ON THE DYNAMICS OF UNEMPLOYMENT IN A DEVELOPING ECONOMY: COLOMBIA[♦]

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ABSTRACT

This paper estimates an asymmetric error correction model to analyse the dynamic behaviour of the Colombian unemployment rate. We find evidence that wages above their long-run equilibrium level do increase unemployment, but wages below this level do not reduce it.

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1. Introduction

Since the mid 1990´s perhaps no country in Latin America has had as great an unemployment problem as Colombia. Indeed, during the second half of the 1990s the Colombian unemployment rate has been rising consistently reaching an unprecedented level of more than 20% in the year 2000, higher than in any other Latin American economy. Increasing unemployment has occurred simultaneously with a gradual disinflationary process, which in turn has led to a recovery of real wages in recent years. In view of these developments, the standard perception in wage negotiations is that wages above their long-run equilibrium level are one of the underlying causes of unemployment in the country.

This paper has two purposes. First, it addresses the validity of the conventional view that wages above their long-run equilibrium level are the cause of unemployment in Colombia. Second, it examines whether reducing wages below their long-run equilibrium level reduces unemployment. To do this we postulate a small labour market model to analyse the dynamics of unemployment, and its relationship to wages, prices and productivity. An important feature of our analysis is that we test for the possibility of asymmetric unemployment effects to positive and negative wage deviations from equilibrium. A number of reasons could potentially explain a different unemployment response to wage deviations from equilibrium, including deficiencies in the labour supply and inadequate worker training.[1]

The plan of the paper is as follows. Section 2 postulates a small labour market model for the Colombian economy, and presents its cointegration properties. Next, the short-run dynamics of the rate of unemployment is analysed, allowing for linear and non-linear adjustment to wage disequilibrium errors. Section 3 concludes.

2. The empirical model

Our starting point is a model of wage determination for the Colombian economy adapted from Layard et. al. (1991); see also Marcellino and Mizon (2000) and the references therein. The variables used in the model are average wages in current prices (w_t), prices as measured by the consumer price index (p_t), labour productivity ($prod_t$) calculated as the ratio of total constant price GDP to employment, and the rate of unemployment (U_t).[2] This set of variables allows us

[1] Lora and Márquez (1998) point out that labour supply deficiencies and inadequate training are among the main concerns of Latin American employers.

[2] The data sources are: Banco de la República for the consumer price index. Departamento Administrativo Nacional de Estadística for wages, employment and unemployment. Departamento Nacional de Planeación for GDP from 1980 to 1993, and Departamento Administrativo Nacional de Estadística from 1994 onwards. The series of wages, employment and unemployment are for the four main metropolitan areas of the country (i.e. Bogota, Cali,

to investigate the extent to which real wages are determined by "inside" factors (i.e. labour productivity) relative to "outside" factors (i.e. the unemployment rate). That real wages should depend upon labour productivity is a condition that can be derived from the classic theory of the firm, which postulates a positive relationship between these two variables. As to the unemployment rate, it enters the model to capture the idea that real wages may be affected by the conditions prevailing in the labour market. In particular, in labour markets with low unemployment, real wages tend to increase because employers find it hard to attract new workers, and the bargaining power of unions and workers is strong. On the other hand, in labour markets with high unemployment, real wages tend to decrease because unions and workers find themselves in a weak position, and firms can easily attract new workers. The relationship between real wages and unemployment would then be expected to be negative.

Our empirical analysis begins with the investigation of the long-run structure of the data. We apply the Johansen (1988, 1995) full information maximum likelihood procedure, as it allows the estimation of multiple cointegrating vectors that can be interpreted as equilibrium relationships among the variables. The data are seasonally unadjusted quarterly observations from 1980:1 to 2000:3, and are considered in logarithms, with the exception of the unemployment rate which is considered in percentage terms. Preliminary analysis of the data using the augmented Dickey-Fuller (1979, 1981) test suggests that w_t, $prod_t$, U_t and p_t are each integrated of order one (these results are available from the authors upon request).

Next, we carry out a cointegration analysis on the set of variables $Y_t = [w_t, p_t, prod_t, U_t]'$, all of which are treated as endogenous $I(1)$ variables. The specification of the model contains an unrestricted constant, and centred seasonal dummy variables to account for seasonal effects. The lag length is selected by starting with five lags, and sequentially testing from the highest order using Likelihood Ratio test statistics. The final model had a lag order of two, and this specification was then subjected to diagnostic checking.[3]

The diagnostic statistics (not reported here) reveal no misspecification except some ARCH effects in the unemployment equation (at a five per cent significance level), and rejection of normality with respect to the wage, inflation and productivity equations (also at a five per cent level). The normality failure, however, is not so serious for the cointegration

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Medellin and Barranquilla). The choice of these series is dictated by the availability of data; more comprehensive series are only available for more recent periods of time. All data are available from the authors upon request.

[3] Estimations are done in PcGive and PcFiml 9.0 (see Hendry and Doornik, 1997).

tests reported below (see Cheung and Lai, 1993, who find that the Johansen tests perform reasonably well in the presence of excess kurtosis, and Johansen, 1995, p. 29, who points out that although the cointegration analysis is based on Gaussian likelihood, the asymptotic properties only depend on the assumption that the errors are *i.i.d.*).

The λ-*max* and the *trace* test statistics reported in Table 1 indicate that a cointegrating rank $r = 0$ is rejected, whereas $r = 1$ cannot be rejected (both statistics with degrees of freedom adjustment; see Reimers 1992). Hence we proceed under the assumption that there is one cointegration relation, which may include essential parts of a wage formation equation. Using the long-run structural modelling techniques advanced by Pesaran and Shin (1999), the restricted cointegrating relation is estimated as (standard errors in (•)):[4]

$$w_t = p_t - \underset{(0.990)}{2.999} U_t .$$

Our findings thus imply that in the long run real wages are negatively related to unemployment, and are not determined by labour productivity. This last result does not give support to the new classical argument that postulates a positive relationship between wages and labour productivity. At first sight this finding might seem peculiar, but it might be explained by the fact that in Colombia wage increases (especially those of public servants) have responded more to institutional factors than to changes in productivity. Historically, wage growth has been strongly influenced by a government-fixed minimum wage which usually responded to past inflation. However, during the 1990´s, government policy attempted to link minimum wage increases to expected inflation plus labour productivity, but a Constitutional Court ruling declared that past inflation had also to be taken into account.[5]

Figure 1 plots the restricted cointegration vector (denoted Lbm_t), after partialling out the full-sample short-run dynamics. From the figure it can be seen that the deviations of nominal wages from the implied long-run relationship have fluctuated within a range of approximately -30 to 40 per cent. It is interesting to notice that since the mid 1990's wages have been consistently above the steady-state level, and this result might help explain the rapid increase in unemployment during the last years.

OLS estimates of the error correction equations together with a number of diagnostic

[4] For exact identification we normalised with respect to *w*. Having imposed this exactly identifying restriction, we then tested the validity of a unit price elasticity and that labour productivity does not enter the cointegrating relation, producing a $\chi^2(2) = 3.564$ (*p-value* = 0.168).

[5] Notice also that *prod* is an imprecise measure of productivity, as it is calculated as the ratio of total GDP to employment in the main four metropolitan areas. It was also tried to estimate a model using a linear trend that is restricted to lie in the cointegrating space, as a proxy for labour productivity. In this case, however, the estimated trend coefficient turns out to be statistically insignificant.

tests are reported in Table 2 (insignificant variables have been dropped based on Wald tests for zero restrictions). The results show that the error correction term has a significant negative impact on current wage changes, suggesting an equilibrating adjustment process for wages in response to changes in domestic prices and unemployment. There is a negative relationship between inflation and the disequilibrium error indicating that wages above the steady-state level are deflationary rather than inflationary. This result is surprising considering the role of wages as part of production costs, although it might be attributed to the omission of other inflation causes (e.g. excess money, foreign prices, exchange rates and interest rates, among others). The formulation and estimation of an inflation model is beyond the scope of this paper though. Lastly, productivity growth does not respond to deviations from the long-run wage relation, and unemployment rises with increases in wages above the steady-state level.

In recent years various authors have examined non-linearities in the behaviour of error correction models (see e.g. Granger and Lee, 1989; Granger and Teräsvirta, 1993; Escribano and Pfann, 1998; and Escribano and Aparicio, 1999, among others). For example, Granger and Lee (1989) partition the error correction term into its positive and negative components, and feed them back into the short-run dynamic equations. Focusing on the ΔU_t equation in Table 2, we take the deviations of Lbm_t around its mean value, and partition it into its positive and negative components, denoted by Lbm_t^+ and Lbm_t^-. The estimated asymmetric error correction equation for the unemployment rate is (standard errors in (•), *p*-values in [•]):

$$\Delta U_t = \underset{(0.003)}{-0.005} + \underset{(0.021)}{0.039}\,\Delta w_{t-1} - \underset{(0.115)}{0.200}\,\Delta U_{t-1} + \underset{(0.009)}{0.024}\,Lbm_{t-1}^{+} - \underset{(0.016)}{0.001}\,Lbm_{t-1}^{-} + \text{Seasonal dummies}$$

R^2	0.540		$\chi^2\,nd$	0.793	[0.673]
F *ar*	0.988	[0.420]	F *het*	0.848	[0.594]
F *arch*	3.042	[0.023]	F *Reset*	0.077	[0.783]

The linear and asymmetric unemployment error correction equations are not statistically distinct: the F-statistic testing whether the estimated coefficients on Lbm_t^+ and Lbm_t^- are the same, yields $F_{1,73} = 1.340$ (*p*-value = 0.251). However, the adjustment of the unemployment rate to positive and negative wage disequilibrium errors (lagged once) is markedly different, see Figure 2. Indeed, it appears that unemployment increases rapidly when wages are above the steady-state level, but does not respond when wages are below.[6]

[6] For the wage equation there is no evidence of asymmetric adjustment in response to positive and negative wage disequilibria lagged once; the cross-plot is in essence a straight line (these results are not reported here, though).

3. Concluding remarks

In this paper we estimate an asymmetric error correction model to analyse the short-run behaviour of the rate of unemployment in Colombia. We find evidence that wages above their long-run equilibrium level do increase unemployment, but wages below this level do not reduce it. This result supports the view that factors that increase unemployment are not the same as those reducing it.

Table 1. Eigenvalues, test statistics, and critical values

λ_i	H_0	H_1	λ-*max* statistic	H_0	H_1	λ-*trace* statistic
0.308	$r = 0$	$r = 1$	26.89*	$r = 0$	$r \geq 1$	50.78**
0.188	$r \leq 1$	$r = 2$	15.17	$r \leq 1$	$r \geq 2$	23.89
0.077	$r \leq 2$	$r = 3$	5.82	$r \leq 2$	$r \geq 3$	8.72
0.039	$r \leq 3$	$r = 4$	2.90	$r \leq 3$	$r \geq 4$	2.90

Notes:
r denotes the number of cointegration vectors. * and ** denote statistical significance at the 10 and 5 percent levels, respectively.

Table 2. Error correction model (OLS estimates)

Variables	Δw_t		Δp_t		$\Delta prod_t$		ΔU_t	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Constant	0.040	0.010	0.037	0.003	-0.002	0.004	0.000	0.001
Δw_{t-1}							0.036	0.020
$\Delta prod_{t-1}$					-0.391	0.105		
ΔU_{t-1}							-0.203	0.115
lbm_{t-1}	-0.109	0.030	-0.058	0.010			0.016	0.006
R^2	0.343		0.668		0.339		0.532	
F ar	1.021	[0.402]	0.282	[0.889]	2.070	[0.094]	0.697	[0.597]
F arch	1.016	[0.405]	1.620	[0.179]	0.310	[0.870]	3.547	[0.011]
χ^2 *nd*	9.345	[0.009]	5.722	[0.057]	11.881	[0.003]	0.551	[0.759]
F het	1.009	[0.419]	0.832	[0.531]	3.406	[0.008]	0.768	[0.646]
F Reset	0.628	[0.431]	0.123	[0.727]	0.042	[0.838]	0.204	[0.653]

Notes:
The error correction equations also include seasonal dummy variables. R^2 is the coefficient of determination. *F ar* is the Lagrange Multiplier F-test for residual serial correlation of up to fourth order. *F arch* is the fourth order Autoregressive Conditional Heteroscedasticity F-test. χ^2 *nd* is a Chi-square test for normality. *F het* is an F-test for heteroscedasticity. *F Reset* is Ramsey's RESET test statistic. Numbers in square brackets are the probability values of the test statistics.

Figure 1. Deviations of nominal wages from the long-run equilibrium (*Lbm*)

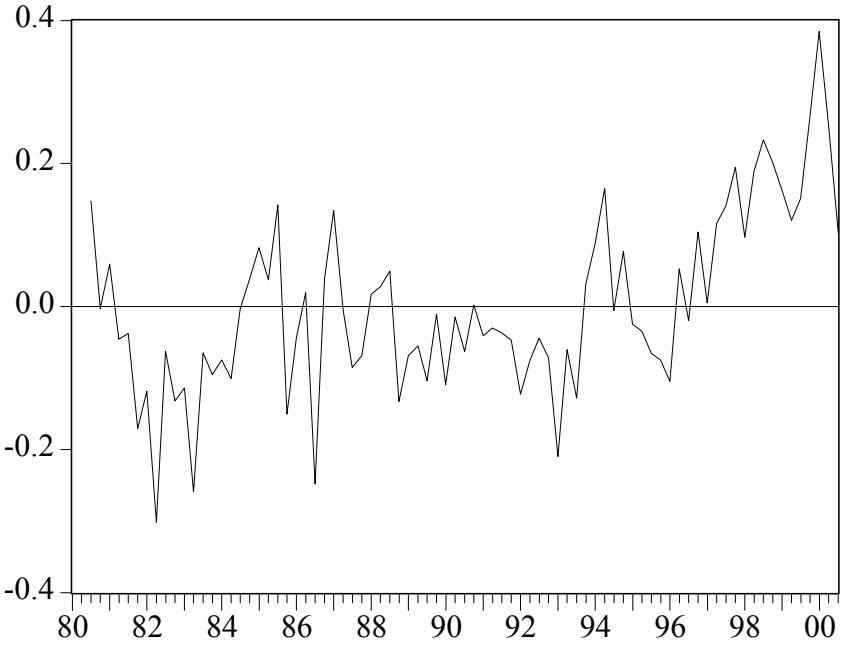
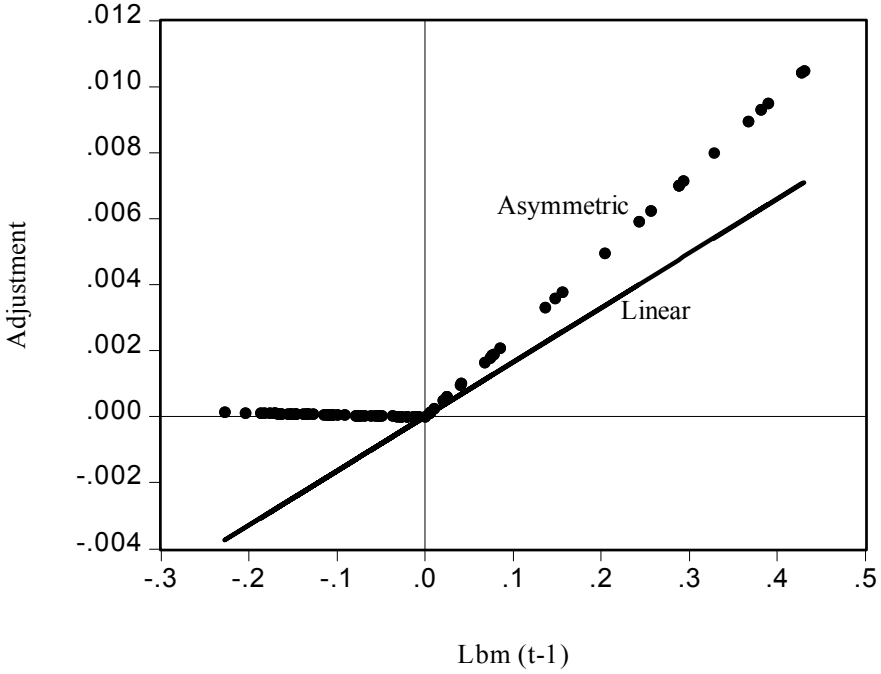


Figure 2. Unemployment adjustment to wage deviations from equilibrium



Notes:

Linear adjustment is calculated as $L = 0.016 Lbm_{t-1}$.

Asymmetric adjustment is calculated as $AS = 0.024 Lbm_{t-1}^{+} - 0.001 Lbm_{t-1}^{-}$.

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