

STABILIZATION POLICY: A RECONSIDERATION

JANET L. YELLEN and GEORGE A. AKERLOF*

Should stabilization policy be a macroeconomic priority? Most central banks consider it a goal, but Robert Lucas has contended that policies to stabilize output, even if effective, yield negligible welfare gains. This article critiques Lucas's argument. Existing literature suggests nontrivial benefits from stabilization due to nonlinearity of the social welfare function and of the short-run Phillips curve. Our analysis and examination of the evidence from periods of prolonged high unemployment also suggest further significant gains to stabilization since the "accelerationist" hypothesis does not seem to hold in times of very low inflation. (JEL E61, E63)

I. INTRODUCTION

In 1936 Keynes's *General Theory* explained how fiscal and monetary policy could be used to end depressions. Since that time no developed country has ever seen a downturn on the scale of the 1930s. *The General Theory* was not just a how-to book on the avoidance of depressions. It was an argument for stabilization policy itself.

The years since *The General Theory* have seen a revolt against Keynesian economics. In a revisionist mode, Milton Friedman argued that countercyclical policy cannot affect the average level of unemployment and output. Robert Lucas and Thomas Sargent (1979) went further, contending that it is not only impossible to increase average output, it is also impossible to stabilize it. More recently, Lucas (1987, 2003) has argued that policies to stabilize output, even if effective, would yield negligible welfare gains. Thus, stabilization policy should not be a macroeconomic priority.

Lucas's conclusion notwithstanding, stabilization policy has long been an explicit or

implicit objective of monetary policy in most industrial countries, even including those countries with inflation targets. The volatility of output has, in fact, declined in most major industrial countries since the mid-1980s, and monetary policy arguably deserves at least partial credit (see Bernanke 2004). Mirroring practice, monetary policy research commonly takes it as "given" that, along with price stability, stabilization policy—the minimization of squared deviations of output around potential—is an appropriate policy objective (see, for example, Clarida et al. 1999). In this article we explore the economic rationale for stabilization as a policy goal, concluding that it does, in fact, deserve high policy priority. We survey a large body of literature that critiques the validity of key assumptions in Lucas's argument. We also offer suggestive evidence that stabilization policy can significantly reduce average levels of unemployment by providing stimulus to demand in circumstances where unemployment is high but underutilization of labor and capital does little to lower inflation. A monetary policy that vigorously fights high unemployment should, however, also be complemented by a policy that equally vigorously fights inflation when it rises above a modest target level. The Federal Reserve Act thus wisely enunciated

*This article forms the basis for Janet Yellen's presidential address to the Western Economic Association, delivered July 1, 2004m in Vancouver, British Columbia.

Yellen: President and CEO, Federal Reserve Bank of San Francisco, and Eugene E. and Catherine M. Trefethen Professor of Business and Professor of Economics, University of California at Berkeley, 101 Market Street, San Francisco, CA 94105. Phone 1-415-974-2121, Fax 1-415-974-2113, E-mail janet.yellen@sf.frb.org
Akerlof: Koshland Professor of Economics, University of California at Berkeley, 549 Evans Hall #3880, Berkeley, CA 94720-3880. Phone 1-510-642-5837, Fax 1-510-642-6615, E-mail akerlof@econ.berkeley.edu

ABBREVIATIONS

CPI: Consumer Price Index
NAIRU: Non-Accelerating Inflation Rate of Unemployment
OECD: Organisation for Economic Co-operation and Development

price stability and maximum employment as twin goals for monetary policy.

II. THE CASE AGAINST STABILIZATION POLICY

Macroeconomic analysis typically assumes that social welfare depends negatively on both inflation (above a modest target level, here assumed zero) and unemployment (above some minimum, socially efficient level). For example, a standard social welfare function is the discounted sum of period losses (L_t) of the form (see, among others, Barro and Gordon 1983, pp. 592–93):

$$(1) \quad L_t = a(u_t - [1 - k]u^*)^2 + b\pi_t^2,$$

where u_t and π_t are the unemployment and inflation rates in period t , and u^* is the natural rate of unemployment. The coefficient k is positive, reflecting the desirability of unemployment below the natural rate. Because real economies deviate in many respects from perfect competition, the natural rate of unemployment is likely to exceed the socially optimal unemployment rate. For example, with monopolistic competition, goods are underproduced because they are priced above marginal cost, so “potential output” is inefficiently low and “equilibrium unemployment” is too high.

Standard macroeconomic analysis additionally assumes that inflation is determined by an expectations-augmented, accelerationist Phillips curve of the form

$$(2) \quad \pi_t = \pi_t^e - f(u_t - u^*) + \varepsilon_t,$$

where π_t^e is the expected inflation rate at time t (with expectations formed at $t - 1$), and ε_t captures supply shocks to the Phillips curve at t . Reflecting the inflationary effects of tighter labor markets, f' is positive; reflecting the definition of u^* , the natural rate of unemployment, as the rate of unemployment where actual and expected inflation match, $f(0)$ is equal to 0. In this formulation u^* is the unique unemployment rate where inflation is stable. This Phillips curve has the property that inflation rises (the price level accelerates) when u is below u^* : Because actual inflation exceeds expected inflation, with adaptive expectations, inflation expectations rise over time and are factored into wage and price setting. In contrast, when unemployment exceeds the natural rate, actual inflation falls short of expected inflation, so inflation declines

over time as expectations adjust downward toward reality. With chronic high unemployment, deflation is inevitable.

To reach the conclusion that the gains from stabilizing output are trivially small, Lucas considers a representative agent with a stochastic consumption stream whose welfare is given by the discounted sum of instantaneous utilities, which depend only on consumption and are characterized by constant relative risk aversion. Thus, welfare is

$$(3) \quad E \left\{ \sum_{t=0}^{\infty} \left(\frac{1}{1 + \rho} \right)^t \frac{c_t^{1-\gamma}}{1-\gamma} \right\},$$

where γ is the coefficient of relative risk aversion, and ρ is the subjective discount rate.

Lucas shows that the gain from eliminating consumption volatility, measured as a fraction of average consumption, is approximately $(1/2)\gamma\sigma^2$, where σ^2 is the variance of the log of consumption about its trend. For values of γ commonly used by researchers, the welfare gain from eliminating consumption volatility of the magnitude experienced in the United States during the postwar period would be minuscule—on the order of one-twentieth of a percent of average consumption.¹ This result is not surprising. With differentiable utility it takes large variations in most variables to have significant effects on welfare, and the percentage variation in consumption over the business cycle is now small.²

Lucas's calculation of very low returns from further stabilization of output results from four separate assumptions regarding the nature of the macroeconomic loss function (1) and the Phillips curve (2).³

First, Lucas's assessment of the potential gains from stabilizing consumption ignores possible relationships between the volatility of output and the volatility of inflation, captured in the term $b\pi_t^2$ in the standard loss function. Policies to stabilize unemployment (and

1. See Lucas (2003), p. 4. Lucas notes that values of γ between 1 and 4 are commonly used in macroeconomics and public finance applications. Lucas's baseline calculation assumes $\sigma = 0.032$ and $\gamma = 1$, corresponding to log utility.

2. The losses also rise with the degree of risk aversion.

3. Romer (2001) provides an excellent discussion of the assumptions underlying Lucas's findings and the implications of Lucas's argument. In the tradition of modern macroeconomics textbooks, however, Romer fails to mention the possibility that the long-run Phillips curve may not always and everywhere be vertical, as emphasized in this article.

consumption) in the face of aggregate demand shocks simultaneously mitigate inflation volatility according to (2), conferring welfare benefits beyond those assessed by Lucas.⁴ In contrast, stabilizing unemployment (and consumption) in the face of supply shocks entails a policy trade-off between the volatility of inflation and unemployment (consumption). In this article we follow Lucas in ignoring the impacts of stabilization policy on inflation volatility.

Second, by considering paths of consumption that differ only in their volatility, Lucas implicitly assumes that the Phillips curve is linear in unemployment. With a linear accelerationist Phillips curve, average unemployment is identical along all unemployment paths with the same initial and final inflation. Assuming further that unemployment is just an index for consumption and varies linearly with it, stabilization policy can affect the volatility of consumption, but not its mean, as Lucas assumes.

If the short-run Phillips curve (the $f(\cdot)$ function in (2)) is nonlinear, however, paths of unemployment with the same beginning and ending inflation rate will differ somewhat in their average unemployment rates. If $f(u - u^*)$ is concave, paths with lower unemployment volatility will also enjoy lower average unemployment, higher average output, and higher average consumption, contrary to Lucas's assumption.

Lucas's third assumption relates to the degree of nonlinearity of the function (1) relating social welfare to unemployment. The loss due to consumption volatility is trivially small in part because values of the rate of relative risk aversion Lucas considers plausible imply only very modest curvature—thus, effective linearity—of the representative agent's instantaneous utility function.⁵ However, significant nonlinearity with respect to unemployment in the social welfare function could reflect ex-

treme losses in income for a small fraction of the population due to very long spells of non-employment when unemployment is high, as well as substantially different values of leisure for the marginally employed person in booms and troughs.⁶

Finally, Lucas's calculation relies on the assumption that the Phillips curve is accelerationist so that expected inflation impacts current inflation with a coefficient of unity. Such an assumption is now considered standard and is surprisingly well accepted: If all wage and price setters are rational, the coefficient on expected inflation "should be" one. However, assuming (even wishing) that wage setters and price setters are fully rational does not automatically make it so. As we argue shortly, wage and price setters have their own ideas, which led Irving Fisher (1928) to deplore their lack of rationality. If the coefficient on expected inflation in wage or price equations is less than unity when inflation is low and unemployment is high, policies to combat unemployment will reduce average levels of unemployment.

In the following sections, we examine the sensitivity of Lucas's conclusion to reasonable alterations in assumptions concerning the linearity of the loss function (1) and the nature of the Phillips curve (2). Section III examines possible reasons why near-linearity of the loss function may be violated. Section IV examines the extent to which nonlinearity of the short-run Phillips curve creates a meaningful role for stabilization policy. Finally, section V examines the possibility that the accelerationist Phillips curve simply fails to fit the facts: It reviews evidence suggesting that in long recessions, when inflation is low and unemployment is high, the Phillips curve coefficient on expected inflation is considerably less than unity.

III. NONLINEARITY IN THE SOCIAL WELFARE FUNCTION

We have reviewed the logic behind Lucas's finding that the losses from volatility in unemployment over the business cycle are likely to be small. There are several reasons why Lucas's calculation may overestimate these losses. However, these upside biases are probably overshadowed by downward biases due

4. Although it is commonly assumed, as in (1), that social welfare depends on both the mean and variance of inflation, the nature of the losses due to inflation volatility are not well understood. See Woodford (2002) for an interesting discussion.

5. Lucas notes that the losses due to consumption volatility are an order of magnitude higher using the far higher estimates of the degree of risk aversion needed to explain the equity premium puzzle. See, for example, Tallarini (2000), and Alvarez and Jermann (2000). However, as Lucas notes, not all volatility can be eliminated by stabilization policy, and not all risk aversion relates to business cycle fluctuations.

6. Lucas's use of the representative agent framework assumes in addition that households are identical and individual risk is diversifiable.

to nonlinearity in the function relating welfare to unemployment.

Modest as they are, there are two separate reasons why Lucas's estimate of the potential gains from stabilization policy could still be too high. First, smoothing of output and employment over the business cycle may not result in much additional consumption smoothing if consumers follow the life-cycle hypothesis. If rational consumers already smooth consumption in response to transitory income shocks, a systematic policy to stabilize output might result in little additional consumption smoothing.

Atkeson and Phelan (1994) have advanced a more subtle argument why welfare could be independent of output volatility. A simple version of their argument supposes that consumers experience only two states, employed and unemployed. When unemployed, individuals have low consumption and low utility (U_L); when employed, they enjoy high consumption and high utility (U_H). Expected utility is simply a weighted average of the high- and low-utility values, U_L and U_H , with the weights equal to the numbers of weeks spent employed and unemployed. In this formulation, stabilization of aggregate unemployment (or aggregate output) leaves welfare unchanged because aggregate utility depends only on the aggregate number of employment and unemployment weeks, numbers that should be totally unchanged by an alteration in the time profile of aggregate unemployment that leaves mean unemployment unchanged. As Romer (2002, p. 495) points out, Atkeson and Phelan's argument provides a justification for linearity in the relationship between social welfare and unemployment. An increase in the variance of unemployment in the Atkeson-Phelan model has the sole effect of increasing the correlation in unemployment risk across individuals. When unemployment is more variable, individuals are more likely to be unemployed when others are also unemployed and to be employed when others are also employed. Neither source of overestimate matters much to Lucas's assessment of the benefits of stabilization policy because it is so very low to begin with.

We next turn to several reasons why welfare may depend nonlinearly on unemployment, suggesting losses from output volatility that are higher than Lucas's assessment. The first possibility is that the severity of an "unemployment" week rises (U_L falls), while the util-

ity of an "employment week" increases (U_H rises), as aggregate unemployment increases. Atkeson and Phelan assume, in contrast, that the utility of an employment/unemployment week is independent of aggregate unemployment. But unemployment is arguably worse when it is higher and employment arguably less beneficial when unemployment is low. If so, the benefits from stabilizing output could be far larger than Lucas estimates.

One reason that unemployment weeks may impose greater hardship during periods of high unemployment is that they disproportionately occur in unemployment spells of long duration. If a week of unemployment is worse when it is experienced as part of a longer spell, and the share of long-duration unemployment in total unemployment rises with the aggregate unemployment rate, then welfare declines nonlinearly, not linearly, as unemployment rises. With higher unemployment, the average severity of unemployment weeks rises. Several recent articles suggest reasons why long-term unemployment may be especially bad. For example, Chetty (2004) argues that long-duration unemployment is especially costly for those who have made fixed financial commitments, for example, to buy a house. They may have to curtail consumption drastically or give up such a commitment. Carroll (1992) has emphasized that the unemployed may have especially low incomes, which means that with unemployment of long duration they have to make especially deep cuts in consumption. Carroll finds a small but nevertheless significant fraction of his sample with very large cuts in annual income.⁷

7. Imrohoglu (1989), Krusell and Smith (2002), and Storesletten et al. (2001) have used calibrated models to simulate the impact of a reduction in business cycle volatility under the assumption that consumers are unable to insure fully against idiosyncratic employment risk. The welfare costs of the business cycle, on average and for low-income, liquidity-constrained households, depend in part on the relationship between aggregate volatility and individual employment and income volatility. Krusell and Smith find that low-income, liquidity-constrained households would enjoy a gain equivalent to about a 4% increase in average consumption from the elimination of business cycle volatility. Their calculation assumes that a reduction in aggregate volatility also lowers individual variability. Storesletten and colleagues find that idiosyncratic risk varies countercyclically, amplifying the cost of aggregate volatility. They estimate average welfare gains from eliminating volatility amounting to about 2.5% of consumption—an order of magnitude larger than Lucas.

Table 1 reports the results of our attempt to determine whether long-duration spells of unemployment rise disproportionately with aggregate unemployment for a sample of Organisation for Economic Co-operation and Development (OECD) countries. The table reports (first-differenced) regressions relating the fraction of unemployment occurring in long spells of at least six months (or one year) to the aggregate unemployment rate. We included all six countries in the OECD labor force statistics database with at least 20 years of annual data. In support of the nonlinearity hypothesis, the incidence of long-duration unemployment rises significantly with the aggregate unemployment rate for Australia, Canada, Sweden, and the United States. The relationship is positive but insignificant for Japan and nonexistent for France.⁸

The obverse side of the Atkeson-Phelan argument is that the utility of employment may differ in good and bad times. In good times, with low unemployment, the marginal employee may be close to indifferent between work and leisure—induced into the labor market by overtime pay and extra perks. In contrast, the marginal employment opportunity in bad times may yield a sizable welfare surplus, as firms draw from the pool of laborers those who are especially anxious for a job. Following Ball and Romer (1990), Galí et al. (2002) have formalized the preceding argument. In their model, the first-best level of employment (and output) exceeds the economy's steady-state employment (and output) level. During booms, the economy comes closer to the optimum, whereas in contractions, the economy moves even further away. Marginal increases in employment

thus result in decreasing gains. The last hired are likely either to need the most enticement to be in the labor force, or, alternatively, they are likely to be the least productive. The function relating social welfare to employment is nonlinear. Thus, the welfare cost of above-average unemployment during a business cycle downturn exceeds the welfare gain from a symmetric period of below-average unemployment during a business cycle expansion. The net welfare loss from business cycle fluctuations is highly sensitive to the assumed elasticities of labor supply and demand. For plausible parameter values Galí et al. find that the welfare cost of the business cycle is an order of magnitude larger than Lucas estimates. For their preferred parameter values, the cost is estimated at about 1.35% of consumption (see Galí et al. 2002, p. 17).

To summarize, evidence of nonlinear variation between long-duration unemployment spells and the aggregate unemployment rate suggests that weeks of unemployment are likely to be more onerous in a trough than in a boom. Employment is correspondingly more beneficial in a bust than in a boom. Estimates of the welfare losses from the business cycle due to this latter effect alone are an order of magnitude greater than Lucas's estimate of the cost of business cycle volatility in consumption to representative agent consumers. We are beginning to identify losses from business cycle volatility that although not huge, are still not to be sneezed at.

It is worth mentioning another methodologically ingenious attempt to measure the loss in welfare due to business cycle volatility using subjective satisfaction measures. Wolfers (2003) analyzed responses from the Eurobarometer survey to the question "Taking things altogether, are you very satisfied, fairly satisfied, not very satisfied, or not at all satisfied with the life you lead?" The survey covers 16 countries from 1973 to 1988. Wolfers regressed alternative measures of life satisfaction on a country's average unemployment and inflation rates and the standard deviations of unemployment and inflation during the previous eight years. He finds that unemployment volatility undermines well-being significantly. Wolfers also tested directly for nonlinearities in the relationship between life satisfaction and unemployment and inflation by the inclusion of quadratic

8. A large number of studies have documented the procyclical character of labor market outcomes, including outcomes for disadvantaged groups. See, for example, Hines et al. (2001). We examined a variety of different labor market and socioeconomic indicators of "distress," in addition to long-duration unemployment for the United States, for evidence that outcomes vary more than linearly with unemployment. With the exception of mean family income at the 20th percentile of the income distribution, most measures, such as the poverty rate, median real family income, the Gini coefficient of income inequality, real hourly earnings, and average weekly hours, do not appear to vary nonlinearly with aggregate unemployment. Crime is also a measure of low welfare, which arguably might vary more than linearly over the business cycle. But Freeman (1994, pp. 8–12) finds only lukewarm evidence of a time-series relation between unemployment and crime. Such a relation has been rendered difficult to find because crime rates have also experienced very large shifts, both up and down, over time.

TABLE 1
The Impact of Aggregate Unemployment on Alternative Measures of Long-Duration
Unemployment in Six Countries

Country	Change in the Fraction Unemployed at Least:	Constant	Change in the Unemployment Rate	\bar{R}^2	Sample Period
Australia	6 months	-0.0008 (0.0034)	0.53** (0.31)	0.51	1979-2002
	1 year	0.0029 (0.0074)	1.55* (0.66)	0.16	1979-2002
Canada	6 months	-0.001 (0.0018)	1.25** (0.18)	0.66	1977-2002
	1 year	0.019 (0.003)	0.87** (0.30)	0.23	1977-2002
France	6 months	-0.002 (0.003)	-0.025 (0.43)	-0.04	1976-2002
	1 year	0.004 (0.006)	0.75 (0.81)	-0.005	1976-2002
Japan	6 months	-0.0005 (0.004)	1.38 (1.3)	0.005	1978-2002
	1 year	0.005 (0.004)	2.09 (1.13)	0.09	1978-2002
Sweden	6 months	0.0001 (0.002)	1.24** (0.21)	0.64	1979-2002
United States	6 months	0.0014 (0.0016)	1.70** (0.17)	0.76	1971-2002
	1 year	0.0017 (0.0033)	0.88* (0.34)	0.15	1971-2002

Notes: Dependent variable is the change in the number of individuals unemployed at least 6 months (1 year) as a fraction of the total number unemployed. Unemployment rate is total number unemployed as a fraction of the labor force. SEs in parentheses. Data from the OECD (2003b).

terms, finding strong evidence of significant nonlinearity in the satisfaction-unemployment relationship. However, the welfare benefits of reducing volatility are subject to rapidly diminishing returns. Thus, eliminating the remaining unemployment volatility in Wolfers's sample of countries would result in gains equivalent to only about a 1/4 point reduction in the unemployment rate—large relative to Lucas's estimate but much smaller than the estimate of Galí *et al.* More research is needed to check the robustness of this clever methodology.

IV. NONLINEARITY IN THE PHILLIPS CURVE

In the most standard form of the accelerationist Phillips curve, current inflation varies linearly with unemployment. In terms of equation (2), the function $f(\cdot)$ is linear so that the Phillips curve takes the form

$$(4) \quad \pi_t = \pi_t^e - \beta(u_t - u^*) + \varepsilon_t.$$

In the United States, β is commonly estimated to be about 1/2, so, as a rule of thumb, a one

percentage point rise in the unemployment rate, maintained for one year, decreases inflation by about 1/2 percentage point.

The assumption of linearity of the Phillips curve has implications for the desirability of countercyclical policy. If the Phillips curve is convex, rather than linear, the change in inflation over any interval of time depends not only on average unemployment over the interval but also on the volatility in unemployment. For paths characterized by constant expected inflation, convexity yields an inverse relationship between the mean level of unemployment and the volatility of unemployment. When unemployment is more stable, average unemployment can be at least somewhat smaller. With a convex short-run Phillips curve, stabilization policy may thus lower average unemployment.

The evidence in favor of nonlinearity of the Phillips curve is reasonably strong. Phillips (1958), for example, chose an $f(\cdot)$ function of the form $\alpha + \beta(1/u_t)$ to characterize data for Great Britain, not for theoretical reasons but because it was most consistent with his

plots of wage inflation and unemployment for the years 1861 to 1957. These graphs showed that as unemployment fell toward zero, inflation could reach very high levels; at times of high unemployment, wage inflation could become negative, but for the most part inflation bottomed out in the face of high unemployment. Lipsey's follow-up publication (1960) provides a theoretical rationale for such nonlinearity. Lipsey argued that wage inflation would not be linear in the unemployment rate even if the rate of change in wages is linear in the gap between supply and demand for labor. The reason is that the unemployment rate reflects the fraction of the labor force searching for jobs, not the excess demand for labor; the relation between unemployment and wage inflation is inherently nonlinear because as the excess demand for labor becomes very large, wage inflation would rise in proportion, but unemployment, which indexes the number of workers who are searching for jobs but do not find them, can only go to zero.⁹ Other possible reasons for nonlinearity of the Phillips curve include menu costs of changing prices, misperceptions, and monopolistic competition (see Dupasquier and Ricketts 1998 for a survey). Downward rigidity of nominal wages is another potential cause of nonlinearity in the short-run Phillips curve. We discuss this topic at considerable length later, because nominal wage stickiness not only makes the $f(\cdot)$ function nonlinear but may also reduce the coefficient on expected inflation below unity, so that the Phillips curve is no longer accelerationist (see Tobin 1972; Fortin 1996; Akerlof et al. 1996).¹⁰

Laxton et al. (1999) show that tests to discriminate among alternative functional forms of the Phillips curve suffer from extremely low power, making reliable assessment of the degree of convexity impossible. Even so, there is considerable evidence of nonlinearity. For example, Clark et al. (1996) find strong evidence of nonlinearity for the United States for 1964 to 1990. Laxton and colleagues

(1995) find evidence of nonlinearity using pooled G-7 data; Mayes and Virén (2000) find nonlinearity for all EU countries except Spain, the Netherlands, and Finland. Debelle and Laxton (1997) have taken the analysis of nonlinearity one step further. For three countries, for the period 1971–95, they have estimated the difference between the average historical rate of unemployment and the “deterministic non-accelerating inflation rate of unemployment (NAIRU),” defined as the level of the unemployment rate consistent with nonaccelerating inflation in the absence of shocks. These estimates are respectively 0.33 percentage points for the United States, 0.57 for the United Kingdom, and 0.86 for Canada (Debelle and Laxton 1997, p. 260). These estimates suggest that the volatility of output and unemployment has a nonnegligible effect on average unemployment (and output) via the nonlinearity of the short-run Phillips curve.

A simple calculation confirms the reasonableness of Debelle and Laxton's findings. Suppose we assume that π depends on $1/u$, consistent with Phillips's and Lipsey's functional form for the Phillips curve. Taylor series expansion yields a formula that approximates the trade-off between mean unemployment, \bar{u} , and the volatility of unemployment, σ_u^2 , for a given deterministic NAIRU, u^* .

$$(5) \quad \bar{u} = u^* \left(1 + \frac{\sigma_u^2}{\bar{u}^2} \right)$$

Usefully, this formula depends only on the functional form of the Phillips curve and is independent of any estimated coefficient. Substituting the actual mean and standard deviation of U.S. unemployment for the period 1971–95 for \bar{u} and σ_u in (4), we estimate that the volatility in unemployment raised average unemployment by 0.23 percentage points, a result that is similar in magnitude to Debelle and Laxton's estimate of 0.33 using an entirely different methodology based on a parametrically estimated Phillips curve.

Such estimates surely overstate the decline in average unemployment due to nonlinearity that could result from additional improvements in stabilization policy. As Lucas notes, it is unrealistic to think that stabilization policy has the potential to eliminate all variability in unemployment. However, the volatility of output and unemployment in the United States and numerous European countries has declined considerably since the 1980s—a

9. See Lipsey (1960), p. 13. Lipsey also argues that with such nonlinear relationships in each individual market, the dispersion of unemployment across markets will affect the level of wage change.

10. Convexity of the short-run Phillips curve could reflect real (rather than nominal) wage rigidity. However, with real as opposed to nominal wage rigidity, the coefficient on expected inflation should be unity, regardless of the inflation rate.

phenomenon that has been dubbed the great moderation. The formula (4) can also be used to estimate the reduction in average unemployment resulting from the great moderation in the United States. Following Stock and Watson (2003), we date the great moderation at 1984. The standard deviation of U.S. unemployment declined from 1.74 to 1.07 between the periods 1960–83 and 1984–2003, respectively. Our formula suggests that the reduction in mean unemployment due to this reduction in volatility amounted to a nontrivial 0.31. Of course, it is debatable just how much of this payoff was due to stabilization policy. Stock and Watson attribute a substantial portion of the moderation to smaller shocks, that is, “good luck.” In the view of some observers (Romer 1999; Bernanke 2004), however, monetary policy probably deserves significant credit.

In summary, the nonlinearity of the Phillips curve implies that successful stabilization policy reduces average unemployment. These gains are not huge, but then again, neither are they so very small.

V. IS THE ACCELERATIONIST HYPOTHESIS ALWAYS VALID?

The accelerationist Phillips curve depicts cyclical downturns and expansions as times when society stashes money in the bank and then draws its balance down. During a cyclical downturn, inflation falls, and with it, inflationary expectations; lower inflationary expectations imply lower inflation at any unemployment rate in the future. High unemployment during a downturn is thus an “investment,” which permits lower unemployment in the future, for any given long-run inflation target. Indeed, with both an accelerationist and linear Phillips curve, the investment pays a zero rate of return, because the trade-off between unemployment in present and future periods is exactly one for one: one extra point of unemployment now permits exactly one less point of unemployment later. Section IV showed that this trade-off is not quite one for one if the short-run Phillips curve is nonlinear, even if it is accelerationist. Section III argued that even with a trade-off between unemployment now and unemployment later that is one for one, social welfare may be higher with a smoother path of unemployment over time.

But it is also possible that the Phillips curve is not accelerationist. There may not always and everywhere be a one-for-one add-on to current inflation as inflationary expectations rise. If the add-on is less than unity, an economic downturn metaphorically puts money in the bank by lowering inflationary expectations and future inflation, but the return on the investment is negative. In this case, an extra point of unemployment now reduces unemployment later by less than a point—a negative return. If the accelerationist hypothesis is violated—which we consider especially likely when inflation is initially low—the returns to stabilization policy may be quite high.

Indeed, the most persuasive critique of Lucas’s case against stabilization policy comes if the accelerationist hypothesis is violated. In this section, we question the validity of the accelerationist hypothesis and present evidence suggesting that monetary policy can combat high unemployment at low initial inflation rates without curtailing the opportunity for low unemployment in later periods. In the words of DeLong and Summers (1988, p. 434): “Successful macroeconomic policies fill in troughs without shaving off peaks.” If so, active stabilization policy—the use of monetary policy both to combat recession and aggressively contain inflation—will reduce average unemployment and raise average output. In support of this view, we review cross-country evidence from the Great Depression and from the downturns afflicting a number of countries during the 1990s. This evidence suggests that once inflation is low, inflation decelerates by much less in the face of high unemployment than is consistent with the accelerationist thesis. If the failure to combat a prolonged recession does little to reduce inflation when it is already low, it creates little opportunity for a future, offsetting boom.

Theory

Empirical research on the Phillips curve usually imposes the restriction that the impact of expected on actual inflation is point-for-point. This restriction guarantees that the long-run equilibrium level of unemployment is independent of the rate of inflation: The long-run Phillips curve is vertical. Such an assumption seems reasonable if firms and workers are rational, in the sense that they base their decisions on real, not nominal, wages

and relative prices, and inflation expectations ultimately mirror reality.

However reasonable, the assumption that individual behavior depends on real, not nominal, magnitudes, is just that—an assumption. Modelers routinely adopt this hypothesis not because the evidence in its favor is overwhelming but rather because it is theoretically correct for rational agents to assess price and wage bargains in real terms.

But, not everyone involved in price and wage setting may always think like an economist. If so, there is the possibility that the parameters of the Phillips curve vary depending on circumstances. For example, individuals might take inflationary expectations fully into account, even incorporating cost-of-living adjustments in contracts, when inflation is high enough to be salient but not when inflation is low. Under some conditions, people may suffer from money illusion. Some employees may consider nominal wage cuts insulting or unfair, so that money wages may be sticky downward. If so, the degree of downward real wage rigidity rises as inflation declines, and the sacrifice ratio rises.

Although macroeconomic textbooks now all but universally assume an accelerationist Phillips curve, the basis for such a claim is surprisingly shaky.¹¹ Textbooks commonly point to the shifts that undoubtedly occurred in the Phillips curve as U.S. inflation rose in the 1960s and early 1970s as evidence of the accelerationist prediction that higher inflation raises inflationary expectations, shifting the short-run Phillips curve upward. Such behavior is “rational,” so it seems logical to assume that it is universal. However, when inflation is low and less salient, and wage setters are preoccupied with other problems, such as low sales, job loss, and the necessity of layoffs, they may approach wage and price decisions with a different mental frame than economists. In these circumstances, the short-run Phillips curve may shift by less than one for one with expected inflation.¹² Summarizing the macroeconomic evidence for a vertical long-run Phillips

curve, Mankiw (2001, p. c48) thus concludes that “if one does not approach the data with a prior favoring long-run neutrality, one would not leave the data with that posterior. The data’s best guess is that monetary shocks leave permanent scars on the economy.”

The basic theoretical premise underlying the accelerationist Phillips curve is that the public and economists think about inflation in the same way. Yet in surveys taken by Robert Shiller (1997), economists and the public indicated that they approach inflation with a very different mental frame, responding quite differently to a battery of questions concerning inflation. The responses to two of Shiller’s questions provide examples of the extent to which economists’ views of inflation differ from those of the general public. Most economists (90%) disagree with the statement: “I think that if my pay went up I would feel more satisfaction in my job, more sense of fulfillment, even if prices went up just as much.” Seventy-seven percent of economists completely disagree with the statement, and none fully agree. In contrast, less than half (44%) of the public disagrees with the statement. Although only 27% completely disagree, more than a quarter (28%) express full agreement (Shiller 1997, p. 37). Responses to another question provide further evidence of the distance between economists’ and the public’s respective mental frames concerning inflation: 49% of economists answered that their “biggest gripe about inflation” was that it “causes a lot of inconvenience,” and only 12% that it “hurt their real buying power.” The public’s answers were massively reversed: Only 7% named “inconvenience” as their “biggest gripe,” whereas a full 77% named their loss of “buying power” (Shiller, 1997, p. 29). Shafir et al. (1997) similarly document substantial money illusion in survey responses. They attribute pervasive money illusion to individuals’ psychological propensity to rely simultaneously on real and nominal mental frames for evaluation purposes. Partial reliance on a nominal frame reflects the “ease, universality, and salience of the nominal representation.”¹³

Such survey findings do not prove false the accelerationist hypothesis. But they raise the question why, with so little examination,

11. Fortin et al. (2002) provide an excellent survey.

12. The implications of downward nominal wage rigidity for the shape of the long-run Phillips curve have been explored by Tobin (1972) and Akerlof et al. (1996). Karanassou et al. (2003) show that a significant long-run trade-off can arise due to the interaction between time discounting and time-contingent nominal contracts even if all agents are rational and lack money illusion and there are no permanent nominal rigidities.

13. Shafir et al. (1997, p. 348). Experimental evidence by Fehr and Tyran (2001) also shows the existence of money illusion.

macroeconomists have assumed that the Phillips curve *of necessity* must take the accelerationist form. They suggest instead that the validity of the accelerationist Phillips curve must be an empirical question.

Microeconomic Evidence

In addition to survey evidence of money illusion, there is considerable microeconomic evidence that firms are reluctant to impose wage cuts on workers except in times of unusual duress for the firm. Bewley (1999) interviewed employers in Connecticut who said they would not cut money wages for fear of harming morale, except in exceptional situations where the survival of the firm was at stake. Similarly, surveys by Blinder and Choi (1990) and Campbell and Kamlani (1997) report a strong negative relationship between work morale and wage cuts. There is also much evidence—from papers using respectively different methodologies, samples, and countries—that wage changes pile up near zero when inflation is low. Such evidence has been reported by Card and Hyslop (1997), Kahn (1997), Lebow et al. (1999), and Altonji and Devereux (1999) for the United States; by Fortin (1996) for Canada; by Cassino (1995) and Chapple (1996) for New Zealand; by Dwyer and Leong (2000) for Australia; by Castellanos et al. (2004) for Mexico; by Kuroda and Yamamoto (2003a, 2003b, 2003c) and Kimura and Ueda (2001) for Japan; by Fehr and Goette (2003) for Switzerland; by Bauer et al. (2003) and Knoppik and Beissinger (2003) for Germany; by Nickell and Quintini (2001) for the United Kingdom; and by Agell and Lundborg (2003) for Sweden.

Downward nominal wage rigidity causes the accelerationist property of the Phillips curve to break down at sufficiently low inflation rates. As inflation falls, the constraint on wage cuts impinges on increasing numbers of firms and employees.¹⁴ The apparent ubiquity of downward nominal wage rigidity strongly suggests that the effect of expected inflation on wage and price bargains could become muted in times of sufficiently low inflation. But, of course, the fact that wages sometimes

do actually fall—as in the Great Depression when they fell a great deal—suggests that wage rigidity is not absolute. The behavior of wages in the Great Depression is consistent with Bewley's finding that, in the downturn in Connecticut in the early 1990s, firms resisted wage cuts, but wages did give way in the presence of sufficient "financial distress." Financial distress made workers far more accepting of wage cuts (see Bewley 1999, pp. 201–8).

Macroeconomic Evidence

We next examine cross-country macroeconomic data on the behavior of inflation in situations characterized by prolonged, abnormally high unemployment. In our view, the evidence from such episodes is grossly inconsistent with the traditional accelerationist hypothesis enshrined in modern macroeconomics textbooks. According to that view, expected inflation feeds through point for point into actual inflation regardless of the initial level of inflation, and inflationary expectations are formed as an extrapolation (via a distributed lag) of recent inflation experience. With a traditional Phillips curve, low unemployment drives actual inflation above expected inflation. With actual inflation continually in excess of expected inflation, expected inflation must, in due course rise. Because expected inflation is passed through into actual inflation one for one, actual inflation must also rise, so, over time, the price level accelerates. Conversely, high unemployment causes inflation to fall short of expectations, producing ever lower inflation—that is, accelerating deflation. We shall see that most data from long economic downturns are inconsistent with such a model of wage, price, and expectations behavior.

There is an alternative interpretation of the behavior of inflation during the long downturns we examine that *is* consistent with the accelerationist Phillips curve: Inflation expectations might not have been adaptive, reflecting an extrapolation of past inflation behavior. Instead, wage and price setters might have expected inflation (or the price level) to revert toward "normal," explaining why inflation could remain stable or even rise in spite of substantial labor market slack. This more sophisticated hypothesis is difficult to assay convincingly, but we shall offer some shreds of evidence suggesting that incomplete

14. The accelerationist property begins to break down as the average rate of money wage change approaches zero. The inflation rate at which this occurs declines point for point with the rate of productivity growth.

pass-through is a more plausible interpretation of wage and price behavior in long downturns. An interesting issue for future research is to devise a test using macroeconomic data to identify the extent of inflation pass-through in depressions while allowing for the possibility of nonadaptive inflationary expectations.

We begin by considering a model in which inflationary expectations are adaptive. In periods in which economic activity is depressed for a prolonged period, so that the unemployment rate is consistently above NAIRU, the systematic part of the driving force of the inflation process, which is $-f(u_t - u^*)$ in equation (2), is always negative. As a result, if inflationary expectations are formed adaptively, as in standard nonrational expectations models, inflation will spiral downward.

This proposition is straightforward to show under simple assumptions and can also be generalized. Suppose that the Phillips curve is of the standard accelerationist form assumed in (2):

$$(6) \quad \pi_t = \pi_t^e - f(u_t - u^*) + \varepsilon_t$$

Suppose also, for simplicity, that expected inflation is inflation in the previous period.

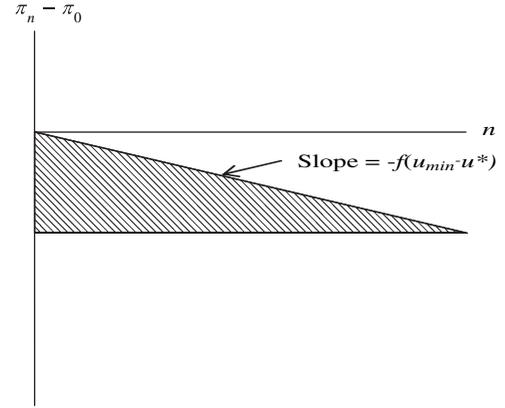
$$(7) \quad \pi_t^e = \pi_{t-1}.$$

Then mere addition shows that the expected cumulative change in inflation from the beginning of a “depression”—a prolonged period of high unemployment—which we label time 0, to any later date n is the sum:

$$(8) \quad E[\pi_n - \pi_0] = - \sum_{t=1}^n [f(u_t - u^*)].$$

Equation (8) shows that in a “depression,” where u_t significantly exceeds u^* for an extended time, the expected value of the change in inflation is negative for all n (and all possible initial dates, 0). The expected value of the cumulative change in inflation becomes increasingly negative as n increases. The cumulative change in inflation also declines as n increases at a rate at least as large as $f(u_{min} - u^*)$, where u_{min} is the minimum unemployment rate during the n periods. Graphically, with an accelerationist Phillips curve, the expectation of the cumulative change in inflation should lie in the shaded area in Figure 1. The slope of the ray in Figure 1 is $-f(u_{min} - u^*)$. This, of course, is the flip side of the accelerationist argument: With

FIGURE 1
Implications of the Accelerationist Phillips Curve for the Cumulative Change in Inflation, $\pi_n - \pi_0$, during an Episode with Unemployment above NAIRU



an accelerationist Phillips curve and adaptive expectations, low unemployment is expected to produce *accelerating* inflation. But in a depression, the opposite occurs; high unemployment should produce *decelerating* inflation, ultimately deflation. An *accelerationist* Phillips curve in a boom is a *decelerationist* Phillips curve in a depression.

Of course, the expectations process assumed in (7) lacks generality even with only adaptive expectations: It should be extended to the case in which expectations are a k -period, rather than a one-period distributed lag of past inflation. In this case, the expectation of a k -period distributed lag of n -period changes in inflation is ever-decreasing in n during periods in which the unemployment rate is continually in excess of the natural rate.¹⁵

15. For example, with two periods, with weights a and $1-a$ on periods one and two respectively, the formula becomes:

$$E \left[\frac{1}{2-a} (\pi_n - \pi_0) + \frac{1-a}{2-a} (\pi_{n-1} - \pi_{-1}) \right] = - \frac{1}{2-a} \sum_{t=1}^n [f(u_t - u^*)].$$

In the more general case of a k -period distributed lag the formula becomes:

$$E \left[\sum_{j=0}^{k-1} A_j (\pi_{n-j} - \pi_j) \right] = - \frac{1}{B} \sum_{t=1}^n [f(u_t - u^*)]$$

where $B = \sum_{i=1}^k a_i$, $A_j = \frac{(\sum_{i=j+1}^k a_i)}{B}$, $\sum_{j=0}^{k-1} A_j = 1$, and expectations are formed by the process $\pi_t = \sum_{i=1}^k a_i \pi_{t-i}$.

Accelerating Deflation in the Great Depression?

Our theorem suggests that a natural way to test the generality of the adaptive-expectations accelerationist hypothesis is to examine data on inflation during periods with prolonged high unemployment. We begin with a look at the Great Depression, a period in which, partly due to linkages of countries through the gold standard (see Eichengreen 1992), unemployment rates rose in almost all countries around the globe and remained considerably above their respective natural rates for almost a decade. Unemployment has never been anywhere near so high in any of the countries we consider either before or since, so it is clear that such joblessness could not be a simple aberration due to time-varying changes in the natural rate. Appeal to time-varying NAIRU has been used to explain apparent violations of the natural rate hypothesis in other periods, but such an appeal cannot apply for the 1930s when the rates of unemployment were so extraordinarily high.

Figure 2 summarizes evidence on the evolution of inflation during the Great Depression for 12 countries. The solid line in each graph plots the annual inflation rate (the change in the Consumer Price Index, CPI) for periods characterized by exceptionally high unemployment. The bars show the cumulative (n -period) change in the rate of inflation from a starting date (1930 or 1931) near the beginning of the depression.

The data reveal no evidence whatever in any country of declining inflation, even under conditions of massive unemployment. Every country other than Denmark experienced deflation for a period at the outset of the 1930s. The common pattern is one of rising inflation over time with positive inflation after 1933 or 1934. The absence of a pattern of declining inflation appears to hold robustly, independent of start date.

No $f(\)$ function, no matter how nonlinear, can explain why inflation declined so very little or not at all during the latter part of the 1930s if inflationary expectations are formed as a distributive lag of past inflations. Unless there were massive shifts in the Phillips curve during this period, the data suggest that the coefficient on inflationary expectations was less than unity during the later part of the Great Depression. Of course, those who believe that

wages or prices might be sticky would not find such a conclusion surprising. But such a conclusion is contrary to the microfoundations of the modern Phillips curve with adaptive expectations.

A potential criticism of our interpretation of these data is that eight or nine years is too short a period in which to expect accelerating deflation to materialize in the presence of long lags and stochastic shocks. The period of the 1930s was also unique for other special reasons, such as the United States' attempt to reflate through the National Recovery Act and its legislation to encourage unionization, which could mask a longer-term trend toward decelerating inflation.¹⁶

However, evidence for three countries (the United Kingdom, Denmark, and Sweden) reveals no pattern of decelerating inflation even after 17 years of high unemployment. These countries suffered from high unemployment continuously after 1921 because the Great Depression of the 1930s struck before they had fully recovered from the downturn of the 1920s. Figure 3 shows the behavior of annual and cumulative inflation after 1922. In each country, we see a period of deflation following the onset of both downturns, but no tendency toward the cumulative and accelerating decline in inflation predicted by the accelerationist hypothesis with adaptive expectations. Gordon and Wilcox (1981) have suggested that the data from the Great Depression roughly conform to a model in which inflation depends not on the level of the output gap but on the change in the output gap (or unemployment). Such a model seems to characterize the data in Figures 2 and 3.

Decelerating Inflation during the Downturns of the 1990s?

Because the Great Depression is so special, it is useful to look for corroborative evidence from later periods. Figure 4 presents data on the behavior of inflation for a number of OECD countries that experienced periods of prolonged unemployment in excess of their respectively estimated NAIRUs during the 1990s. The figure relies on OECD data and covers periods in which unemployment

16. Bernanke (1995) notes that governments also intervened to prevent deflation in other countries, such as France.

FIGURE 2
The Evolution of Consumer Price Inflation during the Great Depression

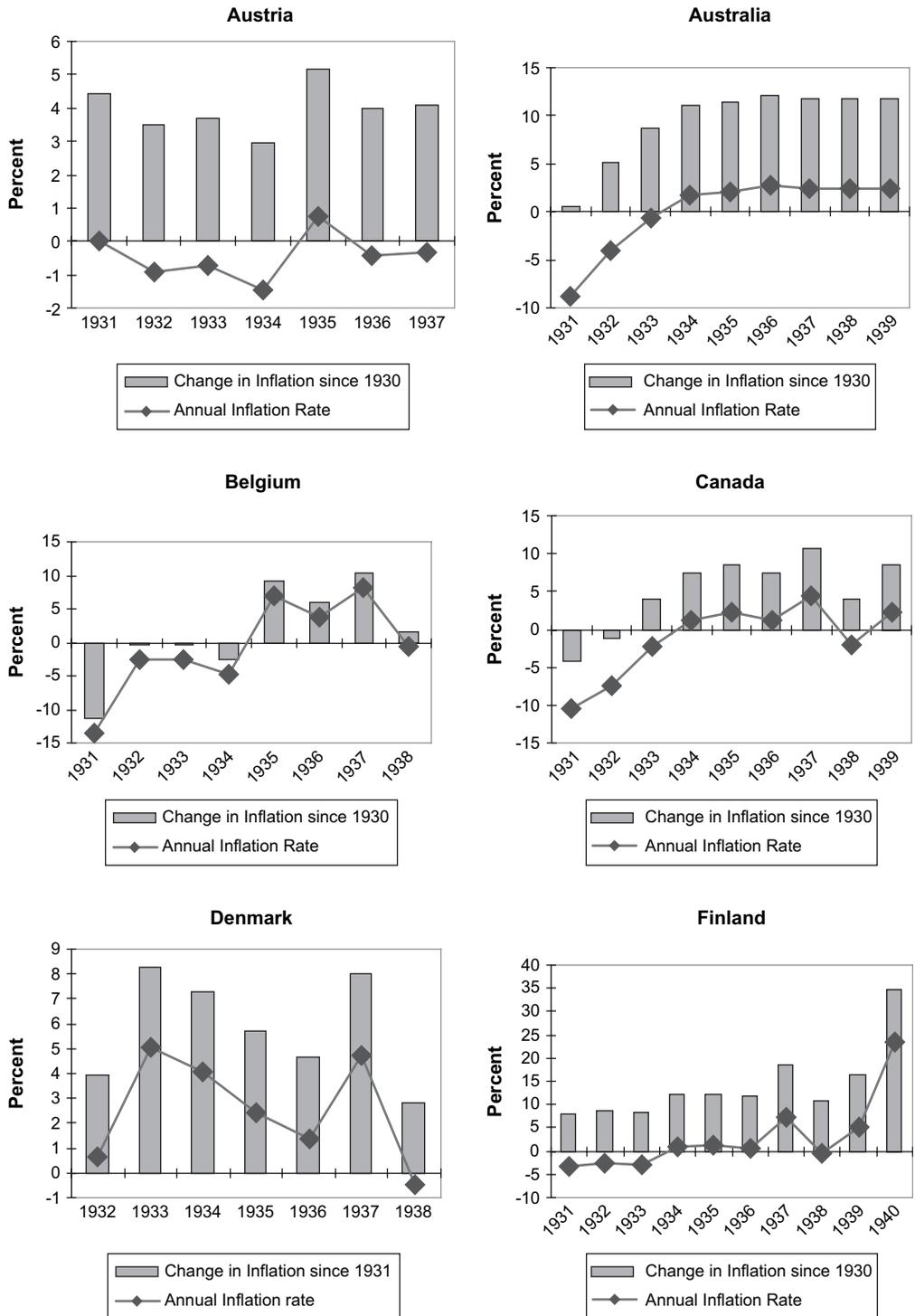
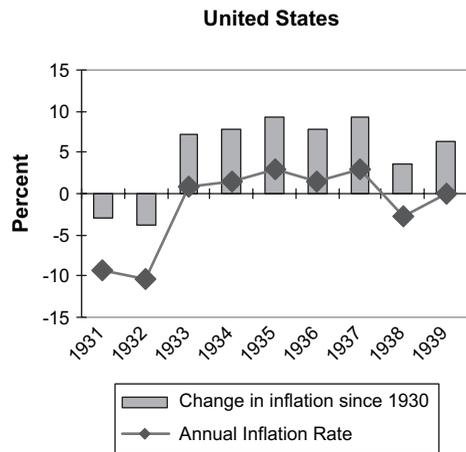
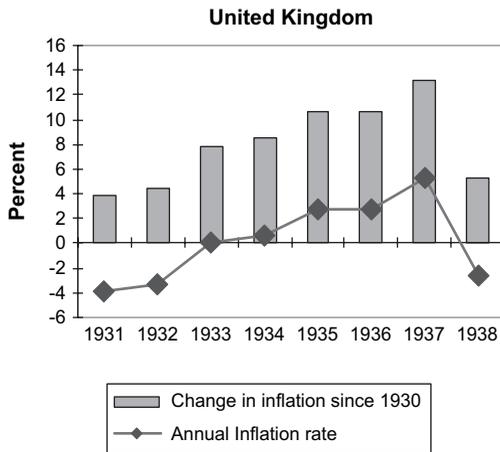
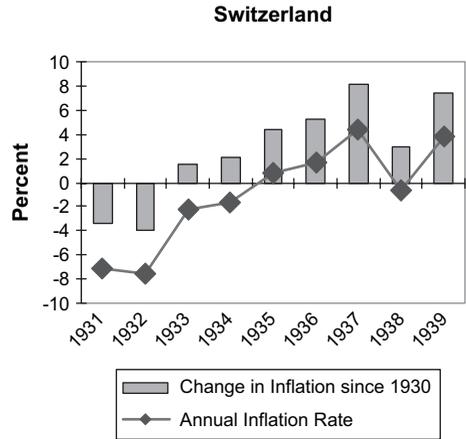
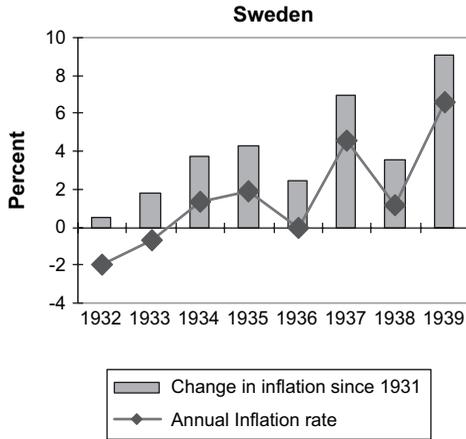
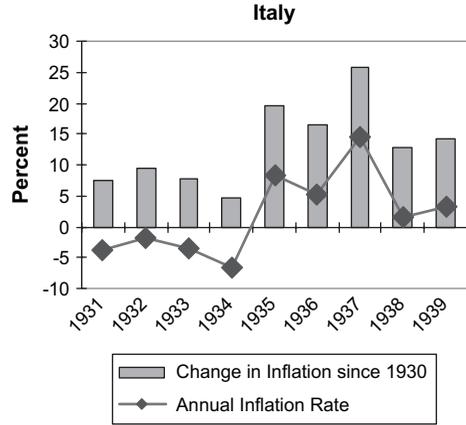
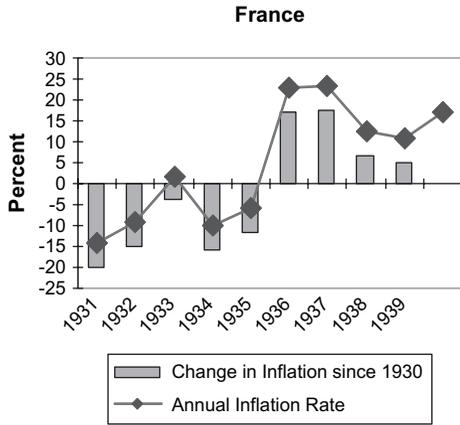
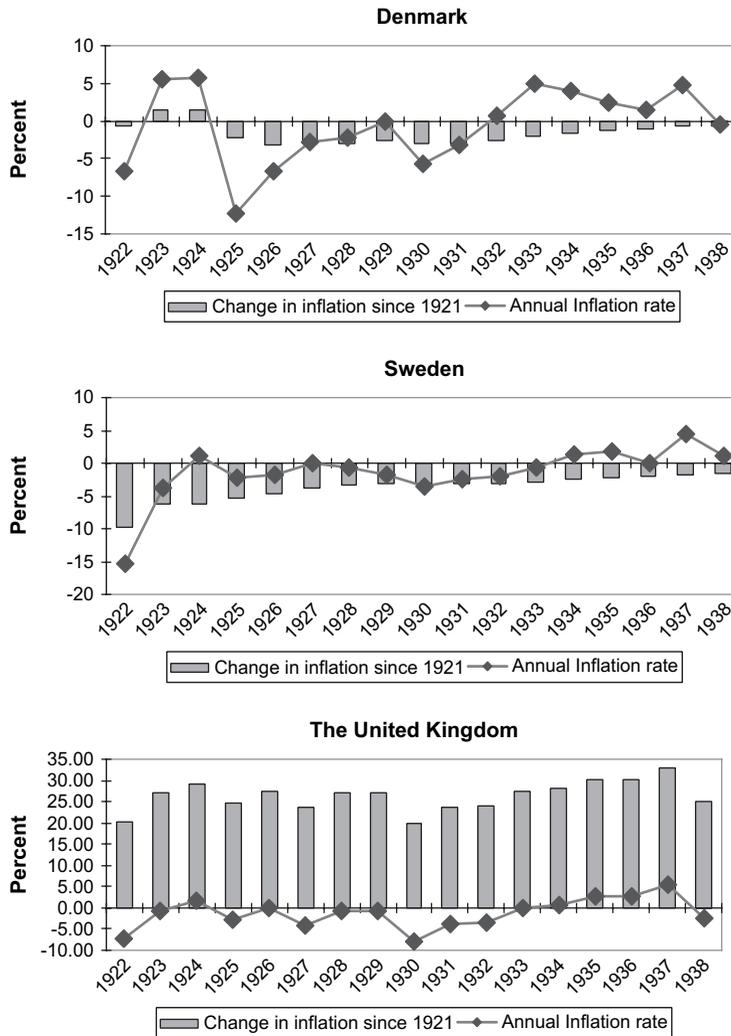


FIGURE 2
Continued



Notes: Data from the Global Financial database.

FIGURE 3
Consumer Price Inflation during the Depressions of the 1920s and 1930s



Notes: Data from the Global Financial database.

exceeded OECD estimates of the NAIUR.¹⁷ These recessions occurred in normal times, in the absence of an international gold standard. Most of the countries operated under a flexible exchange rate regime.¹⁸ The solid

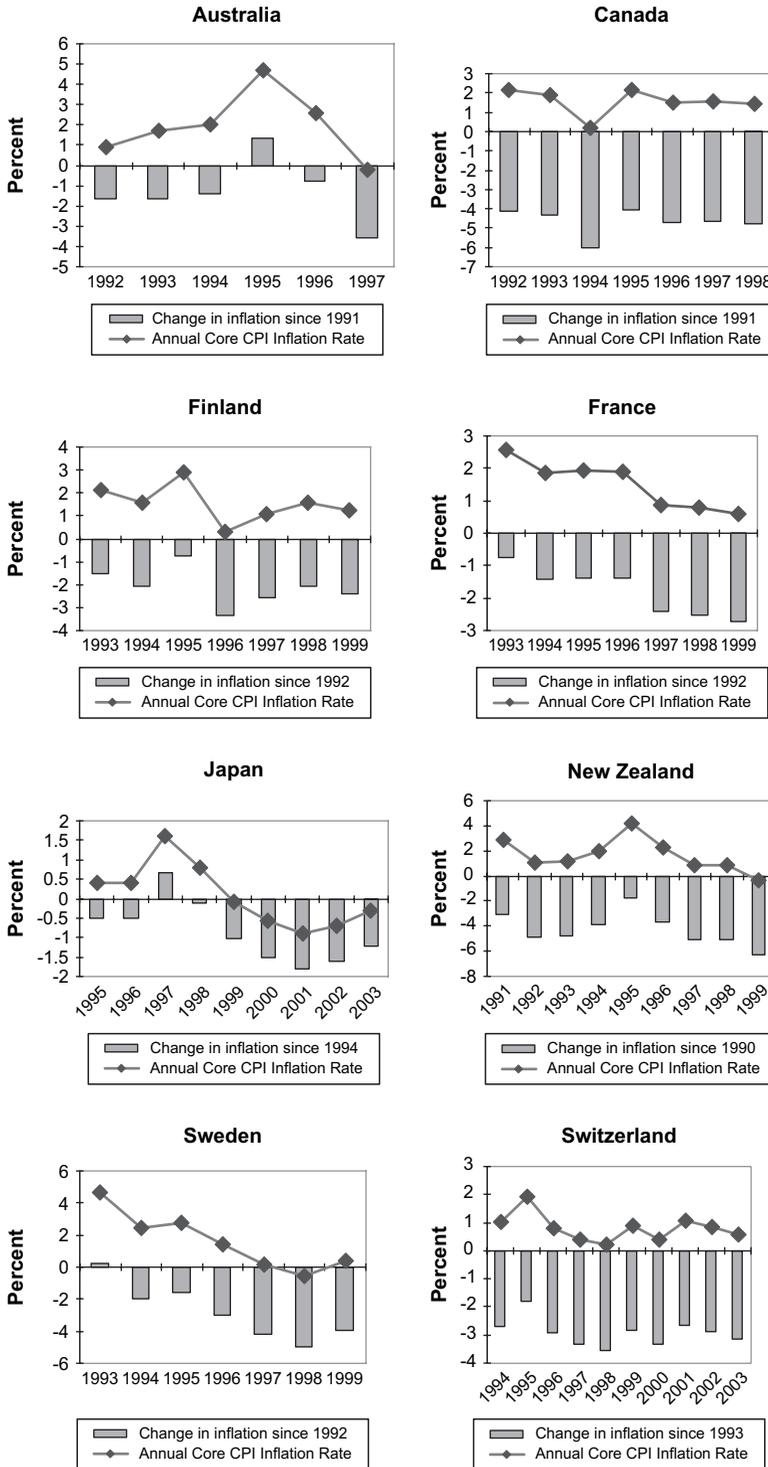
line shows the annual rate of inflation in the core CPI, and the bars again give the cumulative (*n*-period) change in inflation from an initial period in which unemployment exceeds NAIUR.

17. See OECD (2003a, p. 31) for recent NAIUR estimates and Richardson et al. (2000).

18. Australia, Canada, Japan, New Zealand, Sweden, and Switzerland had freely floating exchange rates throughout the period. France was a member of the Exchange Rate Mechanism of the European Monetary System. Finland joined the Exchange Rate Mechanism in October 1996.

The behavior of inflation, as measured by the change in the core CPI since the beginning of the respective downturn, is again largely inconsistent with the adaptive expectations accelerationist hypothesis. Two countries—France and Sweden—exhibit a pattern of almost monotonically declining inflation and

FIGURE 4
Consumer Price Inflation during Recessions of the 1990s



Notes: Data from OECD (2004). Inflation measured as the percentage increase in the CPI, excluding food and energy.

cumulatively declining n -period inflation, consistent with the accelerationist hypothesis. In Japan, also consistent with the accelerationist theory, inflation did decline reasonably consistently after 1994. Japan is the only country in which inflation actually turned negative.¹⁹ However, deflation has not significantly intensified in Japan, in contradiction to the accelerationist hypothesis. The remaining countries provide no evidence of consistently declining inflation in the face of high unemployment. Instead, consistent with the hypothesis of downward nominal wage rigidity resulting in a failure of inflation to reflect changes in inflationary expectations on a one-for-one basis, the graphs (e.g., Canada, Finland, Switzerland) suggest a tendency for inflation to stabilize in the face of high unemployment once inflation has declined to a low positive level.

The data in Figure 5 support the interpretation that downward nominal wage rigidity is to blame for the breakdown of the adaptive-expectations accelerationist hypothesis. Figure 5 presents data on various measures of wage inflation during the 1990s recessions for those countries for which the OECD maintains a wage series. In the basic Phillips curve relationship, the one-for-one pass-through of expected inflation into actual inflation works via wage bargaining. Patterns of wage inflation provide a cleaner test for one-for-one pass-through than patterns pertaining to price inflation, which depend on productivity developments and other supply factors, in addition to wages. Figure 5 reveals no consistent tendency for wage inflation to decelerate in the face of excess unemployment. The general pattern instead is for average wage changes to remain positive, roughly stabilizing at a low level. The only country in which wages are observed to decline is Japan, where bonuses enhance downward wage flexibility.

Other analysts have similarly rejected the accelerationist model based on tests using time-series data. Fair (2000) strongly rejects the accelerationist model for U.S. data by testing restrictions that the accelerationist hypothesis places on inflation dynamics. Estimating the Phillips curve (in first difference form) Fair finds that changes in inflation depend on the lagged price level. This suggests some form of money illusion: as if the current

level of prices (and/or wages) puts a damper on the extent to which high unemployment will cause a reduction in inflation (Fair 2000, p. 70). We have employed a slightly different strategy with a similar finding. King and Watson (1994, p. 163) present evidence of a long-run trade-off between unemployment and inflation, although they also find this trade-off to be greater earlier than later in the late postwar period. Lundborg and Sacklén (2001) estimate a nonvertical long-run Phillips curve for Sweden. Brainard and Perry (2000) find that the coefficient on expected inflation in the Phillips curve varies inversely with inflation.

The evidence strongly suggests that at times of low inflation and high unemployment, the coefficient on expected inflation in wage and price equations is less than unity as long as inflationary expectations are adaptively formed. In this case, there is a long-run trade-off between inflation and unemployment at low inflation rates.

Our reading of these pictures is in agreement with the judgment of others who have examined inflation data for the same period. For example, in a recent assessment of inflation persistence in the euro area, the OECD (2002, p. 163) concluded that “it appears to be a generalized phenomenon that inflation has risen in countries with positive cumulative output gaps but has not fallen in those with negative cumulative gaps. This feature of the data could reflect the presence of nominal rigidities that are hampering inflation adjustment in countries where activity is weak.”

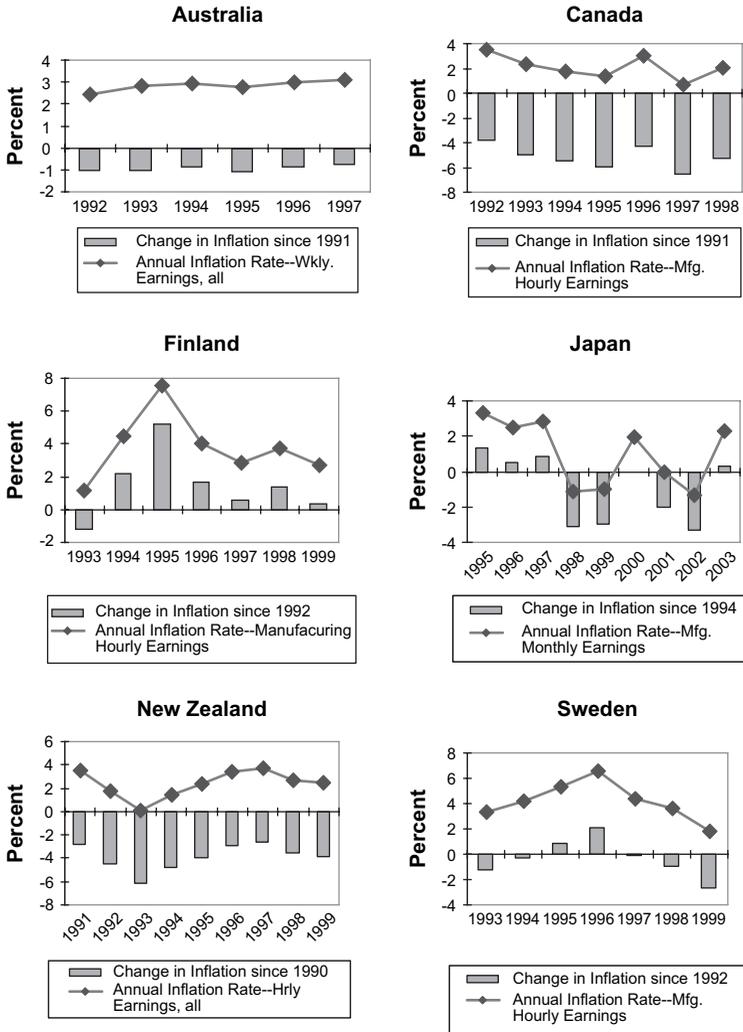
An Alternative Interpretation of the Data

Although Figures 2 to 5 suggest that an accelerationist Phillips curve with *adaptive* expectations cannot explain inflation either during the Great Depression or during some prolonged downturns in the 1990s, there is another possible interpretation of the data.²⁰ Conceivably, inflation expectations during the Depression and these more recent long recessions reflect the view that the level of prices (and/or inflation) would eventually return to normal. Because the absolute price level took

19. The uptick in inflation in Japan in 1997 reflects an increase in the consumption tax.

20. Sargent (1971) long ago pointed out that the appropriate identifying restriction on the sum of coefficients on lagged inflation in the traditional Phillips curve should depend on the process by which inflation (and inflation expectations) was actually generated during the particular period being studied.

FIGURE 5
Wage Inflation during Recessions of the 1990s



Notes: OECD (2004), various wage inflation measures, as indicated.

a downward dive in the early 1930s in virtually all countries, expected inflation could have been positive, rather than negative, thereafter.

We should note at least parenthetically that such regressive expectations concerning the price level would not be rational for countries operating under the gold standard. The adjustment to a negative aggregate demand shock in the gold-standard countries required a decline in prices and wages until full employment had been restored. With massive unemployment, the price level should have been

expected to fall even further. But one by one, countries were going off the gold standard in the 1930s, and the argument does make sense once governments have the scope to expand the money supply and reflate.²¹ Regressive (or forward-looking) inflationary

21. France and Italy remained on the gold standard until 1936; Belgium and Switzerland remained until 1935. The United States left the gold standard in 1933; Austria, Canada, Denmark, Finland, Sweden, and the United Kingdom left the gold standard in 1931; Australia broke with gold in 1929.

expectations might also account for the poor showing of the adaptive-expectations accelerationist Phillips curve during the long downturns of the 1990s, especially since by 1993, Australia, Canada, Finland, New Zealand, and Sweden had all adopted explicit inflation targets, which might have anchored inflationary expectations. The question thus remains whether, during the downturns we have examined, the failure of inflation to decline after reaching a low level reflects regressive expectations, or instead, the use of a nominal, rather than a real frame for setting prices and wages.

Although a method might conceivably be developed to distinguish among these alternative interpretations based on macroeconomic data, our conjecture is that econometric tests using only data on wages and prices have very little power to discriminate between the two hypotheses. This suggests that supplementary microeconomic information and independent, survey-based measures of inflationary expectations would be useful in settling the question.

What evidence we do have from these two different types of sources, however, favors the hypothesis that once inflation is low, downward nominal wage rigidity mutes and truncates the pass-through of inflationary expectations. We have already cited considerable evidence suggesting the existence of downward nominal wage rigidity generally. In addition, O'Brien (1989) and Hanes (2000) find that downward nominal wage rigidity was especially pervasive during the Great Depression, thus explaining our findings in Figures 2 and 3.

An alternative strategy to discern the difference between regressive expectations and incomplete pass-through relies on independent measures of inflationary expectations. Akerlof et al. (2000) estimated Phillips curves with survey measures of inflation expectations, rather than lagged inflation. Consistent with our interpretation of the data, they find that the coefficient on expectations is close to unity when unemployment is low, but close to zero when unemployment is high. This suggests incomplete pass-through rather than regressive expectations. Although these findings are suggestive, they cannot be taken as conclusive. In the case of downward nominal wage rigidity, there is no definitive way to go from the micro findings to the macroeconomic consequences. And the low pass-through coefficient estimated by Akerlof and colleagues could be

the result of high measurement error of inflationary expectations when inflation is low.

VI. CONCLUSION

Both output stabilization and maintenance of price stability have been important policy priorities during the postwar period. These dual policy goals are enshrined in the Federal Reserve Act and are widely accepted by both policy makers and the public as sensible and appropriate. The decline in volatility of output and employment since the mid-1980s suggests that the Fed's efforts have met with some success. In his presidential address to the American Economic Association, however, Robert Lucas argued that stabilization of output, even if possible, should not be a macroeconomic priority because the gains are trivially small. According to Lucas's argument, stabilization policy has no impact on average consumption. It merely alters the timing of consumption, a variable whose aggregate fluctuations have been extremely modest. Lucas's argument rests on assumptions concerning the determinants of social welfare and the characteristics of the Phillips curve that are broadly endorsed by professional macroeconomists and incorporated in most macroeconomics textbooks. Given the strong grounding of Lucas's conclusion in standard theory, our objective has been to reconsider the economic logic of stabilization policy.

This article surveyed a growing body of literature questioning key assumptions underlying Lucas's conclusion. Based on this survey and our own suggestive evidence, we conclude that there is a solid case for stabilization policy and that there are especially strong reasons for central banks to accord it priority in the current era of low inflation. The evidence suggests that stabilization policy can produce nonnegligible gains in welfare. With a nonlinear short-run Phillips curve, stabilization policy reduces average levels of joblessness and raises average output by a nontrivial amount. Stabilization policy also raises social welfare if, as seems likely, welfare deteriorates nonlinearly with increases in unemployment. A nonlinear relationship between unemployment and social welfare may reflect the increasing incidence of long-duration unemployment spells as aggregate unemployment rises, the diminishing benefits associated with additional job creation as unemployment falls, or correlations

between idiosyncratic risks and aggregate risks that result in large losses for low-income, liquidity-constrained households as a result of the business cycle.

A Phillips curve that is not always accelerationist provides a further important reason for central banks to pursue stabilization as an objective. The now traditional accelerationist Phillips curve captures two elementary truths about the nature of inflation. First, when product and labor markets are tight, as typically occurs when unemployment is low, prices and wages both tend to increase. This corresponds to the simplest notion of supply and demand: If unemployment is sufficiently low, the demand for labor exceeds supply, and it would be highly surprising if wages did not rise to close the gap. Higher inflationary expectations should similarly raise labor demand and reduce labor supply, pushing wage and price inflation higher.

But the accelerationist Phillips curve is much more specific and goes further, stating that the impact of inflationary expectations on inflation is exactly point for point at all times and in all phases of the business cycle. Such a conclusion would be justified theoretically if all parties affected by wage and price decisions thought exactly like economists. But the assumption that everybody in the economy thinks about prices and wages in the same real terms as economists is a strong one, and available research we have reviewed suggests that under many circumstances this assumption is violated. The most solid evidence of a violation comes from considerable cross-country evidence revealing a spike in the distribution of money wage changes at zero, with the spike becoming larger as inflation declines. Questionnaires similarly suggest that economists and the public do not answer questions about inflation in the same way. We also argue that the behavior of inflation during long periods with extensive labor market slack, such as the Great Depression and the downturns afflicting numerous countries during the 1990s, appears inconsistent with the accelerationist hypothesis. The macroeconomic evidence instead suggests a diminished tendency for inflation to decline in the face of high unemployment—that is, a higher sacrifice ratio—due to lower pass-through of inflationary expectations into inflation once inflation is already low, as it now is throughout the industrialized world. This violation of the

accelerationist hypothesis is a logical consequence of downward nominal wage rigidity.

Because the gains from stabilization policy depend largely on the nature of the inflation process—whether it is linear or nonlinear and whether it is accelerationist or not—we suggest policy makers should be cautious about embracing inflation forecasts derived from theoretical models embodying overly strong priors. A cautious approach is also dictated by the fact that the fit of the Phillips curve for many countries and time periods is extremely loose (see Staiger et al. 1997). Such a poor fit of accelerationist Phillips curves, even allowing for a time-varying NAIRU, strengthens the case for forecasts of inflation that are independent of natural rate theory and policy strategies that explicitly recognize the uncertainty attached to these forecasts. Indeed, the success of the Federal Reserve in the late 1990s in reducing unemployment and inflation simultaneously was arguably a consequence both of the Fed's commitment to dual policy goals and its empirically oriented and open-minded approach toward forecasting inflation.

REFERENCES

- Agell, Jonas, and Per Lundborg. "Survey Evidence on Wage Rigidity and Unemployment: Sweden in the 1990s." *Scandinavian Journal of Economics*, 105(1), 2003, 15–29.
- Akerlof, George A., William T. Dickens, and George L. Perry. "The Macroeconomics of Low Inflation." *Brookings Papers on Economic Activity*, 1996(1), 1996, 1–59.
- . "Near-Rational Wage and Price Setting and the Long-Run Phillips Curve." *Brookings Papers on Economic Activity*, 2000(1), 2000, 1–44.
- Altonji, Joseph G., and Paul J. Devereux. "The Extent and Consequences of Downward Nominal Wage Rigidity." Working Paper 7236. National Bureau of Economic Research, 1999.
- Alvarez, Fernando, and Urban J. Jermann. "Using Asset Prices to Measure the Cost of Business Cycles." Working Paper 7978. National Bureau of Economic Research, 2000.
- Atkeson, Andrew, and Christopher Phelan. "Reconsidering the Costs of Business Cycles with Incomplete Markets." *NBER Macroeconomics Annual 1994*, edited by Stanley Fischer and Julio J. Rotemberg. Cambridge, MA: MIT Press, 1994, 187–207.
- Ball, Lawrence, and David Romer. "Real Rigidities and the Non-Neutrality of Money." *Review of Economic Studies*, 57(2), 1990, 183–203.
- Barro, Robert J., and David B. Gordon. "A Positive Theory of Monetary Policy in a Natural Rate Model." *Journal of Political Economy*, 91(4), 1983, 589–610.

- Bauer, Thomas, Holger Bonin, and Uwe Sunde. "Real and Nominal Wage Rigidities and the Rate of Inflation: Evidence from German Micro Data." Discussion Paper 959. Institute for the Study of Labor, 2003.
- Bernanke, Ben S. "The Macroeconomics of the Great Depression: A Comparative Approach." *Journal of Money, Credit, and Banking*, 27(1), 1995, 1–28.
- . "The Great Moderation." Remarks at the Eastern Economics Association Meetings, Washington, DC, February 20, 2004.
- Bewley, Truman. *Why Wages Don't Fall during a Recession*. Cambridge, MA: Harvard University Press, 1999.
- Blinder, Alan, and Don Choi. "A Shred of Evidence on Theories of Wage Stickiness." *Quarterly Journal of Economics*, 105(4), 1990, 1003–15.
- Brainard, William C., and George L. Perry. "Making Policy in a Changing World," in *Economic Events, Ideas, and Policies: The 1960s and After*, edited by George L. Perry and James Tobin. Washington, DC: Brookings Institution, 2000, 43–69.
- Campbell, Carl M. III, and Kunal S. Kamani. "The Reasons for Wage Rigidity: Evidence from a Survey of Firms." *Quarterly Journal of Economics*, 112(3), 1997, 759–89.
- Card, David, and Dean Hyslop. "Does Inflation Grease the Wheels of the Labor Market?" in *Reducing Inflation: Motivation and Strategy*, edited by Christina D. Romer and David H. Romer. Chicago: University of Chicago Press, 1997, 71–114.
- Carroll, Christopher D. "The Buffer-Stock Theory of Saving: Some Macroeconomic Evidence." *Brookings Papers on Economic Activity*, 1992(2), 1992, 51–156.
- Cassino, Vincenzo. "The Distribution of Wage and Price Changes in New Zealand." Discussion Paper G95/6. Reserve Bank of New Zealand, 1995.
- Castellanos, Sara G., Rodrigo García-Verdú, and David Kaplan. "Wage Rigidities in Mexico: Evidence from Social Security Records." Working Paper 10383. National Bureau of Economic Research, 2004.
- Chapple, Simon. "Money Wage Rigidity in New Zealand." *Labour Market Bulletin*, 1996:2, 23–50.
- Chetty, Raj. "Consumption Commitments, Unemployment Durations, and Local Risk Aversion." Working Paper 10211. National Bureau of Economic Research, 2004.
- Clarida, Richard, Jordi Galí, and Mark Gertler. "The Science of Monetary Policy: A New Keynesian Perspective." *Journal of Economic Literature*, 37(4), 1999, 1661–707.
- Clark, Peter, Douglas Laxton, and David Rose. "Asymmetry in the U.S. Output-Inflation Nexus." *IMF Staff Papers*, 43(1), 1996, 216–51.
- Debelle, Guy, and Douglas Laxton. "Is the Phillips Curve Really a Curve? Some Evidence for Canada, the United Kingdom and the United States." *IMF Staff Papers*, 44(2), 1997, 249–82.
- DeLong, J. Bradford, and Lawrence H. Summers. "How Does Macroeconomic Policy Affect Output?" *Brookings Papers on Economic Activity*, 1988(2), 1988, 433–80.
- Dupasquier, Chantal, and Nicholas Ricketts. "Non-Linearities in the Output-Inflation Relationship: Some Empirical Results for Canada," in *Price Stability, Inflation Targets, and Monetary Policy: Proceedings of a Conference Held by the Bank of Canada, May 1997*. Ottawa: Bank of Canada, 1998, 131–73.
- Dwyer, Jacqueline, and Kenneth Leong. "Nominal Wage Rigidity in Australia." Research Discussion Paper 2000-08. Reserve Bank of Australia, 2000.
- Eichengreen, Barry. *Golden Fetters: The Gold Standard and the Great Depression, 1919–1939*. New York: Oxford University Press, 1992.
- Fair, Ray C. "Testing the NAIRU Model for the United States." *Review of Economics and Statistics*, 82(1), 2000, 64–71.
- Fehr, Ernst, and Jean-Robert Tyran. "Does Money Illusion Matter?" *American Economic Review*, 91(5), 2001, 1239–62.
- Fehr, Ernst, and Lorenz Goette. "Robustness and Real Consequences of Nominal Wage Rigidity." Working Paper 44. Institute for Empirical Research in Economics, University of Zurich, 2003.
- Fisher, Irving. *The Money Illusion*. New York: Adelphi, 1928.
- Fortin, Pierre. "Presidential Address: The Great Canadian Slump." *Canadian Journal of Economics*, 39(4), 1996, 761–87.
- Fortin, Pierre, George Akerlof, William T. Dickens, and George L. Perry. "Inflation and Unemployment in the U.S. and Canada: A Common Framework," in *Growth, Employment and Technology: New Perspectives on Canadian Policies*, edited by Pierre Fortin and Craig Riddell. Montreal: McGill-Queen's University Press, 2002.
- Freeman, Richard B. "Crime and the Job Market." Working Paper 4910. National Bureau of Economic Research, 1994.
- Galí, Jordi, Mark Gertler, and J. David López-Salido. "Markups, Gaps, and the Welfare Costs of Business Fluctuations." Working Paper 8850. National Bureau of Economic Research, 2002.
- Gordon, Robert J., and James A. Wilcox. "Monetarist Interpretations of the Great Depression: An Evaluation and Critique," in *The Great Depression Revisited*, edited by Karl Brunner. Hingham, MA: Martinus Nijhoff, 1981, 49–107.
- Hanes, Christopher. "Nominal Wage Rigidity and Industry Characteristics in the Downturns of 1893, 1929, and 1981." *American Economic Review*, 90(5), 2000, 1432–46.
- Hines, James R., Hilary W. Hoynes, and Alan B. Krueger. "Another Look at Whether a Rising Tide Lifts All Boats," in *The Roaring Nineties: Can Full Employment Be Sustained?* edited by Alan B. Krueger and Robert Solow. New York: Russell Sage Foundation and the Century Foundation, 2001.
- Imrohroglu, Ayse. "The Cost of Business Cycles with Indivisibilities and Liquidity Constraints." *Journal of Political Economy*, 97(6), 1989, 681–717.
- Kahn, Shulamit. "Evidence of Nominal Wage Stickiness from Micro-Data." *American Economic Review*, 87(5), 1997, 993–1008.
- Karanassou, Marika, Hector Sala, and Dennis J. Snower. "The European Phillips Curve: Does the NAIRU Exist?" Discussion Paper 876. Institute for the Study of Labor, 2003.
- Kimura, Takeshi, and Kazuo Ueda. "Downward Nominal Wage Rigidity in Japan." *Journal of the*

- Japanese and International Economies*, 15(1), 2001, 50–67.
- King, Robert G., and Mark W. Watson. “The Post-War U.S. Phillips Curve: A Revisionist Economic History.” *Carnegie-Rochester Conference Series on Public Policy*, 41, 1994, 157–219.
- Knoppik, Christoph, and Thomas Beissinger. “How Rigid Are Nominal Wages? Evidence and Implications for Germany.” *Scandinavian Journal of Economics*, 105(4), 2003, 619–41.
- Krusell, Per, and Anthony Smith. “Revisiting the Welfare Effects of Eliminating Business Cycles.” Discussion Paper, Carnegie Mellon University, 2002.
- Kuroda, Sachiko, and Isamu Yamamoto. “Are Japanese Nominal Wages Downwardly Rigid? (Part I): Examinations of Nominal Wage Change Distributions.” *Monetary and Economic Studies*, 21(2), Bank of Japan, 2003a, 1–29.
- . “Are Japanese Nominal Wages Downwardly Rigid? (Part II): Examinations using a Friction Model.” *Monetary and Economic Studies*, 21(2), Bank of Japan, 2003b, 31–68.
- . “The Impact of Downward Nominal Wage Rigidity on the Unemployment Rate: Quantitative Evidence from Japan.” *Monetary and Economic Studies*, 21(4) Bank of Japan, 2003c, 57–86.
- Laxton, Douglas, Guy Meredith, and David Rose. “Asymmetric Effects of Economic Activity on Inflation: Evidence and Policy Implications.” *IMF Staff Papers*, 42(2), 1995, 344–74.
- Laxton, Douglas, David Rose, and Demosthenes Tambakis. “The U.S. Phillips Curve: The Case for Asymmetry.” *Journal of Economic Dynamics and Control*, 23(9–10), 1999, 1459–85.
- Lebow, David E., Raven E. Saks, and Beth Anne Wilson. “Downward Nominal Wage Rigidity: Evidence from the Employment Cost Index.” Discussion Paper 99-31. Board of Governors of the Federal Reserve System, 1999.
- Lipsey, Richard. “The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1862–1957: A Further Analysis.” *Economica* 27(105), 1960, 1–31.
- Lucas, Robert E. Jr. *Models of Business Cycles*. Oxford: Basil Blackwell, 1987.
- . “Macroeconomic Priorities.” *American Economic Review*, 93(1), 2003, 1–14.
- Lucas, Robert E., Jr., and Thomas J. Sargent. “After Keynesian Macroeconomics,” in *After the Phillips Curve: Persistence of High Inflation and Unemployment*. Conference Series no. 19, Federal Reserve Bank of Boston, 1979.
- Lundborg, Per, and Hans Sacklén. “Is There a Long-Run Unemployment-Inflation Trade-off in Sweden?” Working Paper 173. FIEF, 2001.
- Mankiw, N. Gregory. “The Inexorable and Mysterious Tradeoff between Inflation and Unemployment.” *Economic Journal*, 111(471), 2001, 45–61.
- Mayes, David G., and Matti Virén. “Asymmetry and the Problem of Aggregation in the Euro Area.” Discussion Paper 11, Bank of Finland, 2000.
- Nickell, Stephen, and Glenda Quintini. “Nominal Wage Rigidity and the Rate of Inflation.” Discussion Paper 489. Center for Economic Performance, London School of Economics, 2001.
- O’Brien, Anthony P. “A Behavioral Explanation for Nominal Wage Rigidity during the Great Depression.” *Quarterly Journal of Economics*, 104(4), 1989, 719–35.
- OECD. *Economic Outlook*, 72, 2002.
- . *Employment Outlook*. 2003a.
- . *Labor Force Statistics Database*. 2003b.
- . *Main Economic Indicators*. 2004.
- Phillips, Alban W. “The Relation Between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861–1957.” *Economica*, 25(100), 1958, 283–99.
- Richardson, Pete, Laurence Boone, Claude Giorno, Mara Meacci, David Rae, and David Turner. “The Concept, Policy Use and Measurement of Structural Unemployment: Estimating a Time Varying NAIRU Across 21 OECD Countries.” Working Paper 250. OECD Economics Department, 2000.
- Romer, Christina D. “Changes in Business Cycles: Evidence and Explanations.” *Journal of Economic Perspectives*, 13(2), 1999, 23–44.
- Romer, David. *Advanced Macroeconomics*, 2nd ed. New York: McGraw-Hill, 2001.
- Sargent, Thomas J. “A Note on the Accelerationist Controversy.” *Journal of Money, Credit and Banking*, 3(3), 1971, 721–25.
- Shafir, Eldar, Peter Diamond, and Amos Tversky. “Money Illusion.” *Quarterly Journal of Economics*, 112(2), 1997, 341–74.
- Shiller, Robert J. “Why Do People Dislike Inflation?” in *Reducing Inflation: Motivation and Strategy*, edited by Christina Romer and David Romer. Chicago: University of Chicago Press, 1997, 13–65.
- Staiger, Douglas, James Stock, and Mark Watson. “How Precise Are Estimates of the Natural Rate of Unemployment?” in *Reducing Inflation: Motivation and Strategy*, edited by Christina Romer and David Romer. Chicago: University of Chicago Press, 1997, 195–242.
- Stock, James H., and Mark W. Watson. “Has the Business Cycle Changed? Evidence and Explanations,” in *Monetary Policy and Uncertainty: Adapting to a Changing Economy*. Federal Reserve Bank of Kansas City, 2003.
- Storesletten, Kjetil, Chris I. Telmer, and Amir Yaron. “The Welfare Cost of Business Cycles Revisited: Finite Lives and Cyclical Variation in Idiosyncratic Risk.” *European Economic Review*, 45(7), 2001, 1311–39.
- Tallarini, Thomas D. “Risk-Sensitive Real Business Cycles.” *Journal of Monetary Economics*, 45(3), 2000, 507–32.
- Tobin, James. “Inflation and Unemployment.” *American Economic Review* 62(1/2), 1972, 1–18.
- Wolfers, Justin. “Is Business Cycle Volatility Costly? Evidence from Surveys of Subjective Well-Being.” *International Finance*, 6(1), 2003, 1–26.
- Woodford, Michael. “Inflation Stabilization and Welfare.” *Contributions to Macroeconomics*, 1(2), 2002, article 1.