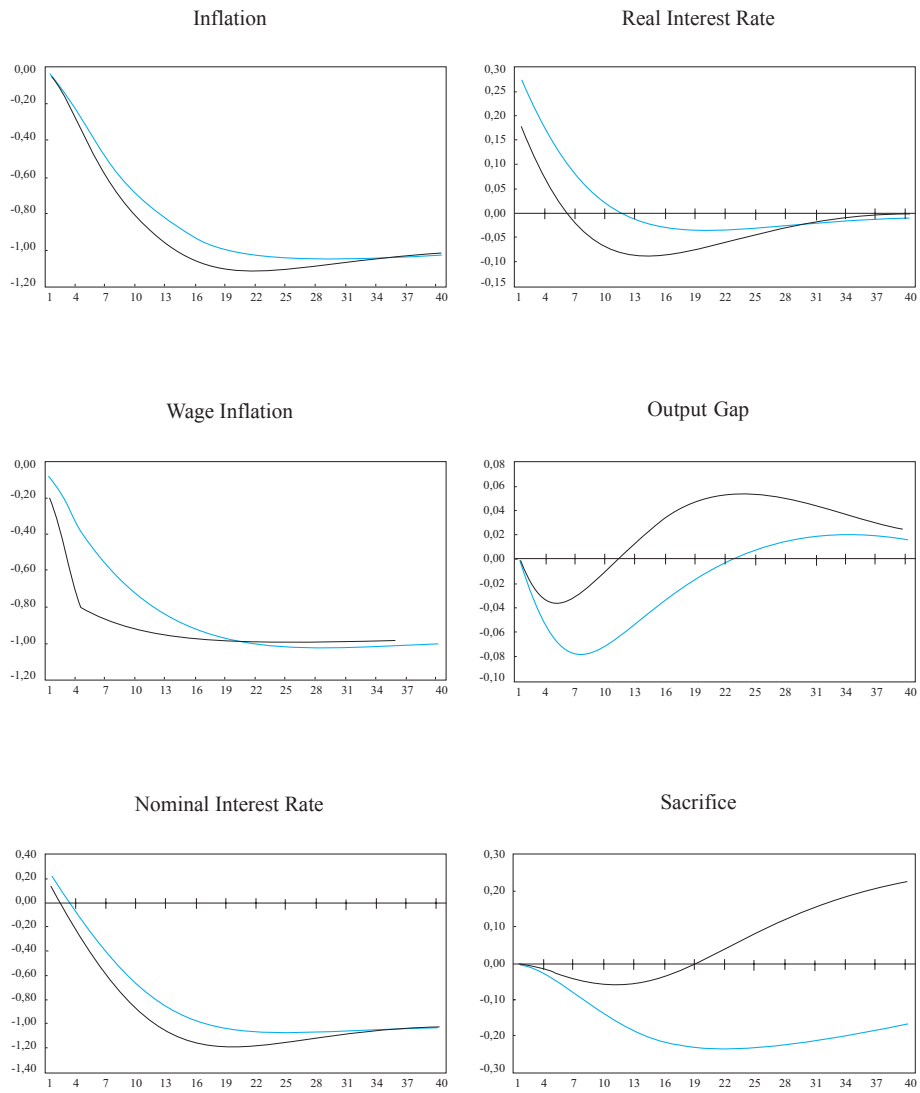
<sup>1</sup> Ball and Cecchetti (1991) point out that real wage variability is one of the many costs of inflation. As inflation erodes real wages, a shorter contract length is better on the grounds of the cost of inflation.

Figure 2  
Disinflation: Backward and Forward Looking Expectations



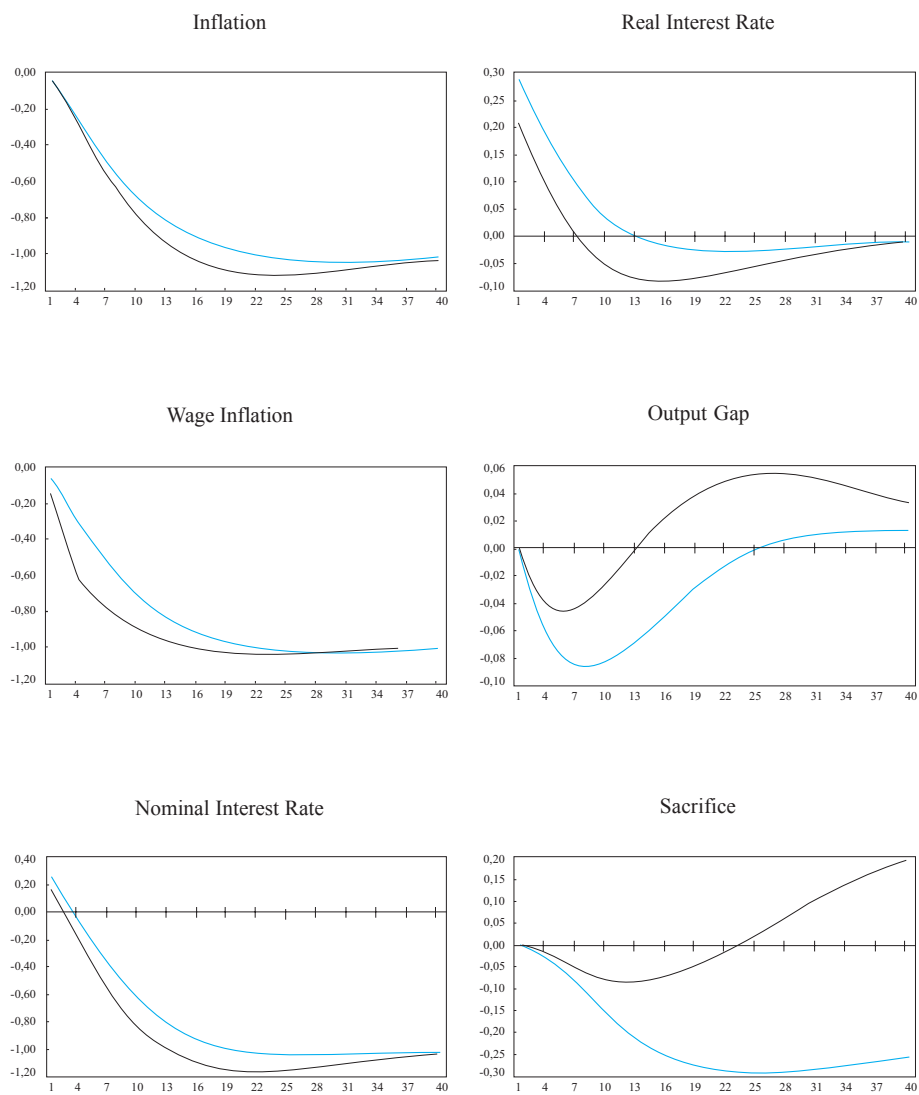
Source: Calculations by the author.

Figure 3  
Disinflation: Backward Expectations and the Inflation Target



Source: Calculations by the author.

Figure 4  
 Disinflation: Backward Expectations and Combination of Forward Expectations and the Inflation Target



Source: Calculations by the author.

Equation (9) indicates that the contract wage at time  $t$ ,  $X_t$ , is negotiated according to the wages and the economic conditions expected to prevail during the year of the contract,  $W_{t+k|t}$ ,  $y_{t+k|t}$ , and Equation (10) states that, in the aggregate, wages are an average of the wages that were contracted in the current and past quarters.

Prices are a mark up over costs with partial adjustment:

$$(11) \quad P_t = c_{14}P_{t-1} + c_{15}W_t + \varepsilon_t^8$$

The interest rate follows the Taylor rule:

$$(12) \quad i_t = \bar{r}_t + \pi_t^A + 0.5\pi_t + 0.5y_t + \varepsilon_t^9$$

and the output gap is determined by the IS curve:

$$(13) \quad y_t = c_{16}y_{t-1} - c_{17}r_t + \varepsilon_t^{10}$$

Besides Eq. (13), the real block is completed by Eqs. (5) and (6).

By comparing one and half year contracts we ask whether contract length is important for the sacrifice ratio. In the alternative specification, Eqs. (9) and (10) are replaced by Eqs. (13) and (14) where wage contracts last half a year:

$$(14) \quad X_t = 0.5(W_t + W_{t+1|t}) + 0.5c_{18}(y_t + y_{t+1|t}) + \varepsilon_t^{11}$$

$$(15) \quad W_t = 0.5(X_t + X_{t-1})$$

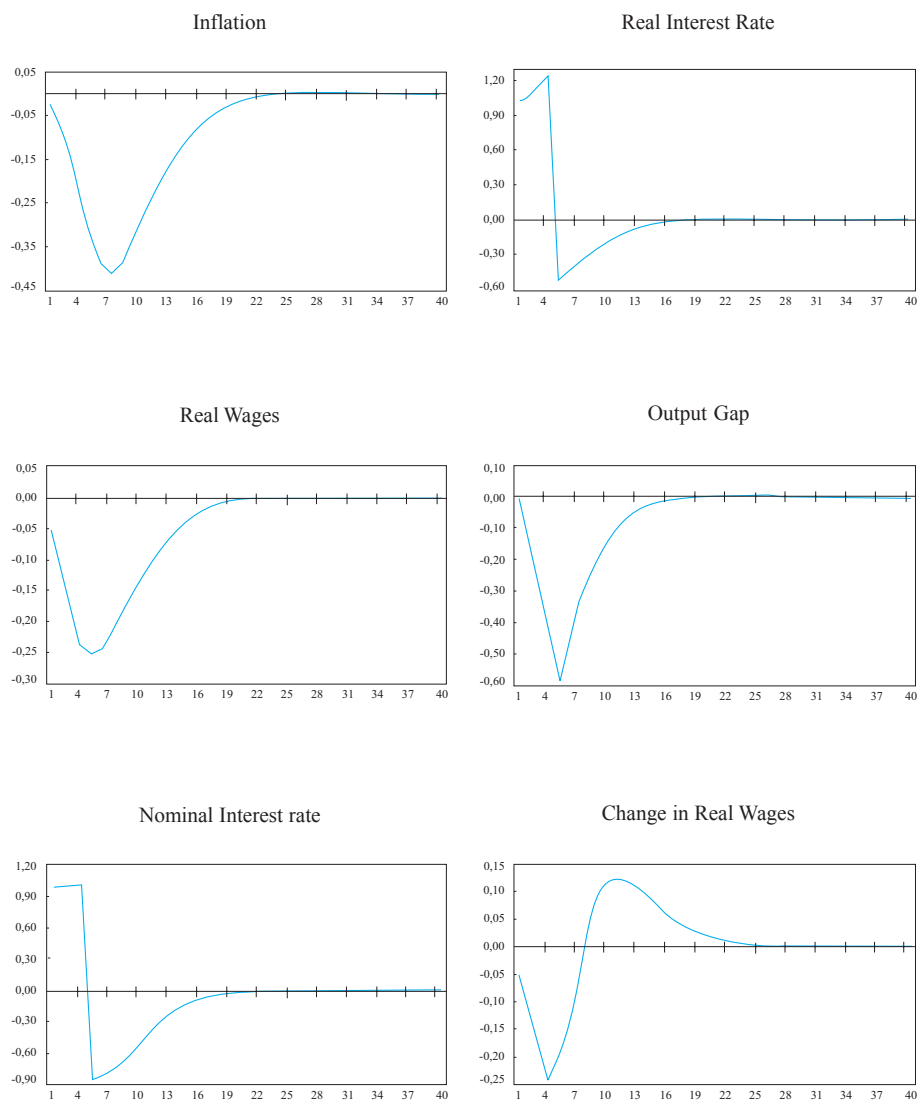
### *B. CALIBRATION*

This model was also calibrated trying to maintain the same two criteria in mind. The effect of monetary policy and the pro cyclical behavior of (the change in) real wages. The highest effect of monetary policy on inflation was maintained in about 0.4 an in the seventh quarter. This required, however, a higher effect on the output gap: 0.6 (Figure 5). A regression of the change in real wages on the output gap gives a coefficient of 0.353, of the same sign and order of magnitude than the estimated coefficient of 0.262.

The calibrated coefficients are  $c_{13} = 0.075$ ,  $c_{14} = 0.7$ ;  $c_{15} = 0.3$ ,  $c_{16} = 0.9$ ,  $c_{17} = 0.15$ ,  $c_{18} = 0.075$ .



Figure 5  
A Shock to Monetary Policy in the Staggered Contracts Model



Source: Calculations by the author.

### *C. RESULTS*

Contract length can change inflation stickiness, the output inflation trade off and hence the cost of disinflation. Compared to one year contracts, half year contracts decrease the sacrifice ratio from 0.233 to 0.100. The results do not necessarily imply that a different wage setting structure should be imposed in Colombia, a country with a different inflation history. The shorter Chilean wage contracting structure is a heritage of the hyperinflation period. The results do imply, however, that the shorter Chilean contract length can also help explain why the cost of disinflation was smaller than in Colombia.

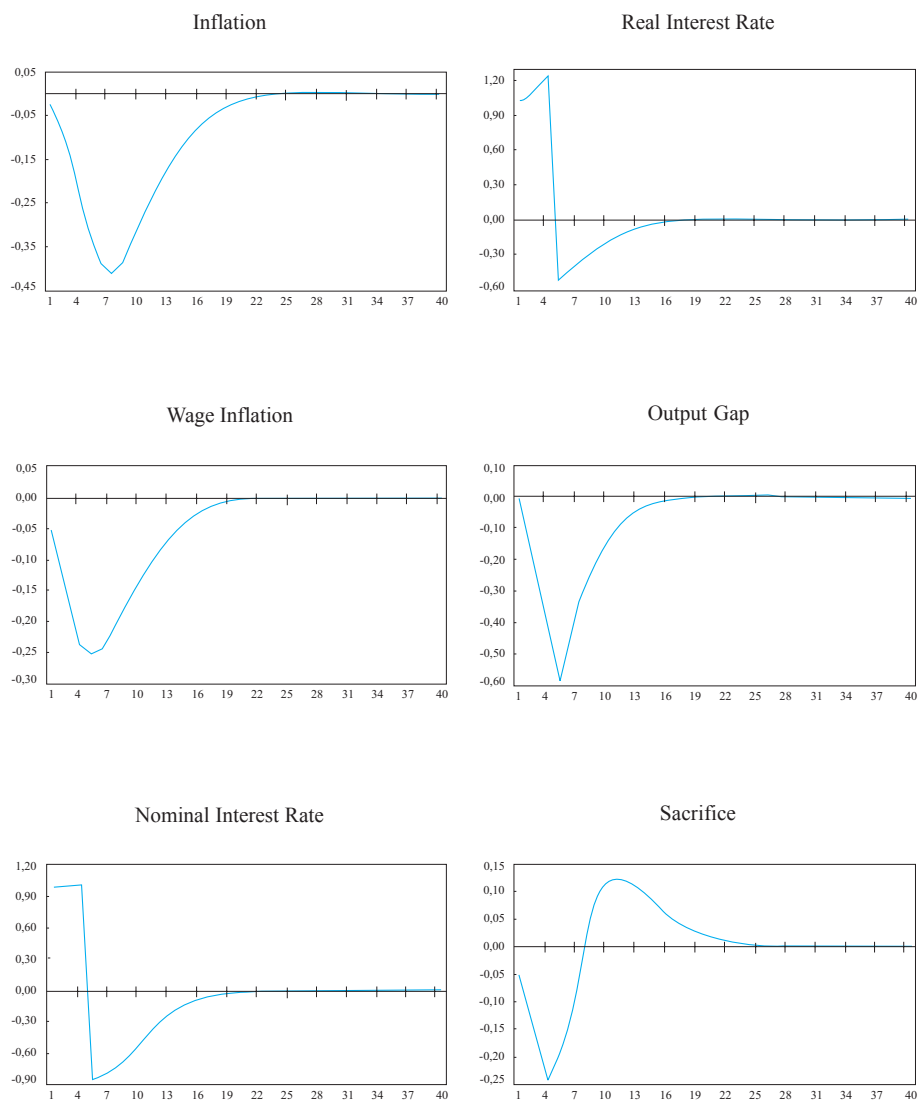
### **IV. CONCLUSIONS**

We have studied the effects of wage indexation, central bank credibility and the frequency of wage negotiations on wage rigidities. Wage indexation to expected inflation, higher central bank credibility and higher frequency of wage negotiations decrease wage rigidities.

The two modes of the wage price system have also serve the purpose of showing how wage rigidities translate into price rigidities. Price rigidities are in turn the key element in explaining the cost of disinflation.

A central bank that cares about inflation should care about determinants of price and wage rigidities such as the characteristics of wage negotiations and its own credibility.

Figure 6  
Disinflation: One Year and Half Year Staggered Wage Contracts



Source: Calculations by the author.

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