

This PDF is a selection from an out-of-print volume from the National Bureau of Economic Research

Volume Title: Reducing Inflation: Motivation and Strategy

Volume Author/Editor: Christina D. Romer and David H. Romer, Editors

Volume Publisher: University of Chicago Press

Volume ISBN: 0-226-72484-0

Volume URL: <http://www.nber.org/books/rome97-1>

Conference Date: January 11-13, 1996

Publication Date: January 1997

Chapter Title: Disinflation and the NAIRU

Chapter Author: Laurence M. Ball

Chapter URL: <http://www.nber.org/chapters/c8884>

Chapter pages in book: (p. 167 - 194)

Laurence Ball

4.1 Introduction

Average unemployment in the countries of the Organization for Economic Cooperation and Development (OECD) stood at 3.1% in 1970. It rose to 5.7% in 1980 and 8.1% in 1994. The rise in unemployment was especially severe in the European Community, where 1994 unemployment averaged 11.5%. Although these movements had a cyclical component, there was also a large rise in the long-run trend, as captured by the non-accelerating-inflation rate of unemployment—the NAIRU. OECD estimates of the NAIRU rose for most countries in both the 1970s and 1980s (OECD 1994).

A large literature has sought to explain the rise in unemployment. In recent years, most explanations have focused on imperfections in the labor market arising from labor unions and from government interventions such as unemployment insurance and firing restrictions. Often, economists argue that these imperfections have interacted negatively with changing economic conditions. On the back cover of its 1994 *Jobs Study*, the OECD summarizes its views: “[M]uch unemployment is the unfortunate result of societies’ failure to adapt to a world of rapid change and intensified global competition. Rules and regulations, practices and policies, and institutions designed for an earlier era have resulted in labour markets that are too inflexible for today’s world.” Krugman (1994) is more specific about the key economic changes. Summarizing “the conventional wisdom,” he focuses on the decline in the equilibrium relative

Laurence Ball is professor of economics at Johns Hopkins University and a research associate of the National Bureau of Economic Research.

The author is grateful to Jorgen Elmeskov and Marco Doudeyns of the Organization for Economic Cooperation and Development for providing data, and to Christopher Ruebeck and Tao Wang for research assistance. Helpful suggestions were provided by Olivier Blanchard, Jorgen Elmeskov, the editors, conference participants, and seminar participants at Columbia, the Kansas City Fed., and the Massachusetts Institute of Technology.

wages of low-skill workers (arising, perhaps, from skill-biased technical change). In Krugman's view, labor market distortions create a floor on real wages, and unemployment rises when equilibrium wages fall below the floor.

This paper argues that the conventional wisdom misses a central cause of the rise in unemployment: macroeconomic policy. In particular, I focus on the decade of the 1980s and argue that the main cause of rising unemployment was the tight monetary policy that most OECD countries pursued to reduce inflation. My evidence comes from a cross-country comparison: countries with larger decreases in inflation and longer disinflationary periods had larger increases in the NAIRU. My principal measure of the NAIRU is the one constructed by Elmeskov (1993) and used in *The OECD Jobs Study*.

In the "natural rate" theories of Friedman (1968) and Phelps (1968), the NAIRU is determined by labor market imperfections and is independent of monetary policy. My argument is inconsistent with traditional natural-rate models. My findings fit easily, however, with "hysteresis" theories (Blanchard and Summers 1986). In these theories, a disinflation causes a cyclical rise in unemployment, which in turn causes a rise in the NAIRU. My results suggest that hysteresis is highly relevant for explaining recent experience.

This paper also examines the role of labor market imperfections in the rise of the NAIRU. I consider various measures of these distortions, and find that their cross-country correlations with the change in the NAIRU are low. However, one labor market variable—the duration of unemployment benefits—has a large effect on the size of the NAIRU increase resulting from disinflation. That is, much of the rise in unemployment is explained by the *interaction* between benefit duration and changes in inflation. Once again, my results support hysteresis theories, which attribute the persistence of unemployment changes to labor market distortions. More specifically, the results about unemployment benefits support hysteresis models based on decreasing job search by the unemployed.

The remainder of this paper contains six sections. Section 4.2 describes how I measure changes in the NAIRU. Sections 4.3–4.5 investigate the cross-country relations among changes in the NAIRU, the size and speed of disinflation, and labor market distortions. Section 4.6 considers robustness, and section 4.7 discusses the results.

4.2 The NAIRU in the 1980s

4.2.1 Measuring the NAIRU

The concept of the NAIRU is based on an accelerationist Phillips curve:

$$(1) \quad \pi - \pi_{-1} = a(U - U^*),$$

where U is unemployment, π and π_{-1} are current and lagged inflation, a is a negative constant, and I ignore supply shocks. U^* is the NAIRU—the level of unemployment consistent with stable inflation. In the Friedman-Phelps model,

U^* is determined by microeconomic features of labor markets. In hysteresis models, U^* is also influenced by the path of actual unemployment, and hence by macroeconomic policy.

In calculating the NAIRU, I follow Elmeskov (1993), whose approach is also used in *The OECD Jobs Study*. Elmeskov estimates the unemployment rate consistent with stable wage inflation (he calls his variable the NAIWRU rather than the NAIRU). There is no clear reason for focusing on wage inflation or on price inflation, and so I follow Elmeskov for simplicity. To estimate the NAIRU in a given year, Elmeskov compares unemployment and the change in wage inflation in that year and the previous one. Assuming a Phillips curve, equation 1, the two observations determine the NAIRU, U^* . For some countries, Elmeskov makes ad hoc adjustments to the NAIRU series to eliminate outliers. Finally, he smooths the series mildly: he applies the Hodrick-Prescott filter with a parameter of 25. This smoothing reduces the influence of supply shocks and other transitory shifts in the Phillips curve.¹

Elmeskov's NAIRU series for several countries are plotted in figure 4.1, along with actual unemployment. Generally, the series appear close to what one would draw by hand if attempting to capture the long-term trend in unemployment. Elmeskov finds that his NAIRU series are similar to two other "natural-rate" series he calculates, one based on the relation between unemployment and vacancies and the other based on capacity utilization.

Elmeskov's procedure is not perfect, of course. The appropriate approach to estimating the NAIRU is controversial. In section 4.6, I consider biases that might arise if Elmeskov's procedure does not completely eliminate the cyclical component of unemployment. I also consider an alternative measure of the NAIRU based on a univariate smoothing of the unemployment series.

4.2.2 The Sample

I seek to explain the change in the NAIRU from 1980 to 1990. I chose this period because the most important macroeconomic shocks were shifts in demand, especially monetary tightenings aimed at reducing inflation and supporting currencies. One can find reasonable proxies for the tightness of policy in different countries, such as the total fall in inflation. Accounting for unemployment movements during the 1970s is more difficult: one has to measure the severity of supply shocks in different countries.

I end the analysis in 1990 because it is difficult to estimate the NAIRU in more recent years. It is not yet clear, for example, whether the large increases in unemployment in Sweden and Finland are changes in the NAIRU or deviations from the NAIRU. At a technical level, Elmeskov's procedure relies on the Hodrick-Prescott filter, which is imprecise near the endpoints of series.

1. To understand Elmeskov's procedure, note that equation 1 implies $\pi_{-1} - \pi_{-2} = a(U_{-1} - U^*)$. Given two years' data on inflation changes and unemployment, this equation and (1) are two equations in two unknowns, a and U^* . The solution for U^* is Elmeskov's initial estimate of the NAIRU.

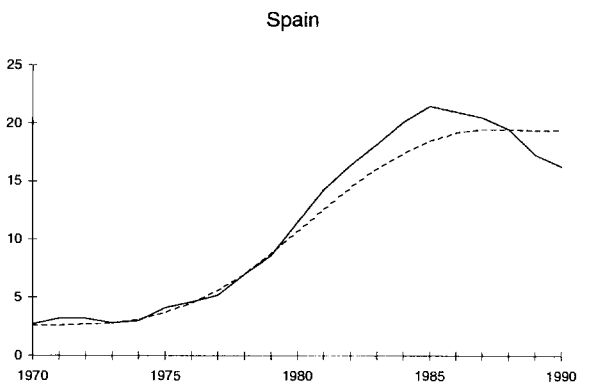
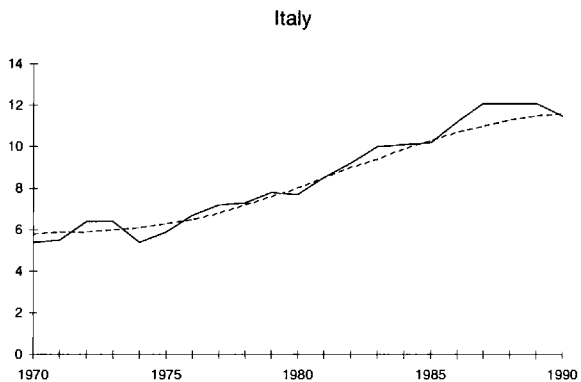
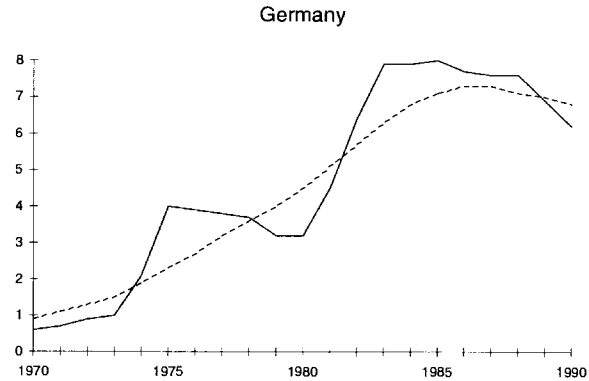
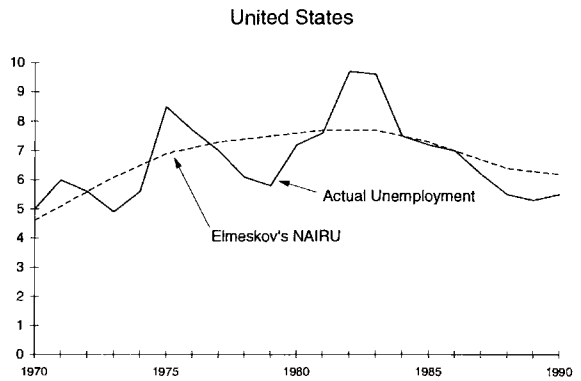


Fig. 4.1 The NAIRU, 1970–90

Elmeskov calculates NAIRU series for twenty-one OECD countries. Of these countries, I examine the twenty with moderate inflation; I exclude Turkey, where inflation was 110% in 1980. My sample of countries is identical to the main sample that Layard, Nickell, and Jackman examine in their 1991 book on unemployment. For each country, I use an updated NAIRU series that Elmeskov has calculated using data in the December 1994 *Economic Outlook* of the OECD. For two countries, the Netherlands and Ireland, I adjust the series based on revisions in unemployment data in the June 1995 *Economic Outlook*.²

In Table 4.1, the first column reports the change in the NAIRU from 1980 to 1990. The NAIRU rose in all countries except the United States, Portugal, and Belgium; Ireland and Spain have the largest increases by a wide margin. The unweighted average increase across countries is 2.1 percentage points.

4.3 The Effects of Disinflation

4.3.1 The Policy Variables

I examine two variables concerning disinflation. The first is the total fall in inflation from 1980 to 1990. This variable measures the overall tightness of monetary policy during the decade. In hysteresis models, a larger disinflation produces a larger cyclical rise in unemployment, which in turn produces a larger rise in the NAIRU. I measure inflation with the year-over-year change in consumer prices, as reported in the June 1995 *Economic Outlook*. The fall in inflation from 1980 to 1990 is reported in the second column of table 4.1.

The other variable measures the *length* of disinflation. For each country, I determine the longest disinflation during the 1980s, defined as the greatest number of consecutive years in which inflation fell or was constant. This variable shows whether a given fall in inflation occurred quickly or slowly.

There are two reasons that the speed of disinflation may affect the change in the NAIRU. First, it may affect the size of the cyclical downturn caused by disinflation. Ball (1994) finds that slower disinflations produce larger cyclical output losses. Second, a given amount of cyclical unemployment may have a larger effect on the NAIRU if it is spread over time. This is true in some hysteresis models. It is true, for example, if the unemployed take more than one period to become “outsiders” in wage bargaining (Lindbeck and Snower 1989), or if only long-term unemployment reduces workers’ job search (Pissarides 1994). All these effects suggest that a longer disinflation produces a larger rise in the NAIRU.

The third column of table 4.1 reports the length of disinflation in each coun-

2. For the Netherlands and Ireland, I compute an initial NAIRU series for both the December 1994 data and the June 1995 data, using the approach in note 1. I add the difference between the two series to Elmeskov’s final NAIRU series. This procedure assumes that the data revision does not affect the difference between the initial NAIRU and the final (smoothed) NAIRU.

Table 4.1 The Sample

	Change in NAIRU 1980–90 (%)	Decrease in Inflation 1980–90 (%)	Longest Disinflation (years)	Duration of Unemployment Benefit (years) ^a
Australia	1.1	2.9	2	4
Austria	1.4	3.0	3	4
Belgium	-0.5	3.3	4	4
Canada	0.6	5.4	4	0.5
Denmark	2.5	9.7	6	2.5
Finland	0.5	5.5	5	4
France	3.7	10.2	6	3.75
Germany	2.3	2.8	5	4
Ireland	9.3	15.0	7	4
Italy	3.6	15.1	7	0.5
Japan	0.3	4.7	3	0.5
Netherlands	2.7	4.0	3	4
New Zealand	4.6	11.0	2	4
Norway	2.3	6.8	4	1.5
Portugal	-1.4	3.2	3	0.5
Spain	8.7	8.9	8	3.5
Sweden	0.4	3.2	4	1.2
Switzerland	0.9	-1.4	3	1
United Kingdom	1.1	8.5	3	4
United States	-1.4	8.1	3	0.5

^aIndefinite benefits are coded as four years.

try. After experimentation with functional forms, I used the square of this variable in the regressions below.³

4.3.2 Results

Table 4.2 reports regressions of the change in the NAIRU on the fall in inflation, on the square of disinflation length, and on both of these variables. Figure 4.2 plots the two bivariate relations.⁴

In each of the simple regressions, the independent variable explains a substantial fraction of the variation in the change in the NAIRU. For the fall in inflation, the *t*-statistic is 3.5 and the \bar{R}^2 is 0.37. For length squared, the *t*-

3. Inflation in Spain was 8.8% in both 1985 and 1986. The Spanish disinflation would be three years shorter if I required inflation to fall in all years rather than fall or stay constant. On the other hand, I count only years of disinflation after 1980. If I measured the longest disinflation that overlaps with the 1980s, the Spanish disinflation would be three years *longer*. This adjustment would not affect any other country.

4. In the reported regressions, I assume that errors are uncorrelated across countries, and use ordinary least squares (OLS). I have also considered a specification in which errors are correlated for countries in the same region. Regions are defined as North America, the EC, non-EC Europe, the Antipodes, and Japan. The estimated within-region correlation is close to zero. Consequently, two-step generalized least squares (GLS) estimates accounting for this correlation are close to OLS estimates.

Table 4.2 Disinflation and the Change in the NAIRU

Dependent Variable: Change in NAIRU from 1980 to 1990			
Constant	-0.593 (0.935)	-0.444 (0.700)	-1.033 (0.801)
Inflation decrease	0.420 (0.121)		0.183 (0.131)
Length squared		0.123 (0.026)	0.095 (0.033)
\bar{R}^2	0.367	0.528	0.552

Note: Standard errors are in parentheses.

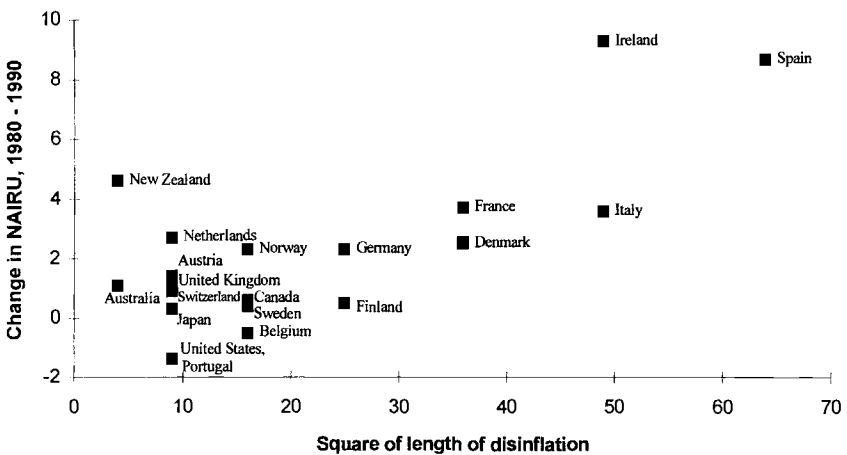
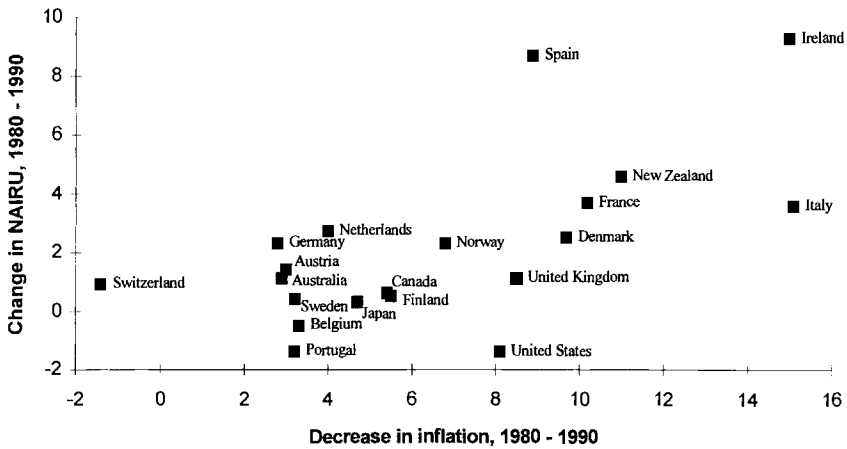


Fig. 4.2 Disinflation and the change in the NAIRU

statistic is 4.7 and the \bar{R}^2 is 0.53. The scatter plots confirm the positive relationships between the change in the NAIRU and the right-side variables.⁵

The correlation between the fall in inflation and length squared is 0.63. It is difficult to separate the effects of these variables with twenty observations, but the data suggest that length squared has greater explanatory power. In the multiple regression, the t -statistic is 2.9 for length squared and only 1.4 for the fall in inflation, although standard confidence intervals include large effects for both variables. The \bar{R}^2 for the multiple regression is 0.55, only slightly higher than the \bar{R}^2 with length squared alone.

The size and speed of disinflation explain an important part of changes in the NAIRU during the 1980s. Yet large residuals remain. As one example, Ireland and Italy had inflation changes of 15.0 and 15.1%, respectively, and both had longest disinflations of eight years. These figures put Ireland and Italy near the high end for both variables. Despite these similar disinflation experiences, the NAIRU rose 9.3% in Ireland and only 3.6% in Italy. Something besides macropolicy must explain such differences.

4.4 The Effects of Labor Market Variables

Most discussions of unemployment focus on imperfections in labor markets. Observers blame unemployment on the power of labor unions and on government policies such as unemployment insurance and firing restrictions. Layard, Nickell, and Jackman (1991) show that measures of labor market distortions explain much of the cross-country variation in unemployment levels in the mid-1980s. It is harder, however, to explain *changes* in unemployment during the 1980s. Most labor market distortions remained constant during the decade or decreased, as some countries weakened firing restrictions and reduced unemployment benefits (OECD 1990; Blank 1994). These changes go in the wrong direction for explaining why unemployment rose.

Nonetheless, authors such as Krugman and the OECD emphasize labor market distortions in explaining the 1980s. They argue that preexisting distortions contributed to rising unemployment through interactions with market forces such as greater wage dispersion. If OECD countries experienced similar economic changes, this view suggests that unemployment rose more in countries with more distorted labor markets. Many authors use this idea to explain why unemployment has risen in Europe but not the United States, where markets are more flexible. Motivated by this view, I explore the relation between the change in the NAIRU and labor market distortions in my twenty countries.

My principal measures of labor market distortions are the six variables that Layard et al. emphasize. Two of the variables concern unemployment insurance: the replacement ratio and the duration of benefits. Three concern wage

5. When the change in the NAIRU is regressed on the length of disinflation rather than length squared, the t -statistic is 3.8 and \bar{R}^2 is 0.42.

Table 4.3 Labor Market Variables and the Change in the NAIRU

Dependent Variable: Change in NAIRU from 1980 to 1990				
Variable	Benefit duration	Replacement ratio	Coverage of collective bargaining	Employer coordination
\bar{R}^2	0.125	-0.053	0.039	0.050
Variable	Union coordination	Expenditure on labor market programs	All six variables	
\bar{R}^2	-0.048	-0.017	0.064	

bargaining: the percentage of workers covered by collective agreements, and the coordination among workers and among employers. The final variable is government spending to help the unemployed find jobs. Layard et al. report these variables as of the mid-1980s. To check robustness, I also examine a set of six variables drawn from *The OECD Jobs Study* (1994). These include four variables similar to Layard et al.'s, and two others: an index of legal employment protection, and the tax wedge between labor costs and workers' incomes.

I run simple regressions of the change in the NAIRU on each of the six Layard et al. variables, and a regression on all six at once. Most of the results are negative. In the multiple regression, the p value for the hypothesis that all coefficients are zero is 0.36. In five of the six simple regressions, the t -statistic is less than 1.5; the \bar{R}^2 , reported in table 4.3, range from -0.05 to 0.05. The only variable close to significant is the duration of unemployment benefits: it yields a t -statistic of 1.9 and an \bar{R}^2 of 0.12. Figure 4.3 plots the change in the NAIRU against the duration of benefits; it suggests a mild positive relationship, but a number of countries have long durations and small changes in the NAIRU. (Following Layard et al., I count indefinite unemployment benefits as a duration of four years.)

Regressions using the six *Jobs Study* variables yield even more negative results. No variable approaches significance, and the \bar{R}^2 are all below 0.01. (The *Jobs Study* variables do not include the duration of unemployment benefits.)

As discussed above, *changes* in labor market distortions are not a promising explanation for the overall rise in OECD unemployment, because most changes go in the wrong direction. Nonetheless, changes in distortions could help explain cross-country differences in unemployment changes; for example, some authors argue that Thatcher's reforms dampened the rise in British unemployment. There is less cross-country data on changes in distortions than on levels, but the OECD has constructed three variables for both 1980 and 1990, or for nearby years. The variables are union density, the benefit replacement rate, and the tax wedge. (As stressed by Phelps [1994], the tax wedge is one distortion that worsened for most countries during the 1980s.) I regress the change in the NAIRU on the change in each labor market variable over the 1980s. Once again, the results are negative: all coefficients are insignificant.

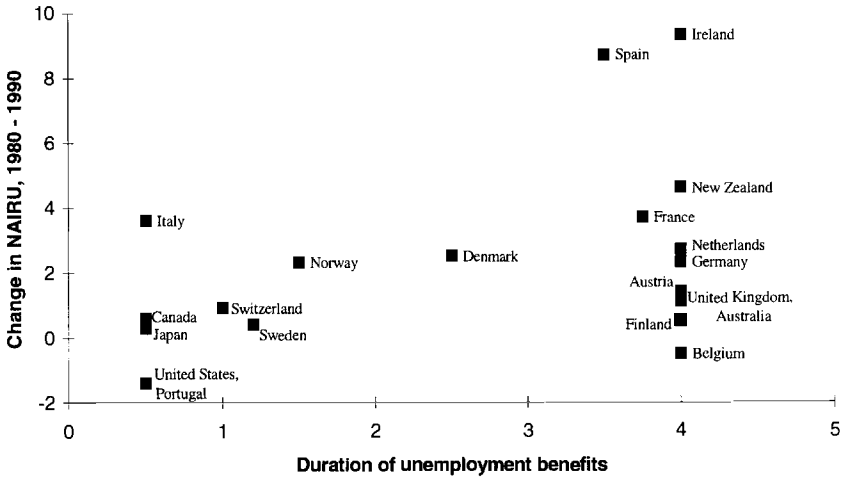


Fig. 4.3 Benefit duration and the change in the NAIURU

Thus an extensive search has failed to find any labor market variable that explains nearly as much of the rise in the NAIURU as the size and length of disinflation.

4.5 Interactions between Disinflation and Labor Market Variables

In hysteresis models, increases in unemployment are triggered by cyclical factors such as demand contractions. But labor market imperfections are the reason that cyclical unemployment leads to a rise in the NAIURU. Thus the models suggest an interaction between disinflation and labor market variables. A given disinflation has a larger effect on the NAIURU in countries with more distorted labor markets.

In exploring this idea, I mainly consider the interaction between disinflation and the duration of unemployment benefits. Recall that the duration of benefits is the only labor market variable with any direct relation to the change in the NAIURU. It also proves to be the variable that interacts most strongly with disinflation.

Figure 4.4 plots the change in the NAIURU against two interaction variables: the fall in inflation times benefit duration ($(\Delta\pi) \times (ben)$), and length squared times benefit duration ($(L^2) \times (ben)$). Table 4.4 reports regressions of the change in the NAIURU on various combinations of the interactions and the individual variables from which they are constructed. The interactions are very important. Simple regressions yield \bar{R}^2 of 0.55 for $(\Delta\pi) \times (ben)$ and 0.59 for $(L^2) \times (ben)$. When both interactions are included, the \bar{R}^2 is 0.67. When $(\Delta\pi) \times (ben)$ is included in the regression, the separate $(\Delta\pi)$ and (ben) coefficients are insignificant. The data do, however, suggest a direct effect of L^2 : it helps explain the change in the NAIURU even controlling for $(L^2) \times (ben)$.

The last column of table 4.4 presents a particularly successful combination

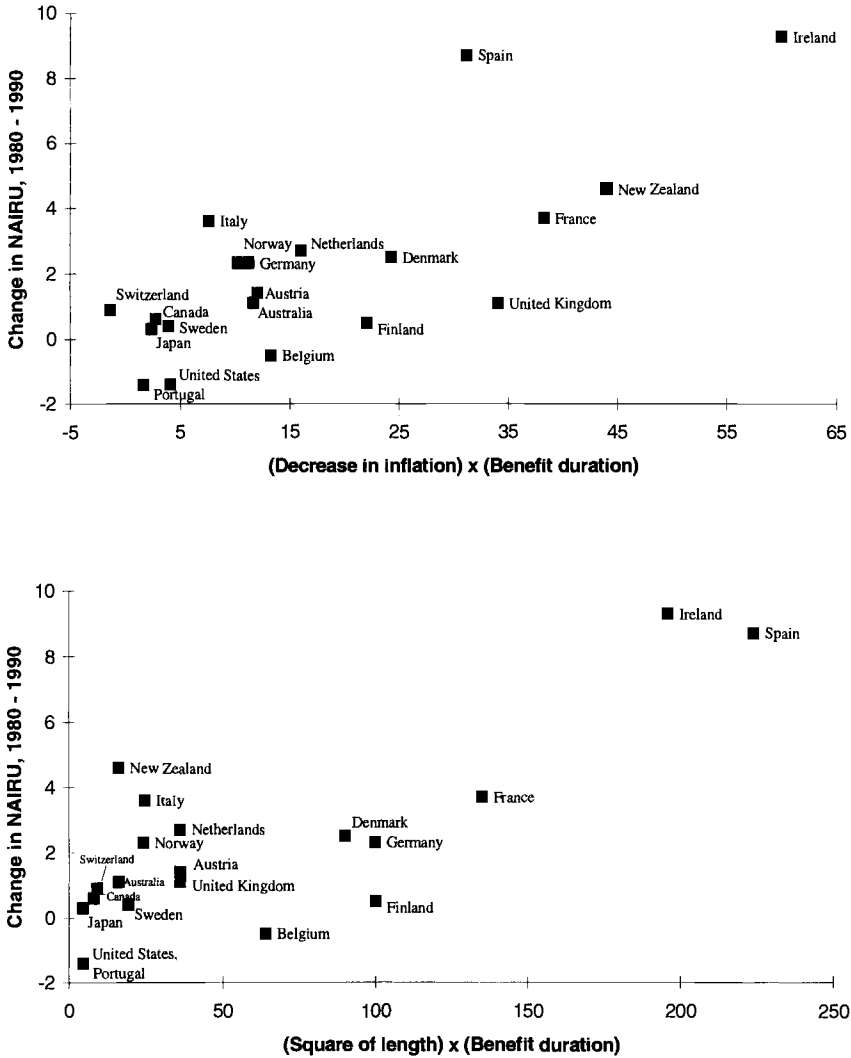


Fig. 4.4 The interaction between disinflation and benefit duration

of variables: L^2 and $(\Delta\pi) \times (ben)$. The t -statistics for these variables are 4.0 and 4.2, and the R^2 is 0.75. Figure 4.5 shows the close relationship between the fitted and actual values of the change in the NAIRU. With twenty observations, I cannot draw firm conclusions about which specification is best. (A priori, there is no obvious reason that L^2 affects unemployment directly while $(\Delta\pi)$ interacts with (ben) .) Nonetheless, a broad conclusion is robust: the explanatory power of macropolicy variables increases greatly when we account for interactions with benefit duration.

I have also explored the interactions between disinflation and the other labor

Table 4.4 Interactions between Disinflation and Labor Market Variables

Dependent Variable: Change in NAIRU from 1980 to 1990						
Constant	-0.142 (0.627)	0.165 (0.550)	-0.493 (1.428)	-1.451 (1.258)	-0.367 (0.545)	-1.217 (0.537)
(Inflation decrease) × (benefit duration)	0.131 (0.026)		0.112 (0.065)		0.072 (0.031)	0.092 (0.022)
(Length squared) × (benefit duration)		0.034 (0.006)		0.008 (0.018)	0.022 (0.008)	
Inflation decrease			0.131 (0.188)			
Length squared				0.093 (0.057)		0.084 (0.021)
Benefit duration			-0.069 (0.506)	0.450 (0.410)		
\bar{R}^2	0.552	0.590	0.529	0.605	0.669	0.754

Note: Standard errors are in parentheses.

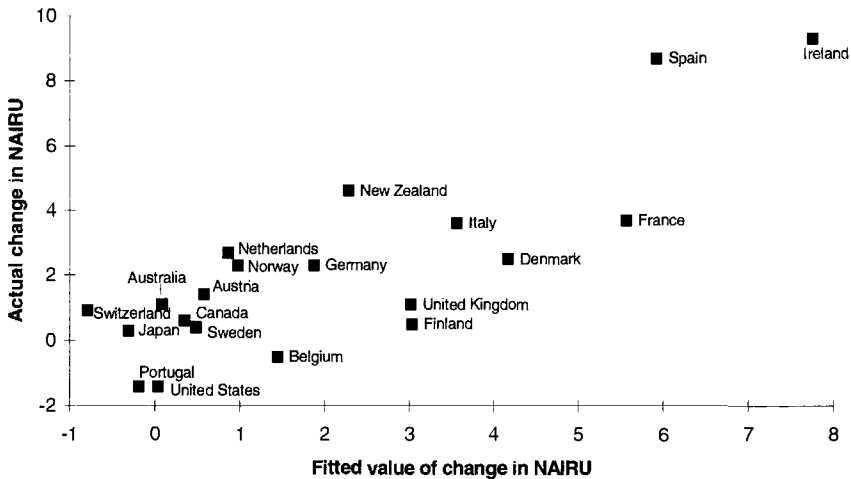


Fig. 4.5 Fitted and actual values of the change in the NAIRU. Independent variables: (decrease in inflation) × (benefit duration) and square of length

market variables that Layard et al. measure. In most cases, these interactions do not help explain changes in the NAIRU once we control for the direct effects of disinflation. One exception is the interaction between the fall in inflation and the coverage of collective bargaining. However, even this variable adds little once we control for the interaction between disinflation and benefit duration.⁶

It makes sense that the duration of unemployment benefits is the variable that interacts most strongly with disinflation. In some hysteresis theories,

6. A simple regression of the change in the NAIRU on the inflation change/union coverage interaction yields an R^2 of 0.46. However, adding this variable to the last column in table 4.4 reduces \bar{R}^2 .

workers who lose their jobs become accustomed to an unemployed lifestyle, stop searching for work, and become detached from the labor force. This effect is likely to be strongest where unemployment benefits are long-lived, making it easier to become satisfied with unemployment. My results support hysteresis theories based on these ideas.

Recall that another of the Layard et al. variables is the replacement rate for unemployment insurance. This is one of the variables that does *not* magnify the long-run effects of disinflation. As long as benefits are cut off quickly, they can be generous while they last without promoting hysteresis.

4.6 Robustness

4.6.1 An Alternative Unemployment Variable

The results so far depend on a particular approach to measuring the NAIRU, the one devised by Elmeskov. Do the results hinge on this choice, or do they hold for other reasonable approaches? Elmeskov estimates the NAIRU with data on unemployment and inflation. An alternative approach (e.g., Mankiw 1994) is simply to smooth the univariate unemployment series. Following this approach, I used the Hodrick-Prescott filter to derive a trend-unemployment series for each country. (I set the HP parameter to 100, a conventional value for annual data.) I then redid my regressions with the change in the HP-filtered variable from 1980 to 1990 as the dependent variable.⁷

Table 4.5 presents a sample of the results. They are qualitatively the same as when Elmeskov's procedure is used to measure the NAIRU. The coefficients and \bar{R}^2 are smaller than before, but only moderately; for example, \bar{R}^2 drops from 0.75 to 0.62 in the equation with L^2 and $(\Delta\pi) \times (ben)$. The lower \bar{R}^2 may reflect greater measurement error, since the HP-filter uses less information to estimate the NAIRU than does Elmeskov. In any case, my basic message does not depend on Elmeskov's procedure.

4.6.2 A Change in Timing

Any measure of the NAIRU is imperfect. In general, measurement error in the dependent variable does not cause bias in my regressions. Problems may arise, however, if the error is correlated with cyclical unemployment—if cyclical fluctuations are not completely filtered out of the NAIRU. Since disinflation causes cyclical unemployment, a cyclical component in the error could bias my estimates of the effects of disinflation. This problem might arise with either Elmeskov's NAIRU variable or the HP variable.⁸

7. I use OECD standardized unemployment series for countries where they exist, and local unemployment series for other countries. Unemployment data from 1975 to 1994 are used to construct the filtered series.

8. There is, however, no clear reason that the bias goes in a particular direction. If the measured NAIRU contains a cyclical component, the errors in the regressions are correlated with the difference in cyclical unemployment between 1980 and 1990. This causes an upward bias in the disin-

Table 4.5 Disinflation and the Change in Detrended Unemployment

Dependent Variable: Change in HP-filtered Unemployment from 1980 to 1990						
Constant	0.115 (0.811)	0.115 (0.614)	0.329 (0.551)	0.558 (0.490)	0.161 (0.508)	-0.464 (0.534)
Inflation decrease	0.294 (0.105)					
Length squared		0.091 (0.023)				0.061 (0.021)
(Inflation decrease) × (benefit duration)			0.097 (0.023)		0.054 (0.029)	0.069 (0.022)
(Length squared) × (benefit duration)				0.026 (0.006)	0.016 (0.007)	
\bar{R}^2	0.264	0.438	0.465	0.496	0.556	0.625

Note: Standard errors are in parentheses.

To address this problem, I perform versions of my basic regressions with a change in the timing. In these regressions, the dependent variable is the change in the NAIRU from 1976 to 1994, not the change from 1980 to 1990. The independent variables are unchanged: they still measure the size and speed of disinflation during the 1980s. If disinflation raises unemployment permanently, disinflation during the 1980s should affect the change in the NAIRU from 1976 to 1994. And with this dependent variable, cyclical unemployment causes less of a problem. If the measured NAIRU contains a cyclical component, the errors in the regressions are correlated with cyclical unemployment in 1976 and in 1994. The errors are uncorrelated with disinflation during the 1980s as long as cyclical fluctuations die out within four years. Under this assumption, there is no bias.⁹

Table 4.6 presents regressions with the 1976–94 change in Elmeskov's NAIRU as the dependent variable. The coefficients are similar to those when the dependent variable covers 1980–90. The fall in inflation contributes less to \bar{R}^2 , but length squared contributes just as much. Indeed, a simple regression on $(L^2) \times (ben)$ produces an \bar{R}^2 of 0.72. A likely explanation is that, for most countries, the longest disinflation between 1976 and 1994 is the same as the longest disinflation between 1980 and 1990. Consequently, the difference in timing between the left-side and right-side variables makes little difference when the latter is length squared. Changes in inflation differ considerably across the two periods, and so the difference in timing adds noise to the regression.

In any case, the results again suggest that my findings are robust.

flation coefficient if countries with larger disinflations had greater cyclical unemployment in 1990 than in 1980. It is not obvious whether this condition holds.

9. Elmeskov's NAIRU series does not extend back to 1976 for Belgium, Finland, or Ireland. For these countries, I use another of Elmeskov's natural-rate series, the one based on capacity utilization, to proxy for the NAIRU in 1976.

Table 4.6 Disinflation 1980–1990 and the Change in the NAIRU 1976–1994

Dependent Variable: Change in NAIRU from 1976 to 1994						
Constant	2.803 (1.506)	1.655 (0.969)	2.380 (0.973)	2.169 (0.620)	1.914 (0.689)	0.821 (0.882)
Inflation decrease	0.352 (0.195)					
Length squared		0.164 (0.036)				0.121 (0.035)
(Inflation decrease) × (benefit duration)			0.155 (0.041)		0.035 (0.040)	0.099 (0.036)
(Length squared) × (benefit duration)				0.051 (0.007)	0.045 (0.010)	
R ²	0.106	0.507	0.413	0.716	0.712	0.640

Note: Standard errors are in parentheses.

4.6.3 Reverse Causality?

Does the correlation between disinflation and changes in the NAIRU reflect a causal relationship? Several readers have suggested a noncausal explanation. In their story, shocks or unwise policies produced both NAIRU increases during the 1980s and high inflation at the start of the 1980s. Countries with the largest NAIRU increases also experienced the highest inflation. And high initial inflation led to large disinflations, since most countries sought low inflation during the 1980s.

My discussant, Olivier Blanchard, has suggested a test of this idea. The size of disinflation is the difference between initial and final inflation—the levels of inflation in 1980 and 1990. Shocks that cause rises in the NAIRU might also cause high initial inflation, but they do not cause low final inflation. That is, there is no apparent reason that countries with large NAIRU increases would push inflation down to especially low levels. We can therefore learn about causality by including initial and final inflation separately in the regressions, relaxing the assumption that only their difference matters. A significant coefficient on final inflation suggests that causality runs from disinflation to the NAIRU.

Table 4.7 presents the results of this test. Both initial and final inflation have significant effects on the change in the NAIRU. One cannot reject the hypothesis that these variables have coefficients of the same absolute size, as assumed before. The point estimate is larger for the final-inflation coefficient, which goes in the wrong direction for the reverse-causality story. Similar results arise when I separate the (inflation change) × (benefit duration) interaction into (initial inflation) × (benefit duration) and (final inflation) × (benefit duration). Thus the data support a causal effect of disinflation on the NAIRU.¹⁰

10. Blanchard has suggested a specific version of the reverse-causality story that goes as follows. Problems in labor markets caused a rise in the NAIRU that was spread over the 1970s

Table 4.7 The Effects of Initial and Final Inflation

Dependent Variable: Change in NAIRU from 1980 to 1990			
Constant	0.566 (1.422)	0.373 (0.715)	-1.035 (0.689)
Inflation in 1980	0.404 (0.121)		
Inflation in 1990	-0.596 (0.203)		
(Inflation in 1980) × (benefit duration)		0.153 (0.030)	0.099 (0.028)
(Inflation in 1990) × (benefit duration)		-0.222 (0.071)	-0.118 (0.063)
Length squared			0.080 (0.023)
\bar{R}^2	0.373	0.574	0.742

Note: Standard errors are in parentheses.

4.7 Discussion

This paper argues that disinflations were a major cause of the rise in OECD unemployment during the 1980s. I show that measures of the NAIRU rose more in countries with larger and longer disinflations. I also find that disinflation had a greater effect on the NAIRU in countries with long-lived unemployment benefits. These results support hysteresis theories based on decreasing job search by the unemployed.

To conclude the paper, I examine several well-known country experiences in light of my results. I then discuss policy implications.

4.7.1 Country Experiences

The United States versus Europe. Many discussions of OECD unemployment emphasize differences between the United States and Europe. During the 1980s, inflation fell as much in the United States as in many European countries, but the NAIRU did not rise in the United States. My results suggest two explanations for the U.S. case. First, unemployment benefits last only half a year, a much shorter period than in most European countries. Consequently,

and 1980s. The rise in the 1970s caused inflation to rise, because policymakers resisted rising unemployment with expansionary policy. In the 1980s, policymakers reversed course and disinflated. Countries with more severe labor market problems experienced larger rises in the NAIRU in both the 1970s and 1980s, and larger disinflations.

In this story, the ultimate cause of disinflation was the rise in the NAIRU between 1970 and 1980. Therefore, following a suggestion by John Shea, I have added this variable to the regressions. Once again, my basic results are robust: the new variable is never significant, and there is little change in the other coefficients. These results reflect the weak relationship between changes in the NAIRU across decades: a simple regression of the change in the 1980s on the change in the 1970s yields an R^2 of 0.05.

there is little hysteresis in the United States, and the cyclical downturn caused by disinflation did not raise the NAIRU. Second, the U.S. disinflation was short. The Volcker disinflation was accomplished in three years, from 1980 to 1983; many European disinflations started at the same time but lasted several years longer.

Portugal versus Spain. A number of authors, notably Blanchard and Jimeno (1995), have puzzled over the different experiences of Portugal and Spain. Their economies are similar in many ways, yet Spain experienced a large rise in the NAIRU during the 1980s while Portugal's NAIRU fell. Here, my results point to three explanations. First, Portugal's fall in inflation during the 1980s was much smaller than Spain's. (This partly reflects an increase in Portugal's inflation in the late 1980s after an earlier disinflation.) Second, in 1985 the duration of unemployment benefits was half a year in Portugal and 3.5 years in Spain. And finally, Portugal's disinflation lasted three years, while Spain's lasted eight years. (If one extends the data before 1980, Spain's disinflation lasted eleven years, from 1977 to 1988. No other country experienced a disinflation longer than seven years.)¹¹

Ireland versus Italy. As discussed earlier, Ireland and Italy had almost identical disinflations, but the NAIRU rose much more in Ireland. My results suggest a simple explanation: the difference in unemployment benefits. Benefits last indefinitely in Ireland, but only six months in Italy.

This comparison puts the Italian case in an unusual light. The NAIRU rose 3.6% in Italy, less than in Ireland but more than in most other countries. The rise in Italian unemployment is often blamed on rigid labor markets; in particular, Italy tops the OECD in most measures of legal employment protection (OECD 1994). My results suggest that the rise in Italian unemployment was *low* considering the large, slow disinflation. And this is explained by labor market *flexibility* along the key dimension of unemployment benefits. Firing restrictions do not appear important for explaining unemployment changes.

Belgium. Belgium demonstrates that long-lived unemployment benefits are not sufficient for a rise in the NAIRU. Belgium has indefinite benefits, but its NAIRU fell during the 1980s. The main explanation is that disinflation was mild: inflation fell only 3.3% (compared, for example, to 10% in France and 15% in Italy). Disinflation was also moderately quick (four years). Disinflation

11. A confusing feature of the Portuguese experience is that unemployment benefits have become more generous over time. Currently, most parameters of benefits, including duration, are similar in Portugal and Spain. This similarity led Blanchard and Jimeno to deemphasize benefits as a source of unemployment differences. But Portuguese benefits were much less generous during the mid-1980s, when disinflation occurred. Stingy benefits during disinflation prevented the cyclical rise in unemployment from affecting the NAIRU.

was mild in Belgium because inflation was low to start with: it was only 6.7% in 1980.

4.7.2 Policy

My results imply that disinflation is very costly, especially in countries with long-lived unemployment benefits. Disinflation raises unemployment not only in the short run, but also in the long run. Previous studies, including Ball (1994), underestimate the costs of disinflation because they assume only transitory losses. Unless we know that living with inflation is very costly, it may be unwise to reduce inflation.

On the other hand, if policymakers choose to disinflate, they should do so aggressively. Both this paper and Ball (1994) find that disinflation is less costly if it is quick. This paper also finds that the costs are smaller if workers are denied long-term unemployment benefits. Efforts to soften the impact of disinflation—whether through gradualism or through support for the unemployed—are counterproductive.

In many countries, policymakers disinflated during the 1980s and left a legacy of high unemployment. Can we now reduce unemployment? My findings do not answer this question. Limits on unemployment benefits prevent increases in the NAIRU if adopted *before* disinflation, but it is not clear that cutting benefits would be helpful today. Such a policy might force the unemployed back to work, but it might not. If the unemployed are detached from the labor market and their human capital is gone, cutting benefits might only increase poverty. So far, no country has reduced benefits enough to test these ideas.

My results suggest another idea for fighting unemployment: expansion of aggregate demand. If tight monetary policy has raised the NAIRU, perhaps loose policy can reduce it — and perhaps a risk of higher inflation is an acceptable price. On the other hand, it is not clear that the effects of tight and loose policy are symmetric. A demand expansion would cause a cyclical fall in unemployment, but would this reverse the hysteresis process, with workers becoming reattached to the labor force? We do not know the answer, because countries have not tried demand expansions to reduce the NAIRU.

References

- Ball, Laurence. 1994. What Determines the Sacrifice Ratio? In *Monetary Policy*, ed. N. Gregory Mankiw. Chicago: University of Chicago Press.
- Blanchard, Olivier J., and Juan F. Jimeno. 1995. Structural Unemployment: Spain versus Portugal. *American Economic Review* 85 (May): 212–18.
- Blanchard, Olivier J., and Lawrence H. Summers. 1986. Hysteresis and the European Unemployment Problem. *NBER Macroeconomics Annual* 1:15–78.

- Blank, Rebecca. 1994. Does a Larger Social Safety Net Mean Less Economic Flexibility? In *Working under Different Rules*, ed. Richard B. Freeman. New York: Russell Sage Foundation.
- Elmeskov, Jorgen. 1993. High and Persistent Unemployment: Assessment of the Problem and Its Causes. OECD Economics Department Working Paper no. 132, Paris.
- Friedman, Milton. 1968. The Role of Monetary Policy. *American Economic Review* 58:1–17.
- Krugman, Paul. 1994. Past and Prospective Causes of High Unemployment. In *Reducing Unemployment: Current Issues and Policy Options*. Kansas City, MO: Federal Reserve Bank of Kansas City.
- Layard, Richard, Stephen Nickell, and Richard Jackman. 1991. *Unemployment: Macroeconomic Performance and the Labor Market*. New York: Oxford University Press.
- Lindbeck, Assar, and Dennis J. Snower. 1989. *The Insider-Outsider Theory of Employment and Unemployment*. Cambridge: MIT Press.
- Mankiw, N. Gregory. 1994. *Macroeconomics*. 2d edition. New York: Worth.
- Organization for Economic Cooperation and Development. 1990. *Labour Market Policies for the 1990s*. Paris: Organization for Economic Cooperation and Development.
- . 1994. *The OECD Jobs Study*. Paris: Organization for Economic Cooperation and Development.
- Phelps, Edmund S. 1968. Money-Wage Dynamics and Labor-Market Equilibrium. *Journal of Political Economy* 76:678–711.
- . 1994. *Structural Slumps: The Modern Equilibrium Theory of Unemployment, Interest, and Assets*. Cambridge: Harvard University Press.
- Pissarides, Christopher A. 1994. Commentary. In *Reducing Unemployment: Current Issues and Policy Options*. Kansas City, MO: Federal Reserve Bank of Kansas City.

Comment Olivier J. Blanchard

In his paper, Laurence Ball develops five propositions:

1. Traditional explanations for the increase in the natural rate in Europe—that is, explanations based on shifts in exogenous factors from the form of bargaining, to taxes, to labor-market rigidities—are empirical failures.
2. There is, however, a strong empirical relation in the data. It is between the natural rate and disinflation: countries that have had larger disinflations have experienced a larger increase in their natural unemployment rate.
3. Furthermore, for a given disinflation, the increase in the natural unemployment rate has been larger in countries that had more generous (in the sense of longer-lasting) unemployment benefits.
4. The last two relations are causal: disinflation is the main cause of the increase in the natural rate. And the more generous benefits have been, the stronger has been the effect of disinflation on the natural rate.
5. This is strong evidence in favor of hysteresis theories, which emphasize the effects of the evolution of the actual unemployment rate on the natural rate.

Olivier J. Blanchard is the Class of 1941 Professor of Economics at the Massachusetts Institute of Technology and a research associate of the National Bureau of Economic Research.

Given my past work on European unemployment, it will come as no surprise that I like and believe Ball's conclusions. Indeed, my reaction when I read the paper is that I should have run these regressions long ago. I blame myself for not doing it, and I thank Ball for performing the task. I am, however, the discussant of this paper, and my role should be to play devil's advocate. Are the facts really that clear-cut? If so, does causality really run from disinflation to the natural rate? And, if so, do hysteresis theories provide a convincing explanation? My answers are largely yes, probably yes, and unfortunately not yet.

Are Traditional Explanations of the Increase in the Natural Rate Such Obvious Empirical Failures?

There is no question that the current official rhetoric that attributes the rise in the natural rate to labor and goods market rigidities has run far ahead of the evidence. The worst culprit here may be *The OECD Jobs Study* (OECD 1994). The study has two parts. The first is composed of two long "annexes," part 1 and part 2, which do a remarkable job of presenting and analyzing the available micro- and macro-evidence on all relevant aspects of labor markets, from the role of reallocation and relative shifts in demand, to the role of wage setting, to the role of unemployment-benefit systems, to the role of taxes, and so on. The second is the official report itself, which could have been (and may well have been) written independently of the two annexes, and singles out labor market flexibility as the key to achieving lower unemployment. The contrast between the carefully argued conclusions of the annex and the simple message of the official report is simply jarring.

It is also true that formal econometric panel studies of OECD countries have had limited success in explaining either the increase in the natural rate over time or cross-country differences in current unemployment rates. The evidence is reviewed in a recent paper by P. N. Junankar and Jakob Madsen (1995). Junankar and Madsen estimate unemployment equations for a panel of twenty-two OECD countries for the years 1960–85 and examine the fit of four different specifications based on four influential theories, by Bruno and Sachs in the 1970s, by Layard and Nickell in the early 1980s, by McCallum and by Phelps more recently. They show the very limited success of these regressions, in terms of fit, subsample stability, and so on. More importantly, they show that, in the postsample years 1986–91, a second-order autoregressive process for the unemployment rate, with country effects, has substantially lower mean square error than all four structural specifications.

The state of the art in such unemployment regressions may be a recent paper by Jackman, Layard, and Nickell (1996), written for a recent OECD conference. The results of estimation of their basic specification for two time periods and twenty countries are reproduced in the first column of table 4C.1. To get a sense of what these results imply, I give the values and the contributions of the explanatory variables for two countries, Spain and Portugal, and show how the estimated equation explains the difference between unemployment rates

Table 4C.1 Unemployment Rate Regressions from Jackman, Layard, and Nickell (1996)

Unemployment Rate Equals	Spain		Portugal	
	Value	Contribution	Value	Contribution
-0.22 × constant		-0.2		-0.2
+0.11* × replacement rate	80	8.8	60	6.6
+0.35 × benefit duration	3.5	1.2	0.5	1.7
-0.09 × active labor policy	3.2	-0.3	5.9	-0.5
+4.14* × union coverage	3	12.3	3	12.3
-2.80* × union coordination	2	-5.6	2	-5.6
-2.82* × employer coordination	1	-2.8	2	-5.6
+0.10 × employment protection	19	1.9	18	1.8
-0.64 × change in inflation	-1.24	0.8	-2.74	1.7
+0.54 × dummy 1989-94				
Implied unemployment rate 1983-88		16.1		12.2
Actual unemployment rate 1983-88		19.6		7.6

Source: Jackman, Layard, and Nickell 1996, tables 2 and 3.

Notes: The dependent variable is the average unemployment rate for 1983-88 and for 1989-94, for twenty OECD countries. There are thus forty observations. $R^2 = 0.74$. Many of the variables on the right-hand side are ranking indices. The "change in inflation" is the average annual change in inflation during the corresponding six-year period, and is there to capture the difference between the actual unemployment rate and the natural unemployment rate.

**t*-statistic above 2.

in the two countries. (I see Spain and Portugal as providing an acid test of any theory of unemployment [Blanchard and Jimeno 1995]: Spain has the highest unemployment rate in the OECD, Portugal one of the lowest.)

At first glance, the regression does a good job of fitting cross-country differences. R^2 is 0.74. The regression also appears to explain the movement of unemployment over time, at last since the mid-1980s: the time dummy for the second period, 1989-94, is neither large nor significant. The statistically and economically significant variables are the generosity of the unemployment-benefit system (in contrast to Ball's results, however, the variable that is significant is the replacement rate, not the duration of benefits), and the structure of bargaining (union and employer coordination). Labor market rigidities (employment protection) play only a marginal role. Tax rates, which figured pre-eminently in earlier studies, are altogether absent. Note also the absence of variables such as the minimum wage, or proxies for the intensity of reallocation and structural change, which figure so much in current discussions.

But the limits of this regression are also clear. This specification is surely unable to explain the increase in unemployment from the early 1970s to the mid-1980s, the most important puzzle to be explained: most of the explanatory variables have moved the wrong way. And the application to Spain versus Portugal gives reason to doubt that robust structural relations have been uncovered. The regression predicts a difference in unemployment rates of only 4%, in

contrast to an actual difference of 12%. Most of the difference is accountable to a difference of 1 in the “employer coordination” index (which ranges from 1 to 3), obviously a difficult variable to measure.

To summarize, I agree with Ball. Economists have been largely unsuccessful at isolating robust relations between the increase in unemployment over time and shifts in exogenous factors. It is surely justifiable to look for other mechanisms.

Has Disinflation Caused the Increase in the Natural Rate?

In contrast, the facts on disinflation and the change in the unemployment rate emphasized in the paper are, I believe, very robust. The main issue is whether correlation should be interpreted as causality. When I discussed the paper at the conference, my comments focused primarily on this issue. I suggested the following alternative interpretation of the data:

- In contrast to Ball’s interpretation, the increase in the natural rate has been due to exogenous factors in all countries.
- Countries that had the largest increase in the natural rate in the 1970s also had the largest increase in the 1980s.
- Countries were slow to allow the actual rate to adjust to the new, higher, natural rate. Thus countries that had the largest increase in the natural rate in the 1970s also had the highest rate of inflation at the end of the 1970s.
- All countries now have low inflation. Thus countries that had the highest rate of inflation at the end of the 1970s have had the largest disinflation.
- It follows that countries that have had the largest disinflation are also the countries where the natural unemployment rate increased the most in the 1980s. But the relation is spurious. Or put another way, the increase in the natural rate is what has caused the size of the inflation, and thus the size of the disinflation, not the other way around.

This story may be challenged on various grounds. But it is a logically impeccable alternative to Ball’s interpretation. Can the two alternative interpretations be told apart? At the conference, I suggested one way in which this might be done. Decompose disinflation as inflation in 1990 minus inflation in 1980, and allow the two inflation terms to enter with separate coefficients. Under Ball’s hypothesis that disinflation matters, the two terms should come in with coefficients equal but of opposite sign. Under the alternative hypothesis, only inflation in 1980 should matter, not how low governments decided to push inflation down at the end of the 1980s.

I was not optimistic that this would work. Ball has carried it out, and the results are reported in table 4.7. It works like a charm: the coefficients are nearly equal and of opposite sign. I cannot think of alternative stories for reverse causality.

Can Hysteresis Theories Explain the Results?

Do hysteresis theories provide a satisfactory explanation for Ball's results? At some general level, yes. Hysteresis theories of unemployment were developed precisely to explain why disinflation and high actual unemployment can lead, at least for some time, to an increase in the natural rate of unemployment.

Let me briefly review these theories. Most give a central role to long-term unemployment: high prolonged unemployment leads to a high proportion of long-term unemployed.

This affects labor supply. The long-term unemployed adapt to unemployment. Some give up looking for work, because they find the probability of getting work too small to justify intensive search. They find ways of surviving, often by relying on the other earners in the family. They return home. In short, they adjust—not happily, but they adjust—to unemployment. And, although they might be formally looking for work, and therefore be classified as unemployed, many no longer effectively are, and, therefore, they put very little pressure on wages. This leads to a higher natural rate of unemployment.

On the labor-demand side, firms look at the long-term unemployed as less employable than the short-term unemployed. From the point of view of firms, this may not be a major decision. In a depressed labor market, vacancies generate many applications, and firms need simple ways of ranking applicants. One simple way, once they have accounted for the objective characteristics of applicants, is to rank them according to the length of time that they have been out of work. Other things equal, someone who has been out of work for a longer time is likely to be less employable than somebody who has not, either because of intrinsic characteristics that the market has recognized, or just because work habits have deteriorated and this person might be harder to train. As a result, firms tend to hire the short-term unemployed first and the long-term unemployed next.

This is tough on the long-term unemployed, but it also has implications for wage determination and for the natural rate. It implies that for those who are still employed, labor market prospects are substantially better than the aggregate unemployment number would suggest: they know that, if they were to lose their job, they would actually be ahead of a number of people in the labor market, namely the long-term unemployed. To the extent that firms have a policy of hiring first people who have been out of work for a short time, their prospects as an employed worker are actually much better than the prospects of the typical unemployed worker, who has been unemployed for a longer period of time. As a result, the pressure of unemployment on wages is low. Put another way, the natural rate of unemployment may become quite high.

These factors point to a more general and more diffuse effect at work here, namely that society, in its many dimensions, also adapts to higher persistent unemployment. When unemployment and the proportion of long-term unemployed becomes high, society is compelled, mostly through the political pro-

cess, to make life bearable for those who are long-term unemployed. Through unemployment benefits, safety nets, real or pseudo-training programs, governments basically make sure that people do not starve. This is the normal response both from a normative and a positive point of view to high unemployment. Nevertheless, it has very much the same effect as the factors I discussed earlier, namely that, by making unemployment more bearable, it increases the natural rate of unemployment.

Are these channels plausible? Yes. Can they explain the magnitudes of the results found in the paper, the apparently large effects of disinflation on the natural rate? The honest answer is, we do not know. We have some formal models, some pieces of empirical evidence. But whether these channels can explain large and long-lasting effects of disinflation on unemployment is far from established.

In my last point, stimulated by one of the results in the paper, I explore one aspect of these models at more length.

Hysteresis and the Speed of Disinflation

Ball finds that short disinflations have less of an effect on the natural rate. He argues that this is what one would expect from hysteresis theories. A long, drawn-out recession, he argues, will lead to more long-term unemployment, to more discouraged and unemployable workers, and thus to a larger increase in the natural rate. If you have to disinflate, he concludes, it is therefore better to make it short: this will have less effect on the natural rate.

The argument is appealing. But it is not right. The shorter the recession, the deeper it is, and the higher the proportion of long-term unemployed. A short but deep recession may in fact lead to more discouraged workers, and more of an increase in the natural rate.

To make progress, consider the following simple model:

- Assume that disinflation requires n point years of excess active unemployment (i.e., counting only those unemployed who are searching). Let the length of disinflation be x years, at n/x point years of excess unemployment. Our focus is on the effects of alternative values of x .
- Assume that variations in unemployment are achieved by equal and opposite variations in hires and layoffs. Thus an increase in unemployment of 1 is achieved by hires being lower and layoffs being higher for a year, each by 0.5.
- Let U_0, U_1 denote short (less than one year) and long-term unemployment. Let e_0, e_1 denote the exit rates to employment from U_0 and U_1 , respectively.
- Let the long-term unemployed differ from the short-term unemployed in two ways. First, let their intensity of search relative to the short-term unemployed be equal to $\beta \leq 1$. Second, let the drop-out rate for the long-term unemployed be equal to γ .

Table 4C.2 Cumulative Stock of Dropouts at the End of the Disinflation, as a Function of the Size and Length of Disinflation, and the Intensity of Search β

	Large Disinflation (20 point years)		Small Disinflation (10 point years)	
	Slow (10 years)	Fast (2 years)	Slow (10 years)	Fast (2 years)
$\beta = 1.0$	1.44	2.13	0.40	0.75
$\beta = 0.5$	3.47	2.79	1.62	1.55

Let l_t and h_t be the values of layoffs and hires required to achieve the desired path of unemployment. Under the assumptions above, the equations of motion for $U_{0,t}$ and $U_{1,t}$ are given by

$$(1) \quad U_{0,t} = l_t$$

and

$$(2) \quad U_{1,t} = (1 - e_{0,t-1})U_{0,t-1} + U_{1,t-1}(1 - \gamma)(1 - e_{1,t-1}).$$

Short-term unemployment is equal to layoffs. The number of long-term unemployed is equal to those short-term unemployed who did not get a job, plus those long-term unemployed who did not get a job and did not drop out.

The exit rates from short- and long-term unemployment are in turn given by:

$$(3) \quad e_{0,t} = \frac{h_t}{U_{0,t} + \beta U_{1,t}}$$

and

$$(4) \quad e_{1,t} = \frac{\beta h_t}{U_{0,t} + \beta U_{1,t}},$$

where the number of unemployed is adjusted for their search intensity.

Let me measure the increase in the natural rate as the cumulative sum of workers who give up searching as a result of the disinflation. (Thus, I am assuming that they will still be counted as unemployed in official statistics, although they are in fact not searching anymore.) Denote this sum by S_t .

Table 4C.2 reports the value of S when disinflation ends. It does it for a large and a small disinflation (the proportion of long-term unemployment is nonlinear in the level of unemployment, so that the size of disinflation matters). In each case, it looks at both a slow (ten years) and a fast (two years) disinflation, and does it for two values of the relative search intensity of the long-term unemployed, $\beta = 1.0$ and $\beta = 0.5$. The steady-state flows of layoffs and hires are assumed to be equal to six so that the steady-state values of U_0 and U_1 are equal to six and zero, respectively.

The results make clear that the larger the disinflation, the larger the increase in S . But they show that the effect of length is ambiguous. When $\beta = 1.0$, then short and deep recessions lead to a larger increase in the natural rate. When $\beta = 0.5$, long and shallow recessions, which allow the stock of long-term unemployment to build up, lead to a larger increase in the natural rate.

Thus, if there is hysteresis, should central banks go for short and strong disinflations? The answer from the table is ambiguous. It could be fun to examine this issue at more length, and the model above may provide a starting point.

References

- Blanchard, Olivier, and Juan Jimeno. 1995. Structural unemployment: Spain versus Portugal. *American Economic Review* 85: 212–18.
- Jackman, R., R. Layard, and S. Nickell. 1996. Combating unemployment: Is flexibility enough? Paper presented at the OECD conference, *Interactions between Structural Reform, Macroeconomic Policies, and Economic Performance*, Paris. January.
- Junankar, P. N., and Jakob Madsen. 1995. Unemployment in the OECD: Models, myths, and mysteries. Working paper 278, Australian National University.
- Organization for Economic Cooperation and Development. 1994. *The OECD Jobs Study*. Paris: Organization for Economic Cooperation and Development.

II

Improving the Conduct of Monetary Policy

This Page Intentionally Left Blank