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The Monetarist-Keynesian Debate and the Phillips Curve: Lessons from the Great Inflation

Robert L. Hetzel

A chievement of consensus over the cause of cyclical fluctuations in the economy and the nature of inflation has foundered on the impossibility of running the controlled experiments that isolate a single cause from the multiple forces that impact the economy. In this respect, the period from the mid-1960s through the end of the 1970s (the Great Inflation) is important in that the characterization of monetary policy—the economists' proxy for an experiment—was unusually clear.[1] Monetary policy was activist in that the Federal Reserve pursued both unemployment and inflation objectives in a way shaped by the assumed tradeoffs of the Phillips curve.[2] The experience of the Great Inflation did produce enduring changes, especially the assumption of responsibility by central banks for the control of inflation without recourse to wage and price controls. However, the

The author gratefully acknowledges helpful comments from Thomas Lubik, Andrew Owen, Felipe Schwartzman, and Alex Wolman. The views expressed in this article are those of the author and do not necessarily reflect those of the Federal Reserve Bank of Richmond or the Federal Reserve System. E-mail: robert.hetzel@rich.frb.org.

[1] Much of the commentary in this article summarizes work by Hetzel (1998; 2008a, Chs. 5–12, 22–25; 2012, Ch. 8; and 2013a).

[2] Over time, economists who urge an activist policy aimed at achieving an optimal mix of low inflation and low unemployment or an optimal tradeoff in the variability of these variables have altered the character of the empirical correlations between inflation and unemployment to which they attribute structural significance. Until the end of the 1970s, the period relevant for the discussion here, most commonly, they emphasized the correlation between inflation and the unemployment rate. Subsequently, they have emphasized the correlation between the difference in the unemployment rate and a reference value often termed the NAIRU (non-accelerating inflation rate of unemployment) and the change in the rate of inflation.

difficulty of isolating the impact of policy from other forces, especially inflation shocks, has limited the conclusions that economists draw from this experience.

In the 1960s, and well into the 1970s, an unusual degree of professional consensus existed. This Keynesian consensus emerged out of two dramatically contrasting episodes. The persistence of high unemployment in the decade of the 1930s (the Great Depression) appeared to demonstrate the weak equilibrating properties of the price system. In contrast, the low unemployment during World War II appeared to demonstrate the usefulness of fiscal policy in managing aggregate demand in order to maintain employment at its full employment level.

Supported by this intellectual consensus during the Great Inflation, policy attempted to stabilize unemployment at a lower level than had prevailed over most of the post-War era. The activist policy pursued in order to achieve this objective engendered the monetarist-Keynesian debate, which centered on whether policymakers could and should base policy on the observed inflation-unemployment relationship captured by the empirical correlations of the Phillips curve.

Section 1 offers a broad overview of the methodology economists use for learning from historical experience—whose antecedents lie in the Friedman-Cowles Commission debate of the early 1950s. Section 2 summarizes the way in which the contemporaneous understanding of the Phillips curve shaped monetary policy in the 1970s. Sections 3 and 4, respectively, contrast Keynesian and monetarist views on the Phillips curve and the resulting disagreement over the desirability of an activist monetary policy. Section 5 explains the way in which the Samuelson-Solow interpretation of the Phillips curve embodying an inverse relationship between inflation and unemployment supported the policy of aggregate-demand management in the Great Inflation. Section 6 reviews the challenge made by Milton Friedman to the Samuelson-Solow interpretation of the Phillips curve. In a way analogous to the contrasting experiences of the Great Depression and World War II, Sections 7 and 8 summarize how the contrasting experiences of the Great Inflation and the Volcker-Greenspan era changed the prevailing Keynesian intellectual consensus. The article concludes, in Sections 9 and 10, with some speculation on the course of the current debate over the causes of the Great Recession, which began in earnest in 2008.

1. FRIEDMAN AND THE COWLES COMMISSION ECONOMISTS: COMPLEMENTARY ADVERSARIES

In the late 1940s, the University of Chicago and the University of Cambridge assembled perhaps the greatest collection of intellectual brilliance the economics profession will ever see. They provided much of the impetus involved in changing economics from its then dominant institutionalist character to the neoclassical character now considered mainstream. Along with the mathematical formalization of Keynes's (1936) book (*The General Theory of Employment, Interest and Money*), in Hicks (1937) the methodology developed by the economists of the Cowles Commission laid out the general framework for construction of models of the economy and highlighted the econometric issues of identification of structural equations from the reduced-form correlations found in the data.[3] In his essay "The Methodology of Positive Economics," Friedman ([1953a] 1953) criticized the identification strategy of the Cowles Commission with its reliance on a priori assumptions about which variables could be excluded in the estimation of the equations comprising a model of the economy.[4]

Friedman argued that many alternative models would fit a set of macroeconomic time series equally well.[5] As a consequence, goodness of fit for a given body of data would not distinguish between models. Hypothesis testing requires the elucidation of contrasting implications of alternative models. Those contrasting implications then should be taken to data sets not available to the economist at the time of building the model. Most notably, testing required that models not only fit the existing data but also that they yield implications about the future.[6]

Understanding the context of Friedman's 1953 essay helps to elucidate the statements it contains about hypothesis testing. At the end of the 1940s, there was an effort to test the marginal foundation of neoclassical economics by examining its "realism," for example, through surveys asking the managers of firms whether they choose price and

[3] The Cowles Commission pioneered the representation of the economy by a system of stochastic difference equations. As expressed by Tjalling Koopmans (1947, 167), the Cowles Commission's members worked on empirical estimation based on recognition of the fact that "the mere observation of regularities in the interrelations of variables ... does not permit us to recognize or to identify behavior equations among such regularities." The general approach of giving the behavioral equations that represent the economy a microeconomic foundation shapes the research agenda of macroeconomics.

[4] Sims (1980) talked about "incredible" identifying restrictions of the large-scale econometrics models spawned by the Keynesian attempt to give empirical content to the Cowles Commission agenda.

[5] See Chari, Kehoe, and McGrattan (2009) for a similar statement.

[6] For a restatement, see Friedman and Schwartz (1991).

output based on a marginal cost schedule. The then-dominant institutionalist school questioned the realism of marginal cost pricing. Friedman argued that the theoretical assumptions of neoclassical models were a necessary abstraction required in order to yield refutable implications.[7] The relevant test of a model is its predictive ability. Because of its complexity, a "realistic" model would always afford a rationalization of the data but the economist could not distinguish between fitting a model to the data and testing its validity.

Beyond the simplification entailed by the theoretical abstraction necessary to compare the implications of a model to the data in a way capable of refuting rather than rationalizing the model, it is necessary to separate exogenous from endogenous variables. The ideal is the controlled experiment of the physical sciences. A test of the competing hypotheses that guide the formulation of alternative models is then simplified because of the assignment of causality made possible by the controlled experiment. Applied to economics, the Friedman strategy was to relate both the evolution of central bank procedures and episodes of significant departures from those procedures to changes in the political and intellectual environment unrelated to the operation of the price system. This diversity of central bank behavior serves as a semi-controlled experiment informative for disentangling causation in the historical association between real and monetary instability.

The spirit of the Friedman approach to testing models involves, as a first step, specification of the alternatives. At this stage, models can be superior along two dimensions. First, some may be better microfounded than others. Second, some may explain a more challenging set of empirical phenomena. That is, they are more resistant to fitting time series through data mining. The ideal is to proceed along two parallel, inter-related paths: model building and the isolation of "robust" correlations.

The search for robust correlations requires searching across time and across countries in pursuit of persistent relationships. In the context of monetary models of the business cycle, correlations between monetary and real instability that survive this diversity of experience are as close as one can come to a controlled experiment. The diversity of experience limits the possibility of some nonmonetary cause common to all episodes producing the correlation between monetary and real instability. The discipline of looking at the entire set of historical experiences rather than isolating individual episodes favorable to one hypothesis, in this case, the monetary nonneutrality explanation

[7] Of course, they also impose the discipline of constrained optimization that households and firms undertake all available trades that improve their welfare (markets clear).

of the business cycle, reveals whether real instability arises in contexts of monetary stability as well as in contexts of extreme monetary instability.

Specifically, the economist looks for event studies, that is, episodes in which he (she) has some information particular to the time period about the nature of causation. Because of the impossibility of controlling for extraneous forces in particular episodes, the ideal is one where metastudies generalize across a wide variety of historical event studies. In particular, do monetary-real correlations appear in a sufficiently wide variety of historical episodes so that the only common element in the episodes is likely to be the behavior of the central bank? Correlations that persist across time and place and come tagged with information of central bank behavior unrelated to the stabilizing operation of the price system then become the "stylized facts" that discipline the choice of frictions to incorporate into models.[8]

The challenge is to run a horse race among models that potentially selects the one that is likely to offer better predictions out-of-sample. Although alternative models can differ in the adequacy of their microfoundations, the Friedman emphasis is on the assumption that each model builder knows the data and will select a combination of model and data that support his (her) model. By itself, neither model fit nor economic theory is adequate to identify the true structural equations. One central element in model selection is to discipline the horse race through identification of policy using a variety of historical information rather than representing policy by a general functional form with free parameters the estimation of which will necessarily aid the fit of any model.

To make the discussion more specific, a correlation common to all recessions is central bank behavior that imparts inertia to reductions in interest rates while the economy weakens. For central banks concerned with the behavior of the external value of their currency, this behavior is associated with countries going onto the gold standard or a peg with a foreign currency at a parity that overvalues the domestic currency (requires a reduction of the real terms of trade through deflation). For the other cases, this behavior is associated with a concern to lower inflation or asset prices considered artificially elevated by speculation. These episodes come tagged with information that the behavior of the central bank does not arise out of a systematic reaction function related

[8] One problem in macroeconomics is the practical difficulty of generalizing from the vast literature on historical episodes that are potentially useful as event studies. This difficulty makes it harder to reach agreement in monetary economics over the "stylized" facts a model should explain. In contrast, new mathematical techniques useful in model construction are more readily incorporated into mainstream models.

to the ongoing behavior of the economy. Monetarists point to such a correlation as robust.

In monetary economics, the horses in these races divide into three basic classes. In the Keynesian tradition, cyclical fluctuations arise from real shocks in the form of discrete shifts in the degree of investor optimism and pessimism about the future large enough to overwhelm the stabilizing properties of the price system and, by extension, to overwhelm the monetary stimulus presumed evidenced by cyclically low interest rates. In the quantity theory tradition, cyclical fluctuations arise from central bank behavior that frustrates the working of the price system through monetary shocks that require changes in individual relative prices to reach, on average, a new price level in a way uncoordinated by a common set of expectations. In the real-business-cycle tradition, cyclical fluctuations arise from productivity shocks passed on to the real economy through a well-functioning price system devoid of monetary nonneutralities and nominal price stickiness. Of course, only the first two horses contended in the debate during the Great Inflation.

2. THE CENTRAL ROLE OF THE PHILLIPS CURVE DURING THE GREAT INFLATION

The Phillips curve is a set of empirical observations showing an inverse relationship between the behavior of inflation and unemployment. At the heart of the activist policy pursued during the Great Inflation was the belief in an "exploitable" Phillips curve, that is, a Phillips curve allowing the policymaker to trade off between the achievement of unemployment and inflation objectives. The monetarist-Keynesian debate turned, to a significant extent, on the issue of whether the empirical correlations of the Phillips curve represented a structural relationship that would allow policymakers to trade off between their pursuit of the two variables, with predictable consequences.[9]

Specifically, during periods of economic recovery from a cyclical trough when inflation had fallen and the unemployment rate was above normal and thus unemployment had become the main concern, policymakers assumed that monetary policy could be expansionary without

[9] During the Great Inflation, monetary policymakers eschewed the language of tradeoffs. As a result, discussions within the Federal Open Market Committee (FOMC) never explicitly employed the conceptual framework of the Phillips curve. Moreover, FOMC discussion followed the packaging for the public of policy actions as individual actions, each of which was defensible in a common sense way in the context of the contemporaneous behavior of the economy and the resulting relative priority assigned to achieving unemployment and inflation objectives. As a result, both the systematic character of monetary policy and the conceptual framework generating that policy have to be inferred by economists.

exacerbating inflation. That is, a flat Phillips curve would allow a reduction in unemployment to its full employment level with little increase in inflation. In the aftermath, in the advanced stages of economic recovery when a reduction in unemployment and an increase in inflation turned inflation into the main concern, policymakers assumed that monetary policy could be restrictive by creating a moderate, socially acceptable increase in unemployment. That is, a moderate but sustained increase in unemployment above its full employment level acting through a downward-sloping Phillips curve would lower inflation at an acceptable social cost in terms of unemployment. In a way given by the sacrifice ratio embedded in the Phillips curve, monetary policy could engineer the required number of man-years of excess unemployment—the so-called soft landing—through an extended but moderate increase in unemployment above its full employment level.

This common understanding of the nature of the Phillips curve and activist policy rested on two basic assumptions. First, inflation is a nonmonetary phenomenon. That is, inflation springs from a variety of real factors rather than from the failure of the central bank to control money creation. One reason that the Great Inflation is an interesting laboratory for economists was the existence of a monetary aggregate (M1) that provided a good measure of the stance (stimulative or contractionary) of monetary policy due to the interest-insensitive nature of real money demand and a stable, albeit lagged, relationship with nominal expenditure. However, the assumption that money responded passively to the various real forces that determine the combined total of real aggregate expenditure and inflation (nominal aggregate expenditure) removed money from consideration as a useful policy instrument. It was the real character of inflation that made the Phillips curve, rather than money, into the relevant predictor of inflation.

The second basic assumption was that policymakers understood the structure of the real economy sufficiently well to pursue an unemployment objective. They knew the level of unemployment consistent with full employment, by consensus, taken to be 4 percent. The excess of unemployment over this full employment level measured the amount of idle workers desiring productive employment. Also, policymakers could forecast the behavior of the economy based on their choice of policy sufficiently well to exploit the tradeoffs of the Phillips curve. They could lower excess unemployment through stimulative monetary policy at an acceptable cost in terms of inflation. Analogously, when the unemployment rate became an intermediate objective of policy central for lowering inflation rather than an objective in itself and policy was restrictive, they could manage inflation with an acceptable cost measured in terms of extended excess unemployment.

3. AN OVERVIEW OF TRADITIONAL KEYNESIAN VIEWS

As described in *The General Theory*, swings in investor sentiment, which Keynes termed animal spirits, drove the business cycle. Adjustment to these swings in sentiment occurred through changes in output unmitigated by the operation of the price system. Keynes fixed nominal prices by assuming rigid wage rates and by taking the price level as an institutional datum. The resulting framework served as a clarion call for government action to counter recession. It did so by challenging the prevailing view that the deflation and recession following the bursting of an asset bubble required an extended period of rectifying accumulated imbalances (Hetzel 1985; 2012, Ch. 3).

In Keynes's framework, the exogeneity of fluctuations in investment captured the assumption that irrational swings from optimism to pessimism about the future overwhelm the ability of the stabilizing properties of the price system. That is, in recession, no decline in the real interest rate is sufficient in order to redistribute demand from the future to the present to maintain aggregate demand equal to potential output. In response to an exogenous decline in investment, output has to decline. Otherwise, given the exogenous decline in investment, the full employment level of saving would exceed investment. A decline in output is necessary to reduce saving in line with a lower level of investment.

However, a given decline in output decreases saving by only a fractional amount because of a marginal propensity to consume out of income (output) greater than zero. The required reduction in saving must occur through a decline in output (income) that is a multiple of the decline in investment. As captured by the Keynesian multiplier, exogenous swings in investment translate into shifts in output in a mechanical way based on the inverse of the marginal propensity to save (one minus the marginal propensity to consume). The optimism in Keynes's message came from the implication that the government could offset the excessive private saving that arose at full employment through public dissaving, that is, through deficit spending. With social saving (government dissaving plus private saving) at the full employment level, output need not fall in order to equate private saving to a lower level of exogenous investment.

At a deeper level, the issue is why an increased desire to save (transfer resources to the future) in order to guard against a future that has become darker and more uncertain does not translate into increased investment but instead requires a decline in output. That desire is frustrated on two levels. The ability of financial intermediation to transfer resources from savers to investors with opportunities for

productive investment breaks down.[10] Also, the nominal rigidity of wages and prices frustrates the desire to save for the future through an increased work effort. Without the management of aggregate demand by government through deficit spending, output and employment can fall short of potential output over extended, perhaps indefinite, periods.

Keynesians believed that the central bank should target the behavior of the unemployment rate (the amount of idle resources in the economy due to the weak ability of the price system to maintain full employment and the full utilization of resources). The central bank should pursue this real objective subject to the constraint imposed by the acceptable level of inflation. The central role of the Phillips curve derived from the assumption that it offered policymakers a practical way of estimating the cost in terms of inflation incurred by the pursuit of the full employment objective. Similarly, in response to inflation shocks, the Phillips curve allowed policymakers to predict the cost in terms of excess unemployment of mitigating the inflation produced by the inflation shock.

4. AN OVERVIEW OF MONETARIST (QUANTITY THEORY) VIEWS

Monetarism, as formulated by Milton Friedman, challenged the activist monetary policy pursued during the Great Inflation and the Keynesian consensus that supported it. Monetarists believed that the central bank should concentrate on the control of money creation with the objective of price stability. This monetary objective would turn over to the price system the exclusive responsibility for the determination of real variables like the unemployment rate.[11] The following elucidates the central role played by the need for monetary control.

Although central banks use the interest rate as their instrument, their uniqueness comes from monopoly control over the monetary base (bank reserves and currency). Because the monetary base is the medium used to effect finality of payment in transactions for whatever instruments possess the property of a medium of exchange (broad money or simply money here), the control of money creation requires the control of the monetary base. It follows that the interest rate rule the central

[10] A liquidity trap (the willingness of the public to hold whatever amount of money the central bank creates) vitiates the effectiveness of monetary policy as opposed to fiscal policy.

[11] The intensity shown by Keynesians in the monetarist-Keynesian debate came from the fear that a central bank policy organized around monetary control would lead to a rule for controlling money that left the determination of real variables to the operation of the price system.

bank follows must provide for that control. The following elucidates the discipline imposed on that rule.

Money serves three functions. It is a numeraire, a store of value, and a medium of exchange. In order to serve its function as a numeraire, the money price of goods (the number of dollars that exchange for a representative basket of goods consumed by households) must evolve predictably. The simplest case is that of price stability. In its function as a numeraire, money has a public good aspect. Although firms set prices in terms of dollars, they only intend to set a relative price (the rate of exchange of their product with other products). There is then an advantage to all firms that set dollar prices for multiple periods in setting the dollar price for their product based on the same assumption about the future price level. An assumption of rational expectations is that the central bank can organize this coordination by following a rule that causes the price level to evolve predictably.[12] In the sense of Hayek (1945), a stable numeraire is one element in allowing the price system to economize on the information that households and firms need in order to make decisions.

Money also serves as a medium of exchange. To effect transactions, the public desires to hold a well-defined amount of purchasing power (the nominal quantity of money multiplied by the goods price of money, the inverse of the price level). To prevent an unpredictable evolution of the price level that vitiates the role of money as a numeraire, the central bank must cause nominal money to grow in line with the real demand for money consistent with growth in potential output plus transitory demands. Even if central banks do not have money targets and even if money does not serve to forecast economic activity, monetary stability requires that central bank procedures control money creation.[13]

A monetary-control characterization of policy follows if the price level is a monetary phenomenon in the strong form in the sense that there is no structural (predictable) relationship between real variables like unemployment and nominal variables like nominal money and the monetary base, the variable over which the central bank exercises

[12] The assumption is not true in any literal sense in that the evolution of the monetary standard since the breakdown of the gold standard has been one of learning. However, it possesses the powerful implication that if the central bank behaves in a credible, consistent way, its rule will discipline the way in which markets forecast inflation.

[13] Like any abstraction, one has to give empirical content to the variable "money." In principle, one would like a measure of the transactions (liquidity) services yielded by different assets, such as contained in a Divisia aggregate (Barnett 1982). A complicating factor is that, since 1994, the Federal Reserve Board has not measured the extent to which banks "sweep" deposits off their balance sheets in order to avoid the tax imposed by non-interest-bearing reserve requirements. Monetary aggregates like M1 are therefore likely mismeasured.

ultimate control. Two implications follow from the absence of a structural relationship between money and real variables. First, the central bank must provide a nominal anchor. Because the welfare of individuals depends on real variables (physical quantities and relative prices), nothing in their behavior gives money a well-defined value in exchange for goods by limiting its quantity. The intrinsic worthlessness of money requires the central bank to follow a rule that limits the nominal quantity of money.

The second implication of the absence of a structural relationship between money and real variables is that in order to provide for monetary and real stability, the central bank must turn over the determination of real variables to market forces. In this sense, in order to provide for monetary stability, the central bank must avoid "price fixing" by interfering with the operation of the price system. Equivalently, given that central bankers use an interest rate as their policy instrument, in order to provide for monetary and real stability, monetary policy procedures must entail moving the nominal interest rate so that the resulting real interest rate tracks the natural interest rate.[14] Specifically, central banks must allow market forces to determine the real interest rate and, by extension, other real variables like the unemployment rate.[15]

The control of trend inflation then comes from the way in which the central bank's rule creates a stable nominal expectational environment that shapes the way in which firms in the "sticky" price sector set prices for multiple periods rather than through manipulation of an output gap based on Phillips curve tradeoffs. A critical facet of the monetarist assumption that the price system works well in the absence of monetary disorder is rational expectations.[16] Specifically, when firms set a dollar price for their product for multiple periods, they take into account the way in which future changes in the price level will affect the relative price of their product. The assumption of rational expectations implies that if the central bank behaves in a predictable and credible way, firms collectively will coordinate these relative-price maintaining changes in

[14] In the context of the New Keynesian model, the natural rate is the real interest rate that would obtain in the absence of any nominal rigidity in prices. The counterpart in the writings of Milton Friedman is the assumption that the price system gives real variables well-defined (natural) values when actual and expected inflation are equal.

[15] This Wicksellian view contrasts with the Keynesian view in which multiple sources of price stickiness exist, say, in the setting of wages and product prices. In principle, if the central bank possessed sufficient knowledge of the economy, it could follow a rule that managed real aggregate demand by controlling the real interest rate in order to trade off optimally between inflation and both employment and output gaps. See the Appendix.

[16] This assumption is not in Milton Friedman's formulation of the quantity theory. It first appears in the mathematical formulation of monetarist ideas in Lucas ([1972] 1981).

dollar prices on the central bank's inflation target. The self-interest of firms in setting their markup of price over marginal cost optimally over time causes them to use information efficiently about the nature of the monetary regime.

Individually, firms set relative prices based on marginal cost. The central bank's rule separates the determination of the price level from the determination of relative prices (at cyclical and lower frequencies). As a consequence of following a rule that causes the real interest rate to track the natural interest rate (the real rate determined by market forces), the central bank allows the price system to determine real variables and allows the price system to keep real output fluctuating around its potential level.[17] As a consequence of its interest rate target, the central bank then allows nominal money to grow over time in line with the real money demand associated with growth in potential output. The interest rate target also allows changes in money to accommodate transitory changes in money demand and whatever inflation occurs as a consequence of the central bank's inflation target. In this way, the rule causes nominal money to grow over time in a way that does not require unanticipated changes in the price level in order to bring real money into line with real money demand.

The central bank can control trend inflation—no less and (just as important) no more. In order to avoid destabilizing economic activity, it should allow transitory noise to pass through into the price level. In the passage containing the famous "long and variable lags" phrase, Friedman (1960, 86–8) argued that the power of the central bank was limited to the ability to control trend inflation. Any attempt to manage the behavior of the real economy or to smooth transitory fluctuations in inflation would in practice destabilize the economy due to policymakers' lack of knowledge of the structure of the economy. The following summarizes the experiment with aggregate demand management in the decade and a half after mid-1965.[18]

5. THE VAST EXPERIMENT OF PAUL SAMUELSON AND ROBERT SOLOW

In *The General Theory*, Keynes assumed that with excess capacity in the economy increases in aggregate demand would raise output. Only

[17] As noted above, Keynesians point to the low rates of interest in recession as evidence of the impotence of monetary policy. Monetarists point to the inertia central banks put into the interest rate when the economy weakens and the associated monetary deceleration. A low interest rate in recession implies only that the public is pessimistic about the future.

[18] For other accounts, see Hetzel (2008a, 2013a) and King (2008).

at full employment would increases in aggregate demand appear as price rises.[19] Given the general consensus that emerged after World War II that a 4 percent or lower unemployment rate represented full employment, an unemployment rate above 4 percent implied the existence of idle workers—workers who wanted to work at the prevailing wage rate but could not find work. Aggregate demand management should then be able to push the unemployment rate down at least to 4 percent without inflation. In the language of the time, demand-pull inflation would not be a problem.

The contest for the presidency between John F. Kennedy and Richard Nixon in 1960 initiated a national debate over the use of aggregate-demand management to lower the unemployment rate to 4 percent or lower. Kennedy's economic advisers wanted to pursue an activist policy of aggregate demand management. Politically, the chief obstacle to adoption of such a policy with its deliberate deficits was fear of inflation. The Kennedy Council of Economic Advisers needed a model that would predict the inflation rate associated with the reduced unemployment rate presumed to follow from a policy of aggregate-demand management. The Samuelson-Solow ([1960] 1966) interpretation of the empirical correlations of the Phillips curve provided those predictions.

Consistent with the Keynesian temper of the time, Paul Samuelson and Robert Solow offered an interpretation of the Phillips curve based on the premise that inflation is a real phenomenon rather than a monetary phenomenon. As a real phenomenon, there is no single explanation for inflation. The Keynesian taxonomy of the causes of inflation contained two kingdoms. Aggregate-demand (demand-pull) inflation arises from a high level of aggregate demand that stresses the rate of resource utilization. Cost-push inflation arises from increases in relative prices particular to individual markets that pass through permanently to the price level. A wage-price spiral could turn cost-push inflation into sustained inflation.

For the years 1861 to 1957 for Great Britain, A. W. Phillips (1958) demonstrated the existence of an inverse relationship between the rate of change of money wages and the unemployment rate. In 1960, Samuelson and Solow ([1960] 1966, 1,347) presented a graph of the same variables for the United States. Collectively, the observations in the Samuelson-Solow graph did not exhibit any particular pattern. The two economists argued, however, that the inverse relationship found by

[19] See Keynes ([1936] 1973, 300–1). He referred to the inflation that would arise as the economy approached full employment as "bottleneck" inflation. Before full employment, cost-push inflation could occur caused by "the psychology of workers and by the policies of employers and trade unions."

Phillips appeared in two periods: 1900–30 (omitting World War I), and 1946–58. The Phillips curve had, however, shifted up in the latter period.[20]

Samuelson and Solow ([1960] 1966, 1,348) assumed that the empirical Phillips curve they identified was "a reversible supply curve for labor along which an aggregate demand curve slides.... [M]ovements along the curve might be dubbed standard demand-pull, and shifts of the curve might represent the institutional changes on which cost-push theories rest." They believed that the Phillips curve offered an exploitable tradeoff. Breit and Ransom (1982, 128) quoted Solow:

> I remember that Paul Samuelson asked me when we were looking at the diagrams for the first time, "Does that look like a reversible relationship to you?" What he meant was, "Do you really think the economy can move back and forth along a curve like that?" And I answered, "Yeah, I'm inclined to believe it," and Paul said, "Me too."

The upward shift in the post-World War II period in the empirical Phillips curve, however, created a conundrum for Samuelson and Solow over what unemployment rate to recommend as a national objective. Their graphical analysis indicated that the unemployment rate consistent with price stability (zero inflation) was 5.5 percent. That unemployment rate was unacceptable to them. Samuelson and Solow ([1960] 1966, 1,351) referred to a 3 percent unemployment rate as a "nonperfectionist's goal" and adopted it as their reference point for full employment.

The issue of what inflation rate would arise if aggregate-demand management lowered the unemployment rate to 3 percent then depended on whether the Phillips curve had shifted upward because of cost-push inflation. If not, then price stability would require an unemployment rate of 5.5 percent. Because the data did not themselves reveal whether the market power of large corporations and unions had pushed up the empirical Phillips curve of the 1950s, Samuelson and Solow ([1960] 1966, 1,350) concluded that only the "vast experiment" of targeting 3 percent unemployment could determine whether their empirically estimated Phillips curve had been pushed up by cost-push inflation. With the objective of 3 percent unemployment achieved with aggregate-demand management, in the absence of cost-push inflation, prices should be stable. If cost-push inflation did arise, government

[20] Samuelson and Solow ([1960] 1966) translated the Phillips curve of Phillips (1958) into the more familiar Phillips curve with inflation on the vertical axis by lowering nominal wage growth by an assumed rate of growth of labor productivity.

programs to deal with the market power of large corporations and unions could make price stability with full employment possible.

Samuelson and Solow ([1960] 1966, 1,347 and 1,352) accepted the possibility that an increase in inflationary expectations could have caused what they conjectured to be cost-push inflation. However, they assumed that a policy to reverse that increase in inflationary expectations would likely entail a prolonged, socially unacceptable period of high unemployment.

> The apparent shift in our Phillips curve might be attributed by some economists to the new market power of trade-unions. Thus, it is conceivable that after they [policymakers] had produced a low-pressure economy [an economy with price stability], the believers in demand-pull might be disappointed in the short run; i.e., prices might continue to rise even though unemployment was considerable. Nevertheless, it might be that the low-pressure demand would so act upon wage and other expectations as to shift the curve downward in the longer run—so that *over a decade*, the economy might enjoy higher employment with price stability than our present-day estimate would indicate. [italics added]

Samuelson and Solow warned of the social cost of maintaining the 5.5 percent unemployment rate necessary to deliver price stability if indeed inflation was of the cost-push variety. Samuelson and Solow ([1960] 1966, 1,352 and 1,353) wrote that such a "low-pressure economy might build up within itself over the years larger and larger amounts of structural unemployment" leading to "class warfare and social conflict." "[D]irect wage and price controls" were a way "to lessen the degree of disharmony between full employment and price stability."

What happened to make a reality the "vast experiment" envisaged by Samuelson and Solow? In the Eisenhower administration, the Keynesian policy prescription of aggregate-demand management exercised no practical influence because of concern for balanced budgets and for the balance of payments and gold outflows. In the 1962 *Economic Report of the President*, President Kennedy did set 4 percent as a national goal for the unemployment rate accompanied by wage "guideposts" in order to control cost-push inflation (Hetzel 2008a, Ch. 6). However, in the context of the Bretton Woods system, Kennedy was unwilling to risk a dollar crisis (a run on the dollar) given the international tension associated with the Cuban missile crisis and the Berlin Wall (Hetzel 2008a, Ch. 7). For that reason, policy remained dominated by the conservative Treasury.

Starting with the 1964 tax cut, enacted in the Johnson administration following the fall 1963 assassination of Kennedy, the political

temper turned activist. President Johnson, with roots in the tradition of Texas populism, simply disliked "high" interest rates. More important, the country split in response to the Vietnam War and the emergence of a militant civil rights movement. "Low" unemployment offered a social balm. At the same time, Keynesian economists proffered the promise of full employment, taken to be 4 percent unemployment, at an acceptable cost in terms of inflation. That promise came from a Keynesian interpretation of the Phillips curve.

With the 1964 tax cut, the political system became hostile to increases in interest rates. Congressmen argued that any such increases would thwart the will of the political system to lower the unemployment rate as evidenced by the tax cut. William McChesney Martin, chairman of the FOMC, also had to deal with an increasingly Keynesian Board of Governors. In response, he worked with Treasury Secretary Henry H. Fowler to get an income tax surcharge that would eliminate the deficit and, hopefully, remove the need for increases in interest rates. However, the temporizing that effort entailed in raising interest rates in response to strong economic growth and declining unemployment caused money growth to surge. By the end of the 1960s, 6 percent inflation had replaced the price stability (1 percent consumer price index [CPI] inflation) of the start of the decade (Hetzel 2008a, Ch. 7).

Arthur Burns replaced William McChesney Martin as chairman of the FOMC in February 1970. Burns was willing to implement an expansionary monetary policy under the condition that President Nixon would impose wage controls in order to control inflation (Hetzel 1998, 2008a). Burns got those controls in August 1971. The United States also got the "vast experiment" envisaged by Samuelson and Solow: a policy of aggregate demand management intended to create a low unemployment rate accompanied by price controls to restrain cost-push inflation.

Over time, the Phillips curve that Samuelson and Solow identified for the United States shifted. Stockman (1996, 906 and 904) shows the Phillips curve for consecutive time periods. After a noisy start from 1950 to 1959, the curve exhibited a negative slope in the 1960s. It then shifted up from 1970 to 1973 and then again in 1974 to 1983. The curve shifted down after 1986. Initially, both Keynesian economists and policymakers interpreted the upward shift in the 1970s as evidence of cost-push inflation.

6. AN EXPECTATIONS-ADJUSTED PHILLIPS CURVE: FRIEDMAN'S CHALLENGE TO SAMUELSON-SOLOW

In their challenge to the Keynesian consensus in favor of an activist monetary policy, Friedman and Schwartz (1963a) organized the data on money and the business cycle using the National Bureau of Economic Research methodology of leading, coincident, and lagging indicators. The historical narrative in Friedman and Schwartz (1963b) associated changes in the behavior of money (changes in a step function fitted to money growth rates) to behavior of the central bank adventitious to the working of the price system. This procedure isolated changes in nominal money arising independently of changes in real money demand. Friedman then used these temporal relationships to forecast both the cyclical behavior of the economy and the rising inflation during the Great Inflation.

Friedman and Meiselman (1963) also published an article showing that money, but not investment, predicted nominal output. The Keynesian assumption was that velocity would adjust in order to make whatever amount of money existed compatible with a level of nominal output independently determined by real forces. This variability in velocity should have limited the predictive power of money. The response by Ando and Modigliani (1965) provided an impetus to the construction of large-scale macroeconomic models as a way of measuring the impact of changes in investment based on structural relationships rather than the reduced-form relationships of Friedman and Meiselman. Keynesians believed that such models would allow forecasts of the evolution of the economy under alternative policies. The intention was to enable an activist policy to improve on the working of the price system, which the Keynesian consensus assumed worked only poorly to maintain the full employment of resources.

Friedman challenged the feasibility of such models. Friedman (1960) argued that "long and variable lags" inherent in the impact of discretionary policy actions could destabilize the economy. In his presidential address to the American Economic Association, Friedman ([1968] 1969) argued that economists lacked the knowledge required to construct proxies for resource slack (underutilization of resources). The large-scale econometric models required to implement an activist monetary policy necessitated measures of these output gaps. Moreover, any attempt to use monetary policy to control the behavior of a real variable like unemployment in a systematic, predictable way would cause the assumed structural equations of these models to change in unpredictable ways.

Specifically, Friedman ([1968] 1969) criticized the idea of an exploitable Phillips curve tradeoff between inflation and unemployment.[21] Friedman's criticism reiterated his belief in the monetary rather than the real nature of inflation. The correlation between nominal and real variables at cyclical frequencies arises from monetary nonneutrality due to monetary disturbances.[22] Any systematic attempt by the central bank to lower unemployment through inflation would founder on the effort of the public to forecast inflation in order to set relative prices optimally. The Phillips curve would then be vertical. This proposition came to be known as the natural rate hypothesis.[23]

This formulation of the natural rate hypothesis derived its predictive content from the distinction between anticipated and unanticipated changes in inflation. Friedman expressed that distinction in the "expectations-adjusted" Phillips curve. That is, variation in the unemployment rate is related not to variation in the inflation rate, but to variation in the inflation rate relative to the inflation rate expected by the public. Surprise changes in inflation can cause actual and expected prices to diverge and thus affect real variables. The short-run nonneutrality of money then corresponded to the interval of time required for the public to adjust its expectations in response to a higher inflation rate.

Friedman predicted that an attempt by the Fed to peg the unemployment rate at a level less than the natural rate (the value consistent with equality between actual and expected inflation) would require increased inflation. He argued that the level of the Phillips curve would shift upward as the public's expectation of inflation rose (see Humphrey [1986]). Friedman also assumed that the public formed its expectation of inflation based on the past behavior of inflation (adaptive

[21] See, also, Friedman (1977).

[22] While prices set in terms of dollars economize on the bookkeeping required to record relative prices, they only serve that purpose adequately in a monetary environment in which the evolution of the price level is predictable. There is then no "illusion" (confusion) about the relative price corresponding to a dollar price.

[23] Economists continue to divide over the issue of whether the central bank can exploit a Phillips curve relationship in order to mitigate large fluctuations in unemployment due to aggregate-demand shocks by increasing fluctuations in inflation. The converse case is that of mitigating large fluctuations in inflation due to inflation shocks by increasing fluctuations in an output gap. Goodfriend and King (1997) exposit the New Keynesian model in the monetarist spirit. The New Keynesian model as exposited by Clarida, Gali, and Gertler (1999) incorporates the assumption that the central bank can exploit a Phillips curve tradeoff in order to mitigate the effects on output of a real shock such as a markup or aggregate demand shock provided it follows a rule that commits it to returning inflation to a long-run target. The Clarida, Gali, and Gertler (1999) argument, however, does not address the issue of whether the central bank possesses the requisite knowledge of the structure of the economy (Friedman [1951] 1953; 1960). See the Appendix for skeptical comments on how well economists can estimate the structural coefficients of the New Keynesian Phillips curve.

expectations). The lag with which expectations adjusted to higher inflation could then explain the correlation between high (rising) inflation and low unemployment.

Friedman's formulation of the expectations-augmented Phillips curve, however, raised the theoretical possibility of long-run monetary nonneutrality. It appeared that the central bank could maintain the lower level of unemployment with ever-rising rates of inflation (the accelerationist hypothesis). For monetarists, the problem with that implication was that money was not necessarily neutral even in the long run in its influence on real variables (provided of course the central bank was willing to tolerate ever higher rates of inflation). As with the original Phillips curve, there appeared to be no unique equilibrium level of unemployment.

An answer to that problem led Robert Lucas to incorporate John Muth's idea of rational expectations into macroeconomics. Lucas ([1972] 1981) used the island paradigm employed by search models as a metaphor for incomplete information. He also imposed "rational expectations" in which the expectations of individuals are formed consistently with the structure of the economy and with the monetary policy followed by the central bank. Individuals on an island would alter output over confusion between a change in the overall island-wide price level and the relative price of their product. Within this model, Lucas stated the monetary neutrality proposition in a way that avoided the paradox of a central bank able to affect real output through systematic variation in the rate of inflation. The central bank could not permanently lower the unemployment rate through an ever-increasing inflation rate because the public would come to anticipate its actions and set prices in order to offset them. Such models incorporated what economists called the natural-rate/rational-expectations hypothesis.

Friedman had offered an explanation for the inverse correlations of the Phillips curve that predicted the disappearance of those correlations in response to sustained inflation. The stagflation of the United States in the 1970s supported that prediction. In reference to the Samuelson-Solow Phillips curve, Lucas and Sargent ([1978] 1981, 303) talked about "econometric failure on a grand scale." Lucas ([1973] 1981) argued that even the short-run tradeoff would tend to disappear as the variability of inflation increased.

Modigliani and Papademos (1975) offered the counterattack to the Friedman-Lucas critique. They pointed out that one could eliminate the empirically observed shifts in the Phillips curve by using first-differences of inflation. They then related first-differences in inflation to the difference in the unemployment rate and a benchmark value they termed the NIRU for "noninflationary rate of unemployment."

The NIRU (later called NAIRU for nonaccelerating inflation rate of unemployment) is the value of the unemployment rate for which inflation remains at its past value.[24] In practice, the estimated NAIRU is close to a slowly moving average of the past value of the unemployment rate.[25]

NAIRU models of inflation allowed for a long-run vertical Phillips curve. Apart from this assumption, however, they are in the tradition of the Samuelson-Solow Phillips curve. Originally, Keynesians adopted the Phillips curve because it supplied a connection between their IS-LM models, which were specified entirely for real variables, and inflation. The Phillips curve was an empirical relationship, not a theoretical one. It specified a relationship going from a real variable, unemployment, to a nominal variable, the rate of change of nominal wages (prices).[26] In NAIRU regressions, the unemployment rate relative to the NAIRU is the independent variable and inflation is the dependent variable. The central bank still possesses the ability to alter the rate of inflation through systematic control of a real variable, unemployment.

Keynesian economists argued that a Phillips curve with inflation in first differences represented a structural relationship that the central bank could use to smooth fluctuations in output around potential by imparting inverse fluctuations to changes in inflation.[27] The converse proposition came to be known as "flexible inflation targeting." That is, the central bank can eliminate an overshoot of inflation from target,

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[24] Modigliani and Papademos suggested the archetypal NAIRU regression with inflation as the dependent variable and the unemployment rate and lagged inflation rates as independent variables. Estimation by constraining the coefficients on the lagged inflation terms to equal one allows calculation of the NAIRU. When inflation remains constant, the expectation of lagged inflation, given by the distributed lag of the inflation terms, equals the actual inflation rate. Consequently, the left-hand side variable (inflation) equals the right-hand side variable, expected inflation. The NAIRU then is the (negative) value of the constant term. That is, one solves the regression equation for the unemployment rate at which inflation equals expected inflation. Sargent ([1971] 1981) initiated a critique of this way of measuring expected inflation. In NAIRU regressions, the coefficients on the right-hand side of lagged inflation terms do not vary with changes in monetary policy. As a result, there is an inherent inertia in the expectations formation of the public that allows the policymaker to exploit a short-run Phillips curve tradeoff.

[25] King, Stock, and Watson (1995, 10) have found that "estimates of the NAIRU were very imprecise." Consistent with the monetarist hypothesis that monetary instability produces the inverse correlations of the Phillips curve, Dotsey, Fujita, and Stark (2011) found that the negative slope of the Phillips curve comes from recessions.

[26] The rationale for treating empirically estimated Phillips curves as structural derives from a generalization to the behavior of the price level of the way in which positive excess demand in individual markets produces relative price increases.

[27] King and Watson (1994) found a relationship between inflation and unemployment at business cycle frequencies, although not over lower frequency (trend) horizons. Their finding that inflation does not Granger cause (predict) unemployment, however, is not supportive of the idea that the central bank can manipulate inflation to control unemployment.

say, from an inflation shock, by raising the unemployment rate above its NAIRU value in a controlled way. The cost in terms of excess unemployment is given by the sacrifice ratio: the number of man-years of unemployment in excess of NAIRU the central bank must engineer to lower the inflation rate 1 percentage point.[28]

7. THE FIRST HALF OF THE SAMUELSON-SOLOW VAST EXPERIMENT

As noted above, the Phillips curve shifted upward in the 1970s. For example, in the 1950s, the unemployment rate among men 25 years and older averaged 3.5 percent. In the 1970s, it averaged 3.6 percent. In the 1950s, inflation (average, annualized monthly growth rates of CPI inflation) averaged 2.3 percent. In the 1970s, however, that figure rose to 7.5 percent. Similarly, annualized CPI inflation averaged over the first six months of 1964 was 0.85 percent while unemployment averaged 5.3 percent over this period. That figure was just slightly less than the 5.5 percent figure Samuelson and Solow had estimated as consistent with price stability. In contrast, for the 12-month period ending July 1971 (preceding the introduction of wage and price controls in August 1971), annualized monthly CPI inflation averaged 4.4 percent, while the unemployment rate averaged 5.8 percent.

In each case, the higher rate of inflation did not lower unemployment. Keynesians, however, attributed these upward shifts in inflation and the Phillips curve to cost-push shocks. In contrast, monetarists attributed them to shifts in expected inflation that frustrated the attempt to lower unemployment through aggregate-demand policies.

In 1970, 6 percent inflation accompanied 6 percent unemployment. Consistent with the prevailing Keynesian consensus, all but a minority of economists, mainly restricted to Chicago, Minneapolis, and the St. Louis Fed, interpreted the advent of this stagflation as a reflection of cost-push pressures that raised the level of the Phillips curve. In 1971, the Nixon administration turned to wage and price controls to restrain this presumed cost-push inflation and thus make way for an

[28] For example, David Stockton (Board of Governors of the Federal Reserve System 1989, 12) told the FOMC: "The sacrifice ratio is arrived at by dividing the amount of disinflation during a particular time period—measured in percentage points—into the cost of that disinflation—measured as the cumulative difference over the period between the actual unemployment rate and the natural rate of unemployment. Thus, it is a measure of the amount of excess unemployment over a year's time associated with each one percentage point decline in the inflation rate."

The staff reported that during the three post-Korean War disinflations, the sacrifice ratio was at or somewhat above 2. The exception was the period of price controls imposed in 1971.

expansionary monetary policy. Although those controls ended in 1974, the Carter administration resorted to various forms of incomes policies (see Hetzel [2008a, Chs. 8, 10, and 11]). These active attempts to control real output growth and unemployment while using incomes policies to control cost-push inflation created the experiment that Samuelson and Solow had talked about. The results contradicted the Keynesian assumption that policymakers could use aggregate-demand management in order to control real variables like unemployment in a systematic way and with a predictable cost in terms of inflation.

In the 1970s, Keynesian economists could see that supply shocks and a wage-price spiral drove inflation. The implication of rational expectations that a credible rule for monetary policy would shape the inflationary expectations of the public conformably with that rule appeared like an abstraction devoid of real-world relevance. It followed that a monetary policy objective of price stability that failed to accommodate inflation from nonmonetary causes would produce high unemployment. The following quotation from Paul Samuelson ([1979] 1986, 972) is representative of the times (see, also, Hetzel [2008a, Ch. 22]):

> Today's inflation is chronic. Its roots are deep in the very nature of the welfare state. [Establishment of price stability through monetary policy would require] abolishing the humane society [and would] reimpose inequality and suffering not tolerated under democracy. A fascist political state would be required to impose such a regime and preserve it. Short of a military junta that imprisons trade union activists and terrorizes intellectuals, this solution to inflation is unrealistic—and, to most of us, undesirable.

Samuelson's statement reflected the 1960s and 1970s Keynesian consensus that the behavior of the price level was determined by nonmonetary forces either having to do with real aggregate demand (demand pull) or with characteristics related to the lack of competitive markets such as the market power of large corporations and unions (cost push) (see, for example, Samuelson [1967]). The activist policy of aggregate-demand management combined with incomes policies of various degrees reflected this belief.[29]

On the international stage, Keynesian policy prescriptions played out in countries that pegged their exchange rates to the dollar as part of the Bretton Woods system. As reflected in the Keynesian spirit of the time, countries with pegged exchange rates also followed policies of aggregate-demand management intended to maintain full employment

[29] The term "incomes policies" refers to any government intervention into the wage and price setting of the private sector. Wage and price controls are an extreme version.

(see Capie [2010] for the United Kingdom case). As Friedman ([1953b] 1953) had predicted, these countries had to resort to capital controls as well as wage and price controls in order to reconcile an exchange rate peg with an unwillingness to allow their internal price levels to adjust in order to vary the real terms of trade to achieve balance of payments equilibrium. In 1973, the Bretton Woods system of pegged exchange rates collapsed (Hetzel 2008a, Ch. 9).

By the end of the 1970s, the experiment with activist monetary policy concluded with double-digit inflation accompanied by cyclical instability. However, as noted above, despite the unusual clarity about policy, extraneous forces always prevent these episodes from offering the kind of certitude as a controlled experiment in the physical sciences. The issue remains whether activist monetary policy produced this result or whether a series of adverse inflation shocks overwhelmed the stabilizing properties of activist policy.[30] Velde (2004) characterized the issue as one of bad hand (inflation shocks) or bad play (destabilizing monetary policy). In early 1979, the United States could have continued the experiment with activist monetary policy reinforced by a return to wage and price controls. However, a change in the political landscape with the election of Ronald Reagan as president, combined with the way in which individuals occasionally change the course of events in the form of Paul Volcker as FOMC chairman, gave the United States a very different kind of monetary experiment.[31]

8. THE SECOND PART OF THE VAST EXPERIMENT

The back-to-back experience of the Great Depression with World War II created the Keynesian consensus. The back-to-back experience in the 1970s of an activist policy directed toward maintaining low, stable unemployment and the policy in the 1980s and 1990s of restoring price stability through restoring nominal expectational stability flipped the professional consensus. The profession came to see inflation as a monetary phenomenon. Also, countries realized that if they were to control their own price levels, they had to abandon fixed exchange rates in favor of floating exchange rates in order to gain control over money

[30] Gordon (1985) and Sims and Zha (2006) emphasized the importance of inflation shocks. Sims and Zha (2006, 54) argued that "the differences among [monetary policy] regimes are not large enough to account for the rise, then decline, in inflation of the 1970s and 1980s." Blinder (1987, 133) wrote: "The fact is that, the Lucas critique notwithstanding, the Phillips curve, once modified to allow for supply shocks ... has been one of the best-behaved empirical regularities in macroeconomics...."

[31] On the political economy of the late 1970s, see Hetzel (2008a, Ch. 12).

creation. Having floated their exchange rates, countries realized that they had to leave the control of inflation to the central bank.

The second part of the "vast experiment" was then the effort by the Volcker and Greenspan FOMCs to restore the nominal expectational stability lost in the preceding stop-go era (Hetzel 2008b). The Volcker-Greenspan FOMCs discarded the idea of measuring the level of idle resources (the output gap). Instead, they moved the funds rate in a persistent way designed to counter sustained changes in the rate of resource utilization. That is, they removed the measurement error inherent in trying to measure the level of idle resources by focusing on changes in the degree of resource utilization (Orphanides and Williams 2002). Given the desire to restore credibility in instances of sustained increases in the rate of resource utilization, the Fed watched bond markets for evidence that the "bond market vigilantes" were satisfied that increases in the funds rate would cumulate to a sufficient degree in order to prevent a revival of inflation. In response to inflation scares, the FOMC raised the funds rate more aggressively (Goodfriend 1993).

The willingness of the FOMC to move the funds rate in a sustained way made it clear to markets that it had abandoned the prior practice of inferring the thrust of monetary policy from a "high" or "low" level of short-term interest rates. That is, the FOMC did not back off from changes in the funds rate when the funds rate reached a "high" or "low" level. These procedures, termed "lean-against-the-wind with credibility" by Hetzel (2008a), removed the cyclical inertia from interest rates (see Hetzel [2008a, Chs. 14, 15, 21, and 22]). Equivalently, the discipline they imposed in removing cyclical inertia from funds rate changes prevented attempts to use Phillips curve tradeoffs to achieve macroeconomic objectives.

The demonstration that the Fed could maintain low, stable inflation without incurring the cost of recurrent bouts of high unemployment weakened the Keynesian consensus. The economics profession became receptive to replacement of the IS-LM model with what would become, in time, the New Keynesian model. In the Great Inflation, Keynesians had fleshed out the IS-LM model with explanations of inflation that turned on a wage-price spiral propelled by expectations of inflation untethered by monetary policy. They also assumed the existence of negative output gaps persisting over many years arising from the weak equilibrating properties of the price system. The New Keynesian model challenged the self-evident descriptive realism of such assumptions with incorporation of rational expectations and an inner real-business-cycle core in which the price system worked well to maintain macroeconomic equilibrium.

The traditional Keynesian Phillips curve with inflation generated by the momentum of lagged inflation and an output gap measured as cyclical deviations of output from a smooth trend ceded place to the New Keynesian Phillips curve. The forward-looking agents posited by the New Keynesian model base their behavior not only on the current policy actions of the central bank but also on the way in which the central bank's systematic behavior shapes the policy actions it takes in the future in response to incoming data on the economy. As a result, contemporaneous inflation (current price-setting behavior) depends on the expectation of future inflation, which depends on the rule the central bank implements.

9. THE GREAT DEBATE WILL CONTINUE

The recent Great Recession has weakened the New Keynesian consensus described above, at least in the Goodfriend-King (1997) version in which the optimal policy for the central bank is to stabilize the price level and thereby allow the real-business-cycle core of the economy to control the behavior of the real economy. To a significant extent, both popular and much professional commentary have reverted to the historical "default option" for explanations of the business cycle—the "imbalances" model (Hetzel 2012, Ch. 2). The business cycle is self-generating because imbalances accumulate during periods of expansion. At some point, the extent of maladjustments cumulates to the point at which a correction becomes inevitable. The economy must then endure a period of purging of the economic body.

In financial markets, these imbalances appear as credit cycles. In periods of economic expansion, investors become overly optimistic about the future. They take on debt and push asset prices to levels not supported by the underlying productive capacity of the assets. Inevitably, these asset bubbles burst. Investors find themselves with too much debt. A long, painful process of deleveraging ensues in which economic activity is depressed. When this process works its way out, recovery can begin. Once again, the process of swings in investor sentiment from unfounded optimism to unfounded pessimism begins. Commentary in this vein on the Great Recession has focused on an asset bubble in the housing market made possible by expansionary monetary policy in the years preceding 2008.

In order to move beyond the "descriptive reality" of these age-old explanations of the business cycle based on the correlation that in economic booms asset prices rise and debt increases while in recessions asset prices decline and debt declines, one needs a model and plausible exogenous shocks. The Keynesian model with its swings in animal

spirits among investors that overwhelm the stabilizing properties of the price system was an attempt to construct such a model. In the spirit of this article, how will economists test the imbalances hypothesis or Keynesian versions of it against the monetarist hypothesis that highlights as the precipitating factor in recessions central bank interference with the operation of the price system?

To recapitulate the discussion of methodology of Section 1, there will be a multitude of models assuming different shocks and different structures of the economy and frictions that can explain historical time series and, a fortiori, particular events like the Great Recession. It is thus improbable that economists will ever reach consensus over the cause of a particular recession. However, scholarly debate will return to the pattern of asking how well a particular recession like the Great Recession fits into one of the alternative frameworks that explain the recurrent phenomenon of cyclical fluctuations. Economists will continue running horse races among models based on the entire historical record. Using models based on microeconomic foundations, they will ask whether the implications of the model adequately explain correlations in the entire historical record that are robust in that the correlations persist over time and across countries, that is, in a variety of circumstances. The latter characteristic is the social sciences version of the controlled experiment in the physical sciences.

Consider the correlation between monetary and real instability. The monetarist hypothesis is that, to a significant degree, causation runs from monetary to real instability. In the world of Milton Friedman, prior to 1981, given the existence of a monetary aggregate (M1), which was interest insensitive and stably related to nominal output (GDP), the robust correlation was that monetary decelerations preceded business cycle peaks. Furthermore, the central bank behavior that accompanied those monetary decelerations plausibly produced changes in nominal money originating independently of changes in real money demand. The robustness of this generalization across countries and across time reduces the possibility that it reflects causation produced by some third variable so that real instability arises independently of monetary instability. Of course, no controlled experiment produced these correlations. The hypothesis that monetary instability produces real instability has to be put into a form in which it yields testable predictions about the future.

Because of the disappearance since 1981 of a monetary aggregate like M1 that is useful as a predictor of nominal GDP, it is necessary to refocus the search for robust correlations based on the monetarist hypothesis that monetary disorder originates in central bank interference with the operation of the price system. Reformulated in this spirit,

the monetarist hypothesis receives support from the continuance of the central bank behavior associated with the monetary decelerations preceding business cycle peaks in the pre-1981 period.

What is this central bank behavior? In the post-World War II period, when the Fed became concerned about inflation, it first raised interest rates and then, out of a concern not to exacerbate inflationary expectations, introduced inertia into the downward adjustment of interest rates when the economy weakened (Hetzel 2012, Ch. 8).[32] Although the Fed did not employ the language of tradeoffs, these attempts to exploit a Phillips curve relationship by allowing a negative output gap to develop have constituted a reliable leading indicator of recession (Romer and Romer 1989; Hetzel 2008a, Chs. 23–25; Hetzel 2012, Chs. 6–8). The same empirical regularity existed in the pre-World War II period, but the Fed raised rates and then introduced inertia into the downward adjustment of interest rates while the economy weakened not out of concern for inflation but out of concern that the level of asset prices reflected a speculative asset bubble.

Hetzel (2009, 2012, 2013b) argues that the Great Recession fits into this monetarist characterization of central bank behavior associated with recessions. The persistent inflation shock that began in summer 2004 intensified in summer 2008 and pushed headline inflation well above core inflation and central bank inflation targets. That inflation shock created a moderate recession by dampening growth of real disposable income. Moderate recession turned into severe recession in summer 2008 when central banks either raised interest rates (the European Central Bank) or left them unchanged as economic activity weakened (the Fed). The attempt to create a negative output gap to bend inflation down mirrored the stop phases of the earlier stop-go monetary policy.

10. TESTING THEORIES OF THE BUSINESS CYCLE

In the absence of consensus within the economics profession over the causes of the business cycle, popular commentary fills the void with explanations based on descriptive reality. That verbiage is inevitable given the importance of phenomena like cyclical fluctuations in unemployment. However, economists do possess a methodology for learning and will make progress in understanding the causes of the business

[32] The exceptions are especially important for evaluating robust correlations. Prior to the April 1960 business cycle peak, the FOMC raised rates and then maintained them despite a weakening economy out of a concern not for inflation but rather out of concern for a deficit in international payments and gold outflows (Hetzel 1996; 2008a, 52–5).

cycle. In this respect, the stumbling, painful, and ongoing process of the central bank learning how to manage the fiat money regime that replaced the earlier commodity standards remains a still under-investigated source of the semi-controlled experiments required to extract causation from correlation.

APPENDIX: RECENT WORK ON THE PHILLIPS CURVE

Little in the work on the New Keynesian Phillips curve (NKPC) challenges the Friedman assertion that policymakers lack sufficient information about the structure of the economy in order to implement an activist monetary policy. As summarized by Hornstein (2008), the results of empirical estimation of the NKPC offer little useful information for the policymaker interested in exploiting a Phillips curve tradeoff. For example, Hornstein (2008, 305) comments:

> Nason and Smith [2008] also discuss the finding that the estimated coefficient on marginal cost tends to be small and barely significant. This is bad news for the NKPC as a model of inflation and for monetary policy.

The coefficient on real marginal cost referred to summarizes the real-nominal interaction implied by the nominal price stickiness in the New Keynesian model. As implied in the above quotation, econometric estimation provides no practical guidance for monetary policy procedures based on Phillips curve tradeoffs.

Hornstein elucidates the reasons for this lack of guidance in his discussion of Schorfeide (2008). Estimation of the NKPC through single-equation methods founders on the seemingly technical but fundamental issue of the lack of plausible instruments useful for forecasting inflation, while at the same time being unrelated to the other variables in the Phillips curve and macroeconomic shocks. Everything in macroeconomics is endogenously determined. The alternative is to treat the elements in the NKPC, like real marginal cost, as "latent variables," that is, variables not observable but constructed from the equations of a complete model. The problem then is that different models yield different measures and there is no consensus on the true model (the model useful for the analysis of policy).

Given a model with a NKPC, Schmitt-Grohé and Uribe (2008) conduct a normative exercise evaluating different monetary policy rules.

However, as Hornstein (2008, 307) notes, with "no agreement on how substantial nominal rigidities are" it is hard to know how useful such exercises are for policy. For example, the authors make use of a Taylor rule, which assumes that the central bank can respond directly to misses in its inflation target without destabilizing the economy. In actual practice, the assumption is that in response to such a miss, the central bank can create a controlled negative output gap (increase firms' markups in order to eliminate the miss). The whole issue then reemerges of whether central banks can control inflation through exploiting a Phillips curve tradeoff. The Lucas-Friedman contention that attempts by the central bank to exploit real-nominal relationships destabilize the economy remains a live issue.

The econometric difficulties highlighted by Hornstein (2008) turn ultimately on the issue of identification, both of shocks and of structural relationships. That fact suggests that in future research the profession should revive the monetarist identification scheme implicit in the work of King (2008), who uses historical narrative to isolate the monetary policy experiments conducted by the regime changes of central banks (see, also, Hetzel [2008a, 2012]).

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