

REVIEW

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Is There a Case for "Moderate" Inflation?

Alvin L. Marty and Daniel L. Thornton

The proposition that inflation is a monetary phenomenon is more widely embraced now than it was three decades ago. Moreover, it is more widely accepted that inflation is subject to long-run control by the central bank. In recent years, the central banks of the United Kingdom, New Zealand and Canada have placed increased emphasis on reducing their long-run inflation rates. In the United States, former Rep. Steven Neal, D.-N. Carolina (*House Joint Resolution 55*, January 5, 1993), and Sen. Connie Mack, R.-Florida, have proposed making stable prices the primary objective of the Federal Reserve.

Nevertheless, considerable opposition remains to making price stability the overriding objective of U.S. monetary policy. Some argue that the benefits of price stability do not warrant the cost of achieving it. For example, although extolling the virtues of price stability, Howitt (1990) is uncertain whether the benefits are worth the costs in terms of lost output (temporary, and perhaps permanent, due to hysteresis effects).

Although we are skeptical whether the empirical and theoretical analyses to date have correctly identified all of the benefits of price stability, this article addresses an issue that is logically prior to this one. Specifically, it addresses the question: If the inflation rate were zero, could society benefit from a higher rate of inflation? In other words, is moderate inflation preferable to price stability? Several arguments have been advanced that the economy benefits from moderate inflation. Recently, DeLong and Summers (1992)

and Summers (1991) have suggested several rationales for why a central bank would choose moderate inflation over price stability as its long-run policy goal.

This article addresses four reasons that have been suggested to prefer moderate to zero inflation:

1. Moderate inflation enhances the stability of the economy.
2. Moderate inflation results in a higher steady-state level of output per person.
3. Moderate inflation increases the efficiency of inter-industry labor market adjustments.
4. Inflation enhances the efficacy of counter-cyclical monetary policy by allowing the real rate of interest to be negative, thereby stimulating effective demand in periods of recession.

The first two of these arguments are well-known to economists, but have received scant attention in public debates. Moreover, they are framed within specific, although quite different, theoretical models, so it is possible to provide a rather definitive evaluation of their merit. The remaining two arguments have received considerable attention, and may play a role in any public policy debate regarding the desirability of making price stability the primary monetary policy objective. The conceptual frameworks for these arguments are not well-specified, however, so we try to shore up their analytical footing by proposing specific interpretations.

Before proceeding, several issues should be clarified. First, the hypotheses that there are economic benefits from moderate inflation considered here implicitly argue against a so-called Friedman Rule (Friedman, 1969), that is, the "optimal" rate of money growth is one that generates steady-state deflation. Nevertheless, this article is not specifically about the Friedman Rule. Analyses of a Friedman Rule generally have been carried out in well-specified model economies.

Second, although the last two arguments for moderate inflation lack explicit theoretic-

cal foundations, this has not prevented them from achieving an intellectual status among some economists and policymakers. The lack of theoretical foundations forces our analysis to range from the fairly technical to the somewhat conjectural, so that we may not provide a definitive evaluation of these arguments. In this case, we are content to present an analysis of these arguments.

Third, the arguments for moderate inflation analyzed here are based on the assumption of a fully anticipated, steady-state inflation. Although such inflations do not characterize real-world economies, we make this assumption until it is relaxed when we discuss the reasons why price stability is preferable to moderate inflation.

Fourth, the phrase "moderate inflation" is not well-defined. Some might consider moderate inflation to be 2 to 3 percent. For others, any rate under 5 percent could be moderate. Still others may deem anything less than double-digit inflation moderate. We suggest 5 percent as the break point for moderate inflation in the United States.

Finally, although we used the phrases price stability and zero inflation interchangeably, we are aware that price stability is different and more stringent than zero inflation. Price stability implies that jumps in the price level are reversed; zero inflation need not.

THE CASE FOR MODERATE INFLATION

Is Stability of the Economy Enhanced by Moderate Inflation?

The first argument for moderate inflation is that certain stability conditions are sturdier at a high-money (nominal) rate of interest, making the economy less vulnerable to various shocks. Understanding this argument requires an understanding of the notion of stability upon which it rests. To illustrate, suppose that the real rate of interest suddenly rises, say, because of an increase in expected future profits. Given the underlying rate of inflation, this raises the money rate of interest, reducing the quantity of real money balances that individuals desire to hold. As individuals attempt to reduce their

holdings of real balances, prices rise still further, fueling expectations of further inflation. This reduces the quantity of real balances demanded still further, giving rise to a further increase in prices and so on. The question is: Under what conditions will this sequence converge?

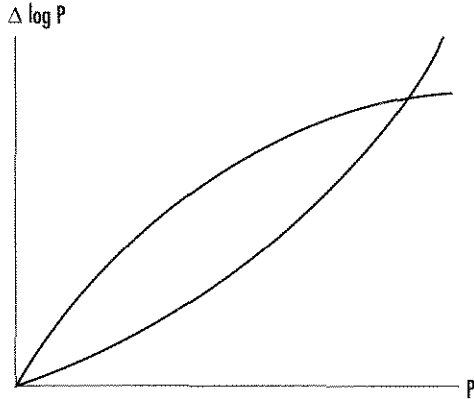
The answer is: Self-generating inflation cannot occur if, as the price level rises, its rate of change declines. Holding the growth of the money supply constant, this condition is illustrated in Figure 1, which shows two plots of the change in the log of the price level, against the price level itself, P . In one case, the slope of the curve rises with P . In this instance, the sequence will not converge and the ultimate solution is the trivial one; the demand for real money balances approaches zero. In the other case, the slope of the curve decreases as P increases, so that the sequence converges to a steady rate of inflation.

The argument that inflation enhances economic stability is an argument about the demand for money. To see this argument, assume that the demand for real money balances is solely a function of the nominal interest rate, whereby the nominal interest rate equals the constant real interest rate plus the actual rate of inflation (which is fully anticipated). Cagan (1956) showed that the rate of inflation decreases as the price level rises if $\alpha\beta < 1$. The parameter α is the semi-log slope of the demand for real money balances with respect to the nominal interest rate, that is, percent change in the demand for real money balances per percentage point change in the money interest rate ($d \ln(M/P)/di$). The parameter β is the rate at which individuals revise their expectations of inflation under adaptive expectations, $dE/dt = \beta(\pi - E)$, where π and E are the actual and expected rates of inflation, respectively.

If $\alpha\beta < 1$ and the expected rate of inflation is initially greater than the actual rate, expected inflation falls until a stable steady state is reached at which the expected rate of inflation is equal to the actual rate. If, however, $\alpha\beta$ is greater than unity and actual inflation is initially greater than expected inflation, both expected and actual inflation grow without limit with real balances falling.

Figure 1

Log of the Price Level Vs. Actual Price Level



On the other hand, if $\alpha\beta > 1$ and actual is initially less than expected inflation, both actual and expected inflation fall without limit. The steady state at which the actual and expected rate are equal is unstable.

Stability Through Moderate Inflation

If α and β are constants, the stability conditions will be invariant to the steady-state inflation rate. Consequently, the suggestion that the stability conditions are sturdier at non-zero rates of inflation is an argument that either α or β is inversely related to the steady-state inflation rate. Specifically, it was argued that α should be smaller at higher rates of money interest. That this may be so comes from noting that the elasticity of the demand for real money balances with respect to the money interest rates, e_m , is equal to αi , where i is the money interest rate. Thus, if e_m is constant, α will decline as the rate of inflation and, hence, the money interest rate rises.¹ All other things the same, the stability condition is more likely to be satisfied at higher rather than lower rates of money interest if the interest elasticity demand for real money balances is constant.

The widely used Cagan (1956) money-demand function assumes that α is independent of the nominal interest rate. Cagan's function significantly underpredicted real money balances during periods when prices were or had been relatively constant, but performed well during periods of high infla-

tion.² This suggests that the underprediction was due to α being higher at low rates of inflation.

That α is inversely related to the steady-state inflation rate is plausible, but this does not imply that stability is more likely at higher rates of inflation. For example, it is plausible that individuals revise their expectations of inflation more rapidly at higher rates of inflation, that is, that β is positively related to the inflation rate. Indeed, Bruno (1989) provides some empirical support for a positive association between β and the rate of inflation. Consequently, it is not necessarily the case that stability is greater at high inflation rates. An inflation-induced fall in α might be just offset, or perhaps more than offset, by an inflation-induced rise in β . Using adaptive expectations, no general conclusion can be reached about the stability conditions and the steady-state inflation rate.

Getting on the Wrong Side of the Laffer Curve

Bruno and Fischer (1990) have revisited Cagan's stability condition in the context of financing a given budget deficit solely through seigniorage from money creation. Although assuming that the deficit is financed solely through money creation is not realistic in developed economies like the United States, where other forms of taxation are available, the Bruno and Fischer assumption is a useful theoretical device which allows stability conditions to be anchored by two equilibria on either side of the Laffer curve. The Laffer curve is the recognition that tax receipts do not increase continuously with the tax rate. Beyond some point, receipts decline as a further increase in the tax rate results in a significant erosion of the tax base. Consequently, except at that unique tax rate where tax revenue is maximized, there are two alternative tax rates and tax bases that generate the same tax revenue: a low tax rate and a high tax base, or a high tax rate and a low tax base. Bruno and Fischer demonstrate that if $\alpha\beta < 1$, a stable equilibrium is at the socially desirable low tax rate-high tax base point. If $\alpha\beta > 1$, an equilibrium is at the socially undesirable

¹ Note that e_m is constant if the money demand function is in double log form: $M/P = i^k$, so $e_m = \alpha i = k$.

² See Bailey (1956) and Friedman and Schwartz (1963) for a discussion of the issue of the empirical validity of Cagan's money-demand equation.

point on the Laffer curve. Consequently, the argument is not whether the system is stable or explosive, but whether equilibrium is achieved at a socially desirable point on the Laffer curve.

What If Expectations Are Rational?

From the condition that $E = \pi$, it is easy to see that rational expectations are the limiting case of adaptive expectations. Adaptive expectations approach rational expectations as $\beta \rightarrow \infty$. Consequently, if expectations are rational, the condition $\alpha\beta < 1$ cannot be satisfied for any value of α . In Cagan's world, the system explodes. In the Bruno and Fischer world of a fixed real deficit, a stable equilibrium (if it exists) is achieved at a high inflation rate on the wrong side of the Laffer curve. Under rational expectations, any affect on α is completely overwhelmed by β , which is infinite.

It appears that nothing remains of the argument for stability through inflation. In the case of adaptive expectations, any possible reduction in α due to inflation may be offset by an increase in β . If expectations are rational, an infinite β swamps any effect of inflation on α . Indeed, the stable equilibrium is at the socially undesirable side of the Laffer curve, that is, at a high rate of inflation (tax rate) and a low level of real cash balances (tax base). In particular, no argument can be made that moderate inflation produces stability on the socially desirable side of the Laffer curve.

Does Moderate Inflation Lead to a Higher Level of Output?

The second argument for moderate inflation, that it leads to a higher level of steady-state output and consumption, was first formulated by Tobin (1965). The essence of Tobin's model is that in a growing economy, non-interest bearing real money balances augment disposable income. Given that the propensity to save out of disposable income is less than unity, an increase in real balances, all of which must be saved, gives rise to smaller saving in the form of physical capital. In Tobin's portfolio-balance model, real

money balances and physical capital are substitutes. A higher anticipated rate of inflation induces individuals to economize on their holdings of money balances, freeing up savings for capital accumulation. This leads to a higher steady-state capital/labor ratio, resulting in higher consumption per person so long as the steady state is not pushed beyond the point where consumption per person is maximized (the so-called Golden Rule point).

The Tobin effect, that higher inflation induces higher levels of capital, output and consumption per worker, is open to a number of objections. For one thing, it is dependent on Tobin's assumption that savings are a constant proportion of income. If the savings rate is directly reduced by higher inflation, the Tobin effect can be reversed—even in the framework of Tobin's model (Dornbusch and Frenkel, 1973). Moreover, the Tobin effect is model-specific. The effect is absent in Ramsey-type models, in which the marginal product of capital is tied to the representative agent's rate of time preference. In such models, the marginal product of capital defines a unique steady-state capital/labor ratio which is independent of the level of real money balances. It is now generally recognized that the results of both Tobin- and Ramsey-type models are sensitive to small changes in assumptions. Moreover, Orphanides and Solow (1990) show that different models or small changes in assumptions in a particular model deliver disparate conclusions about the Tobin effect. Consequently, it is impossible as a matter of pure theory to make a compelling case that inflation increases real output.

A crucial reason for the fragility of these results is that, by their very nature, these money-growth models are the wrong vehicles for analyzing the role of money in the economy and, hence, the effect of inflation on the economy. A striking example of this is provided by Tobin's model, which predicts that the highest level of output per person occurs in a barter economy, in which holdings of real money balances are nil. This result stems from not taking money seriously. Real money balances reduce transaction costs. They do this by overcoming the dou-

ble coincidence of wants associated with barter and by conveying information (for example, Brunner and Meltzer, 1971). Compared to a barter economy, the reduction in total transaction costs permits society to devote more of its scarce resources to production, raising output and the consumption of goods and leisure. By reducing marginal transaction costs, money also results in a higher level of trade and correspondingly higher levels of output. Although the development of Solow-type growth models was an important first step in the analysis of growing economies, it is not surprising that these one-commodity models fail to capture the important role that money plays in real-world economies.

Thus far, we have contrasted money and non-monetary barter economies. In principle, similar effects occur when individuals are induced by a rise in anticipated inflation to reduce their holdings of real balances. If inflation induces individuals to hold fewer real balances, even if one were to accept Tobin's argument that inflation increases output per person, any increase would be at the expense of a loss to society of the services of real balances. In fact, if money enters the production function, the Tobin effect may well be reversed; inflation then reduces output per person, as in Stockman (1981).

Inflation may not only reduce the steady-state level of per capita output, it may reduce the growth rate of output itself. For if capital is appropriately defined more broadly to include human capital, as is done in recent endogenous-growth models, inflation reduces investment in human capital, as well as in physical capital. Reduced investment in human capital lowers the growth of efficiency per person, which reduces the growth rate itself (for example, Lucas, 1988; King and Rebelo, 1990; and Dotsey and Ireland, 1993). A small but permanent reduction in the growth rate due to inflation has an adverse effect on output levels. This continual effect on output levels is more significant than any effect of inflation on the one-time altering of the level of output per capita explored in earlier exogenous-growth models.

Once we leave purely theoretical-growth models, and look at real-world economies,

we must deal with how inflation interacts with real-world institutions. It has been shown that the interaction of inflation with a less-than-fully indexed tax system works to discourage capital accumulation (Feldstein, 1976, 1979; and Tatom, 1976).

The bottom line is that even within the framework of theoretical-growth models, the Tobin effect is subject to small changes in assumptions. When real-world institutions are included in the analysis, the weight of evidence is that inflation discourages capital accumulation. The Tobin effect is reversed.³ When capital is defined more realistically to include human capital, the effect of inflation is to continually reduce the levels of output per person below what they would have been under stable prices.

Does Moderate Inflation Enhance Relative Real-Wage Adjustments?

The third argument for moderate inflation (Tobin, 1972; Schultze, 1985; Lucas, 1989; DeLong and Summers, 1992; and Summers, 1991) asserts that declines in the price of commodities and in the real wage of workers specialized to a particular industry can be made with less friction in a world with moderate inflation than in a world of stable prices. It is argued that under moderate inflation, the decline in a product's price and in the real wage rate of workers can be accomplished through a rise in prices and money wages elsewhere.

The belief that inter-industry adjustments are smoother under a regime of moderate inflation rests on the view that laborers prefer a rise in the prices of wage goods to an absolute reduction in money wages. But why should this be the case? Workers experience an identical decline in real wages in both cases.

One answer depends on the existence of a money illusion: A decline in real wages brought about by a rise in the prices of wage goods is incorrectly perceived as smaller than the same decline in the real wage that occurs through a reduction in money wages. The persistence of money illusion in a steady state of anticipated moderate inflation is difficult to rationalize. Moreover, recent evi-

³ After a survey of theoretical models, Blanchard and Fischer (1989) conclude: "Calculations suggest, however, that the effects of changes in the inflation rate on capital accumulation in models of the type developed in this chapter are very small. If inflation has systematic effects on capital accumulation (and there is empirically a negative association), it is probably for reasons not included so far. One likely reason is that the tax system is not neutral with respect to inflation."

dence (McLaughlin, 1994; and Lebow, Stockton and Wascher, 1993) suggests there is no dearth of nominal wage cuts, even during periods of moderate inflation.

Furthermore, firms in a declining industry may adjust workers' compensation without cutting wages. Compensation includes benefits and perks which can be adjusted relatively easily relative to wages in cases in which workers have an irrational fear of nominal wage cuts. In any event, we believe that for the resistance to nominal wage cuts to be widespread, it must be motivated by considerations deeper than a pure money illusion.

One possible rationale for such resistance is that workers feel they have some control over money wages but no control over the general price level. Consequently, the same reduction in the real wage rate due to reduction in money wages brings into play factors that workers believe they can negotiate, in contrast to an increase in the prices of wage goods, which they are powerless to affect.

The second possible motivation would interact with the first. Workers may have less knowledge of demand than do employers. Consequently, when the industry demand declines, workers may be concerned that the employer is misrepresenting the true state of nature to force an unnecessary reduction in money wages. In this case, a fall in the real wage rate due to a rise in the prices of wage goods elsewhere avoids triggering a signal-extraction problem.

We have endeavored to make the best possible case for moderate inflation as a device for smoothing inter-industry wage adjustments, but in doing so, we have ignored the existence of a cushion on money wage declines even in a regime of stable prices. If we were to introduce technical progress, even under price stability, the average level of money wages would rise at a rate equal to the average increase in output per person. This provides a cushion mitigating the need for an absolute decline in the money wage.

Finally, we suggest the hypothesis that workers' resistance to nominal wage cuts is not independent of the inflation regime in

which they live. Under stable prices, such cuts may become more frequent and workers will become more accustomed to and less distrustful of money wage cuts. Accordingly, any "lubricant" that moderate inflation may provide to ease labor market frictions will become increasingly unnecessary in a zero-inflation regime.

Although the claim that moderate inflation facilitates inter-industry wage adjustments cannot be definitively rejected, it does not rest on compelling theoretical or empirical foundations. In any event, monetary policy is an inappropriate and ineffective instrument for dealing with labor market problems, such as market frictions or the sub-optimality of the natural unemployment rate. The latter may be due to taxes on wages which make the after-tax real wage smaller than the before-tax marginal product of labor. The socially optimal amount of employment equates the disutility of labor to the before-tax real wage so that after-tax employment is sub-optimal. Moreover, high unemployment compensation increases time spent in "search unemployment." The drift to higher unemployment in Europe and Canada is unlikely to reflect a movement up a short-run Phillips curve produced by unanticipated deflation, but rather is due to an upward drift in the natural rate of unemployment. In this case, appropriate policies to reduce unemployment are reforms in taxes and unemployment compensation, not monetary policy.

Moderate Inflation Enhances the Countercyclical Efficacy of Monetary Policy

A fourth argument for moderate steady-state inflation is that it enhances the countercyclical efficacy of monetary policy by enabling the Federal Reserve to make the real rate of interest negative. The argument that the efficacy of monetary policy is enhanced by a moderate rate of steady-state inflation stems from the recognition that the money rate can never be negative, so that in a non-inflationary environment, in which the real and money rates are equal, the best that monetary policy can do is to drive both the

real and nominal rates of interest to zero.⁴ DeLong and Summers (1992) and Summers (1991) argue that in a zero inflation regime, monetary policy will be unable to produce a sufficiently large reduction in the real interest rate to restore full employment in times of large adverse shocks to aggregate demand.

Is this an important argument for moderate inflation? There are several reasons to think not. First, the argument is based on the belief that the monetary authority can exert considerable influence over real interest rates through the so-called liquidity effect, and that monetary policy works primarily, if not solely, through its ability to influence the real interest rate. According to this view, an expansionary monetary policy drives real interest rates down, inducing an increase in spending. But the extent and duration of the effect of monetary policy on short-term real interest rates is controversial, theoretically and empirically. The exchange between Ohanian and Stockman (1995) and Hoover (1995) highlights the difficulties with theoretical models of the liquidity effect. The empirical evidence on the liquidity effect is mixed. Work by Reichenstein (1987), Thornton (1988), Gordon and Leeper (1994) and Pagan and Robertson (1995) suggests the liquidity effect is relatively weak and short-lived, although research by Christiano and Eichenbaum (1991, 1992), Cook and Hahn (1989) and Romer and Romer (1990) suggest a more significant effect of monetary policy on real short-term interest rates.

Second, it is difficult to argue that sufficient investment opportunities will not exist unless the real rate is negative. The issue is whether the economic outlook can become sufficiently pessimistic that the expected real return on longer-term investments is negative. That DeLong and Summers (1992) and Summers (1991) have raised it again suggests that this old debate is far from settled. Bailey (1971) argues that there will always be some investments that yield a small non-negative return, even if a depressed economy were not expected to return to its steady-state growth path for a period of 10 to 20 years. If investment opportunities increase

sufficiently at very low but positive interest rates, the efficacy of monetary policy is not impaired by a zero lower bound on the real interest rate. Bailey's argument suggests that credit demand becomes very large (essentially infinite) at very low real interest rates, so that the real longer-term interest rates do not have to be negative to significantly increase investment.

Finally, despite the empirical evidence to the contrary, there appears to be a fairly widespread belief that the Federal Reserve exerts considerable influence over real short-term interest rates, but much less influence over longer-term interest rates (see, for example, Goodfriend, 1993; and Greenspan, 1993). If monetary policy cannot make the long-term rate negative, it is natural to ask: Is there any gain from the possibility that the Federal Reserve may be able to make short-term interest rates negative for temporary periods? In markets in which there are few impediments to the flow of funds between the long and short end of the market, consistency of expectations requires that the current long-term interest rate be equal to the expected average of future short-term rates plus a risk premium. The risk premium is affected by a number of things, including uncertainty about future short-term interest rates.

If the market believes that the policy does not signal an increase in policymakers' desired steady-state inflation rates, people know that today's policy must give rise to reversals later. Whether the difference in the magnitude of the decline and subsequent rise in short-term interest rates in the zero and moderate inflation regimes will result in significantly different paths for real long-term interest rates under the two regimes is impossible to determine, a priori. Indeed, it is as easy to conjecture scenarios in which there would be no difference in the response of long-term real interest rates under the two steady-state inflation regimes as it is to conjecture scenarios in which there would be a significant difference.⁵

Given that it is unlikely that moderate inflation will enable the Federal Reserve to have a significantly larger effect on long-term real interest rates, and that very low or zero

⁴ No one would willingly trade a dollar for, say, 95 cents a year from now, so long as the same dollar could be held for a year at zero carrying cost.

⁵ Indeed, Fuhrer and Madigan (1993) simulate the effect of more aggressive policies that result in negative short-term interest rates and find very small changes in long-term rates.

real interest rates are likely to be sufficient for the Fed to offset adverse aggregate demand shocks, the argument that moderate inflation enhances the efficacy of monetary policy seems doubtful. If some role for inflation uncertainty is factored in, the idea that moderate inflation enhances the efficacy of monetary policy becomes even more tenuous.

Why Zero Inflation Is Preferable

Although many estimate the output losses of moderate inflation to be modest, this issue is far from settled. In addition to the usual problems of measuring the permanent output losses, Dotsey and Ireland (1993) have shown that in a general-equilibrium analysis, the usual effects of inflation (the inefficient economizing on real money balances, substituting market activity for leisure, and redirecting resources from goods production to financial activities) compound to produce a significant output loss. Dotsey and Ireland's result stems in part from the fact that inflation lowers real output growth. Although the effects on output growth appear small, compounded over time, they are significant.

Another compelling reason to prefer zero inflation is that higher inflation is associated with increased variability of both inflation and relative prices. The increased variability of inflation and consequent inflation uncertainty shorten contract lengths, thereby increasing contract costs. The greater variability also contaminates price signals, so the price system conveys less information. As the variability of inflation (associated with higher inflation) increases, it becomes more difficult to determine whether a particular commodity price change reflects a movement in the general price level, or a real shift in supply or demand resulting from taste and productivity shocks.

In addition, inflation and the higher variability of the general price level cause a reallocation of resources from the production of goods to financial services for the sole purpose of hedging against inflation. Even if there is no reduction in conventional measures of output, inflation produces a distortion of output. The banking system and

financial service industries expand relative to other employment of resources such as industrial output, and households sacrifice leisure to reduce their real balances when the inflation tax rises. These effects call into question the notion that, by penalizing the consumption of priced commodities, inflation reduces work effort and increases leisure.

Although it is difficult to quantify the degree to which inflation impairs the ability of the price system to signal correct information, there is no doubt that the price system allocates resources most efficiently in the absence of inflation.

Moreover, zero inflation is preferable to moderate inflation because inflation, even moderate inflation, distorts accounting, legal contracts and the tax system. Inflation also distorts the true cost of inventories, the depreciation of plant and equipment, as well as the time profile of real mortgage payments, and other fixed-dollar denominated contracts.

Of course, this analysis assumes that taxes and private contracts are not indexed against inflation. Why, it may be asked, don't the authorities index taxes against changes in the price level so that real payments are unaffected? Why, in turn, doesn't the private sector index wages and financial contracts to nullify the impact of price changes?

In fact, the tax code is now partly indexed against inflation. Indexation, however, is often taken as a signal that the authorities are giving up the battle against inflation. This was the basis for the outspoken opposition to indexation by former Federal Reserve Chairman Arthur Burns and why the Bank of Canada has opposed indexation. It is easy to construct examples in which inflation-mitigating schemes, such as indexation by reducing the marginal costs of inflation, lead to an increase in the aggregate inflation rate. Moreover, foregoing indexation may be a help in developing a reputation for credibly pursuing anti-inflation policies (see, for example, Fischer and Summers, 1989). For these reasons, it is not clear that indexation of tax codes is desirable.

In the private sector, indexation is unlikely to occur. At the heart of the diffi-

culty is a coordination problem. To be successful, indexation must be implemented by a large number of diverse firms facing different information. For example, are price changes due to nominal or real variables? It is well-known that indexing money wages to changes in prices due to real shocks is undesirable.⁶ Are price changes permanent or transitory? Are the price changes industry-specific or global? It is unlikely that individuals will agree on the cause of a price change and then coordinate their actions. Given these obstacles, indexation in the private sector is difficult and, hence, fairly rare. Moreover, in instances in which private indexation is fairly widespread, as in Israel, it reduces the resolve to fight escalating inflation.

Finally, it is impossible to fully index real cash balances against inflation, as previously discussed, because inflation leads people to hold fewer cash balances and results in a loss of their services.⁷ For these reasons, indexation is a frail reed on which to rest hopes of mitigating inflation's effects.

Price Stability as the Objective of Monetary Policy

Reducing an established moderate inflation trend may disrupt economic activity, producing temporary output and employment losses. Given an established moderate inflation rate, Howitt (1990, p. 104) argues that despite the desirability of zero inflation, the cost of achieving it probably outweighs the benefits. This argument against moving to price stability ignores the inflationary bias (and resulting uncertainty) that characterizes policy regimes motivated by concerns for transitional output and employment losses.

In the absence of a commitment to stable prices, a central bank concerned about transitional unemployment is likely to respond asymmetrically to shocks—temporary or permanent. This asymmetric behavior has clear implications for the price level in the case of demand shocks. A monetary authority concerned with transitional unemployment will be less willing to offset a demand shock that raises prices and employment than to offset an adverse demand shock that lowers prices and employment.

This asymmetric behavior extends to supply shocks as well.⁸ Adverse shocks will be accommodated; favorable ones will be ignored. Although the price level depends on many factors, including the relative incidence of positive and negative shocks, concern for transitional unemployment leads a central bank to pursue policies that will cause the price level to be higher than it would be otherwise.

This asymmetric behavior creates an inflationary bias with the potential for accelerating inflation. As inflation increases, the monetary authority may be forced to tolerate transitional unemployment to bring the inflation down. Indeed, this appears to be what happened in the United States in the late 1970s and on a smaller scale in the late 1980s. The best way to avoid such disruptions is to commit to a policy of stable prices.

SUMMARY AND CONCLUSIONS

We have reviewed several arguments in favor of moderate inflation and we find them to be lacking theoretically and, in some instances, empirically. The first argument, that moderate inflation enhances economic stability, is subject to compelling objections. If expectations are adaptive, any decline in the semi-elasticity of money demand associated with a higher inflation may well be offset by a more rapid revision of inflationary expectations. If expectations are rational, this must be the case.

The argument that inflation leads to a higher level of output is based on theoretical models that are not robust to small specification changes. When real-world institutions are taken into account, the weight of the evidence is that inflation discourages capital accumulation. When capital is defined to include human capital, inflation may reduce not only the level of output per capita but its rate of growth as well.

Also suspect is the proposition that moderate inflation increases the efficacy of monetary policy by allowing the central bank to make the real rate of interest negative. Sufficient investment opportunities are likely to exist at very low but positive real

⁶ The authorities in Israel indexed money wages to a price index which included imported goods. In fact, imported goods should be excluded since changes in import prices reflect changes in a real variable, the terms of trade. Later on, this mistake was rectified and terms of trade effects were excluded from the price index.

⁷ In principle, to maximize the services of real balances, it would be desirable to have prices fall at the real rate of interest and set the money rate of interest to zero. People would then be induced to hold the satiation quantity of real balances. It would take us too far afield, however, to discuss the merits of deflation at the real rate in comparison with stable prices. Therefore, we confine our attention to a comparison of zero with moderate inflation.

⁸ In the case of the oil shock in the 1970s (an adverse supply shock which tended to raise inflation and reduce output), a number of economists advocated a quantum increase in the stock of money to offset a potential increase in unemployment. On the other hand, how many voices were raised in favor of a reduction in the money stock when OPEC collapsed?

interest rates. Consequently, negative real rates are not required to make monetary policy effective. Also, even if positive inflation enabled the Fed to make real short-term interest rates negative, such actions may not lower long-term interest rates.

The proposition that moderate inflation eases inter-industry wage adjustments is weak too. One argument rests on the existence of a money illusion; we see no economic rationale for money illusion in the steady state. If the asserted resistance to nominal wage cuts is based on a deeper motivation, we suggest that it should disappear entirely as the regime of zero inflation persists. Moreover, the evidence suggests that nominal wage cuts are frequent even during periods of moderate inflation. Hence, the conjecture that workers resist nominal wage cuts lacks both theoretical and empirical justification.

Finally, we argue that a policy of living with inflation cannot be rationalized on the grounds that there are transitory output costs associated with reducing inflation. A policy motivated by concern for transitional unemployment is likely to have inflationary bias that will erode a commitment to any price objective.

REFERENCES

- Bailey, Martin J. *National Income and the Price Level: A Study in Macroeconomic Theory*. McGraw Hill, 1971.
- _____. "The Welfare Cost of Inflationary Finance," *Journal of Political Economy* (April 1956), pp. 93-110.
- Blanchard, Olivier J., and Stanley Fischer. *Lectures on Macroeconomics*. MIT Press, 1989.
- Brunner, Karl, and Allan H. Meltzer. "The Uses of Money: Money in the Theory of an Exchange Economy," *The American Economic Review* (December 1971), pp. 784-805.
- Bruno, Michael. "Econometrics and the Design of Economic Reform," *Econometrica* (March 1989), pp. 275-306.
- _____. and Stanley Fischer. "Seigniorage, Operating Rules, and the High Inflation Trap," *Quarterly Journal of Economics* (May 1990), pp. 353-74.
- Cagan, Philip. "The Monetary Dynamics of Hyper Inflation," in Milton Friedman, ed., *Studies in the Quantity Theory of Money*. University of Chicago Press, 1956.
- Christiano, Lawrence J., and Martin Eichenbaum. "Liquidity Effects and the Monetary Transmission Mechanism," *The American Economic Review* (May 1992), pp. 346-53.
- _____. and _____. "Identification and the Liquidity Effect of a Monetary Policy Shock," National Bureau of Economic Research Working Paper No. 3920 (1991).
- Cook, Timothy, and Thomas Hahn. "The Effect of Changes in the Federal Funds Rate Target on Market Interest Rates in the 1970s," *Journal of Monetary Economics* (November 1989), pp. 331-51.
- DeLong, J. Bradford, and Lawrence H. Summers. "Macroeconomic Policy and Long-Run Growth," Federal Reserve Bank of Kansas City *Economic Review* (fourth quarter 1992), pp. 5-29.
- Dornbusch, Rudiger, and Jacob A. Frenkel. "Inflation and Growth: Alternative Approaches," *Journal of Money, Credit and Banking* (February 1973), pp. 141-56.
- Dotsey, Michael, and Peter Ireland. "On the Welfare Cost of Inflation in General Equilibrium," unpublished manuscript (August 1993), Federal Reserve Bank of Richmond.
- Feldstein, Martin S. "The Welfare Cost of Permanent Inflation and Optimal Short-Run Economic Policy," *Journal of Political Economy* (August 1979), pp. 749-68.
- _____. "Inflation, Income Taxes, and the Rate of Interest: A Theoretical Analysis," *The American Economic Review* (December 1976), pp. 809-20.
- Fischer, Stanley, and Lawrence H. Summers. "Should Nations Learn to Live with Inflation?" *The American Economic Review* (May 1989), pp. 382-87.
- Friedman, Milton. "The Optimum Quantity of Money," in *The Optimum Quantity of Money and Other Essays*. Aldine Publishing Co., 1969.
- _____. and Anna Jacobson Schwartz. *A Monetary History of the United States 1867-1960*. Princeton University Press, 1963.
- Fuhrer, Jeff, and Brian Madigan. "A Monetary Policy When Interest Rates are Bounded at Zero," unpublished manuscript (August 25, 1993), Board of Governors of the Federal Reserve System.
- Goodfriend, Marvin. "Interest Rate Policy and the Inflation Scare Problem: 1979-1992," Federal Reserve Bank of Richmond *Economic Quarterly* (winter 1993), pp. 1-24.
- Gordon, David B., and Eric M. Leeper. "The Dynamic Impacts of Monetary Policy: An Exercise in Tentative Identification," *Journal of Political Economy* (December 1994), pp. 1228-47.
- Greenspan, Alan. "Statement before the Subcommittee on Economic Growth and Credit Formation of the Committee on Banking, Finance and Urban Affairs of the United States House of Representatives," *Federal Reserve Bulletin* (September 1993), pp. 849-55.
- Hoover, Kevin D. "Commentary," this *Review* (May/June 1995), pp. 26-32.
- House Joint Resolution 55. "Directing the Federal Reserve Open Market Committee of the Federal Reserve System to Adopt and Pursue Monetary Policies Leading To, and Then Maintaining Zero Inflation," 103rd Congress, 1st Session (January 5, 1993).

REVIEW

JULY/AUGUST 1995

- Howitt, Peter. "Zero Inflation as a Long-Term Target for Monetary Policy," in Richard G. Lipsey, ed., *Zero Inflation: The Goal of Price Stability*. C. D. Howe Institute, 1990.
- King, Robert G., and Sergio Rebelo. "Public Policy and Economic Growth: Developing Neoclassical Implications," *Journal of Political Economy* (October 1990, Part 2), pp. S126-50.
- Lebow, David E., David J. Stockton and William L. Wascher. "Inflation, Nominal Wage Rigidity, and the Efficiency of Labor Markets," unpublished manuscript (August 1993), Board of Governors of the Federal Reserve System.
- Lucas, Robert E., Jr. "On the Mechanics of Economic Development," *Journal of Monetary Economics* (July 1988), pp. 3-42.
- Lucas, Robert E. "The Bank of Canada and Zero Inflation: A New Cross of Gold?" *Canadian Public Policy* (March 1989), pp. 84-93.
- McLaughlin, Kenneth J. "Rigid Wages?" *Journal of Monetary Economics* (December 1994), pp. 383-414.
- Ohanian, Lee E., and Alan C. Stockman. "Theoretical Issues of Liquidity Effects," this *Review* (May/June 1995), pp. 3-25.
- Orphanides, Athanasios, and Robert M. Solow. "Money, Inflation and Growth," in Benjamin M. Friedman and Frank H. Hahn, eds., *Handbook of Monetary Economics*, vol. 1. North-Holland, 1990.
- Pagan, Adrian R., and John C. Robertson. "Resolving the Liquidity Effect," this *Review* (May/June 1995), pp. 33-54.
- Reichenstein, William. "The Impact of Money on Short-Term Interest Rates," *Economic Inquiry* (January 1987), pp. 67-82.
- Romer, Christina D., and David H. Romer. "New Evidence on the Monetary Transmission Mechanism," *Brookings Papers on Economic Activity* (1990:1), pp. 149-98.
- Schultze, Charles L. "Microeconomic Efficiency and Nominal Wage Stickiness," *The American Economic Review* (March 1985), pp. 1-15.
- Stockman, Alan C. "Anticipated Inflation and the Capital Stock in a Cash-in-Advance Economy," *Journal of Monetary Economics* (November 1981), pp. 387-93.
- Summers, Lawrence. "How Should Long-Term Monetary Policy Be Determined?" Panel Discussion, *Journal of Money, Credit and Banking* (August 1991, Part 2), pp. 625-31.
- Tatom, John A. "The Welfare Cost of Inflation," this *Review* (November 1976), pp. 9-22.
- Thornton, Daniel L. "The Effect of Monetary Policy on Short-Term Interest Rates," this *Review* (May/June 1988), pp. 53-72.
- Tobin, James. "Inflation and Unemployment," *The American Economic Review* (March 1972), pp. 1-18.
- _____. "Money and Economic Growth," *Econometrica* (October 1965), pp. 671-84.