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A Companion to the History of Economic Thought

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CHAPTER TWENTY-SIX

A History of Postwar Monetary Economics and Macroeconomics

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26.1 World War II as a Transitional Period

Despite a degree of arbitrariness, World War II provides a natural division in the history of macroeconomics. The macroeconomics of the interwar period was a rich tapestry of competing models and methodologies, pursued with a sophistication that was only gradually regained in the postwar period (see chs. 19 and 20; Laidler, 1999). John Maynard Keynes's *The General Theory of Employment, Interest and Money*, published in 1936, three years before the onset of war in Europe, appeared to many as an important, but not preeminent, contribution to the contemporary debates. Yet, by 1945, Keynesian macroeconomics was clearly ascendant.

Keynes provided a conceptual framework that greatly simplified professional discussions of macroeconomic policy. The main elements were: (i) an aggregative analysis – his key distinction between the economics of individual or firm decision-making, taking aggregate output as fixed, and the economics of output and employment as a whole supplies the content, if the not the name, of the now common distinction between microeconomics and macroeconomics; (ii) the determination of aggregate output by aggregate analogues to Marshallian supply and demand; (iii) the possibility (even likelihood) that aggregate supply and demand could determine a level of output at which resources were not fully employed; and (iv) the possibility that monetary and fiscal policies could boost aggregate demand to counteract unemployment.

The decade after the publication of *The General Theory* was a period of exploration, investigation, and consolidation – a period in which the Keynesian model

was forged into the paradigm that guided mainstream macroeconomic analysis for the next three decades. John Hick's (1937) IS–LL model (later renamed the IS–LM model) emerged as the canonical representation of the Keynesian system. The downward-sloping IS curve represented combinations of interest rates and output for which planned savings (directly related to income or output) and planned investment (inversely related to interest rates) were equal. The upward-sloping LM curve represented combinations in which the demand for money (directly related to income and inversely related to interest rates) equaled the fixed supply of money. The crossing point determined the level of aggregate demand. Hicks placed little stress on aggregate supply, while Modigliani's (1944) influential Keynesian model offered a highly simplified aggregate-supply curve: perfectly elastic at the current price level up to full employment and inelastic at full employment – a reverse L-shaped curve in price/output space.

These models simplified Keynes's account in an effort to render it into a closed set of algebraic equations. They represented the core structure of *The General Theory*, but omitted many nuances. Alan Coddington (1983) stigmatized them – with some justice – as "hydraulic Keynesianism." What it lost in detail, hydraulic Keynesianism made up in its suitability for mathematical and structural econometric elaboration.

The war itself gave a boost to practical Keynesianism. Keynes had diagnosed the Great Depression of the 1930s as a massive failure of aggregate demand. The war represented an enormous boost to aggregate demand that finally ended the Depression and led governments to accept the legitimacy of deliberate interventions to direct the economy. The Beveridge Report of 1942 in Great Britain and the Employment Act of 1946 in the United States provided blueprints for government involvement in the macroeconomy along Keynesian lines. The war was financed through massive government borrowing. After previous wars, governments had generally placed a high priority on the repayment of these debts. This time, however, Abba Lerner's (1943) Keynesian notion of "functional finance" suggested that government fiscal policy should be judged for its effects on output, employment, and prices, rather than on accounting standards in which the balanced budget held a special place. Policy-makers were concerned that demobilization of the millions of men and women under arms could trigger a postwar recession, and they were prepared to respond with demand stimulus. Practical policy required good information on the state of the economy. Keynes's aggregative framework fitted well with the design of systematic national accounts due to Colin Clark, Simon Kuznets, and Meade and Stone. The collection of macroeconomic data accelerated rapidly after the war in most developed countries, which proved a boon for scientific research in macroeconomics as well as for practical policy-making.

26.2 The Era of Keynesian Dominance, 1945–1970

For at least 25 years after the end of World War II, mainstream macroeconomics was predominantly Keynesian. *The General Theory* had collapsed the rich debates

of the 1920s and 1930s into a static, short-run, aggregative model, concerned exclusively with a closed economy. One central plank on the agenda for macroeconomic research was to recover what was lost in Keynes's simplifications. A second was to use the newly available data sources to give empirical content to ever more detailed Keynesian models. A third was to explore the relationships between the now distinct categories of macroeconomics and microeconomics.

26.2.1 Long-run growth

Fluctuations in investment were the key to Keynes's analysis of aggregate demand and the business cycle, yet *The General Theory* contains no systematic account of its role in economic growth. To repair this omission, Roy Harrod, beginning in 1939, developed a theory in which labor and capital combined in fixed proportions to generate output.

Ignoring technical progress, the growth rate of the economy depended on the investment rate (misleadingly referred to as the savings rate) and the rate at which capital was converted into output. Harrod defined the *warranted rate of growth* as $g = s/v$ = *investment share in GDP/capital-output ratio*. He defined the *natural rate of growth* as the rate of growth of the labor force (n). So long as $g = n$, the economy will grow steadily. Evsey Domar independently constructed essentially the same model. The Harrod–Domar model displays "knife-edge" instability. If s is low enough, so that $g < n$, then unemployment in the economy will rise progressively; if it is great enough, any existing unemployment will be absorbed and, with no further labor available, the growth in output will be stymied.

Working independently, Robert Solow and Trevor Swan suggested in 1956 that the knife-edge property of the Harrod–Domar model resulted from the assumption of fixed technology (constant v). If firms could adjust their inputs to reflect relative factor prices, then progressively increasing unemployment, for example, would result in a falling real wage and a fall in the capital-output ratio, raising g and reestablishing a *balanced* or *steady-state* growth path at the natural rate (n).

The Solow–Swan (or *neoclassical* growth) model was easily adapted to include technical progress treated as a rescaling of its underlying constant-returns-to-scale production function. It formed the basis for Solow's accounting exercise in which the sources of US GNP growth were attributed to growth in the factors of production and to technical progress (total factor productivity). His conclusion that total factor productivity was overwhelmingly the dominant factor seemed to many to be counterintuitive. By the early 1960s, intellectual effort focused on developing the model, including adding endogenous technical progress, embodied in a capital stock differentiated by investment vintage, and extending it to multiple sectors. (For a contemporaneous survey of the growth literature, see Hahn and Matthews, 1964.)

Joan Robinson, Nicholas Kaldor, and other economists at the University of Cambridge (England) developed accounts of growth that were closely related to Harrod's and skeptical of the neoclassical approach. They tried to integrate the

Keynesian demand model and a Marxist or neo-Ricardian account of income distribution. Robinson, in particular, criticized the *aggregate* neoclassical, marginalist theory of distribution in which profits were the marginal product of capital. While the marginal analysis might work for a particular, homogeneous physical capital good and a single firm, aggregate capital was measured in monetary terms: the sum of the present discounted value of the expected profit streams of the physical means of production of all firms. The quantity and price (the rate of discount) of aggregate capital must be jointly determined. Aggregate capital was not, then, the sort of independent quantity that could have a well-defined marginal product, which in turn determined its rate of return. Robinson maintained that the very notion of aggregate capital was circular and absurd.

In the debate that came to be known as the "Two Cambridges Controversy," Paul Samuelson, Solow, and other economists associated with the Massachusetts Institute of Technology in Cambridge, Massachusetts, essentially conceded Robinson's point. Nonetheless, they maintained that, as an idealization or "parable," the distributional consequences of the Solow–Swan (or neoclassical) growth model pointed robustly in the right direction. Cambridge, England, won the debate on a technicality, demonstrating, that with heterogeneous physical capital goods, it was possible that there would not be a monotonic inverse relationship between wage and profit rates as predicted by the neoclassical parable. Cambridge, Massachusetts, however, won the larger battle: aggregate capital, aggregate production functions, and the Solow–Swan model remain workhorses of mainstream macroeconomics to this day (see Harcourt, 1972; Bliss, 1975).

The Solow–Swan model provided a framework for the analysis of long-run policy. The first efforts of Edmund Phelps and others took the maximization of consumption per head to be the policy goal. The so-called "golden rule" for growth called for investment policies that resulted in a rate of return on capital equal to the sum of the rate of growth of the labor force, the rate of technical progress, and the rate of depreciation. The analysis warned against overinvestment: capital–labor ratios higher than the golden rule level were inefficient in the comparative static sense that a lower level supported a higher consumption per head; and also in the dynamic, or Paretian, sense that movement toward the golden rule would free up capital for consumption and would permit higher consumption per head in *every* period along the transition to the golden-rule balanced-growth path. Because investment rates below the golden rule are dynamically efficient and not Pareto-rankable, growth theory from the mid-1960s on stressed optimal-growth models in which preferences over intertemporal consumption patterns are reflected in an aggregate utility function. Essentially, the investment rate (s) was treated as an endogenous variable rather than a given parameter.

In another extension, Robert Mundell and James Tobin incorporated money demand functions into the neoclassical growth model. The "Tobin–Mundell effect" in their models violates superneutrality: inflation raises the opportunity cost of holding money and encourages substitution into real capital, boosting output. In contrast, Miguel Sidrauski's monetary model, which introduces real money holdings into the utility function of an optimal-growth model, preserves superneutrality.

To this day, the optimal growth model forms the core of the account of long-run dynamics in mainstream macroeconomics – and is widely accepted by economists who disagree extensively over short-run and policy issues. By 1970, research into growth models had reached diminishing returns, and little advance was made until the advent of endogenous growth models in the work of Paul Romer and Robert Lucas, in the mid-1980s. These models widened the scope of macroeconomics to address important questions in economic development, but have little affected the larger course of macroeconomics. (For further references on growth, see Wan, 1971; Jones, 1998.)

26.2.2 Short-run dynamics

Interwar macroeconomics had included elaborate accounts of the short-run dynamics of the business cycle, but *The General Theory* offered only a static model. Substantial postwar research reintroduced dynamical features into every aspect of the Keynesian model. The two most significant areas, perhaps, were dynamical accounts of inflation and unemployment.

He was not the first to discern an inverse relationship between wage inflation and unemployment, but A. W. H. Phillips's (1958) study of nearly 100 years of data for the United Kingdom proved to be a landmark. Phillips's study was grounded in a vision of the Keynesian model as a system developing in real time and in Phillips's own research into the mathematics of optimal control. Unlike Keynes, Phillips modeled firms as wage-setters. In light of later developments, it is also worth noting that Phillips was careful to account for the role of trend inflation in such a way that he respected the distinction between real and nominal wages.

Development of the Phillips curve proceeded on three tracks. First, by the early 1960s Phillips curves were estimated for many countries, using both wage inflation and price inflation as dependent variables. Secondly, a number of economists, most notably Richard Lipsey, elucidated the microeconomic behavior that might account for the Phillips curve. And, thirdly, Paul Samuelson and Solow provided an analysis that treated the Phillips curve as a menu of policy choices in which higher inflation was the price of lower unemployment. Their notion of an exploitable tradeoff helped to place the Phillips curve in the center of practical policy analysis. Again, in light of later developments, it is worth noting that Samuelson and Solow were aware that the overly aggressive exploitation of the tradeoff might lead to an acceleration of trend inflation and an unfavorable shift of the tradeoff itself (see Wulwick, 1987).

By the beginning of the Kennedy Administration, Keynesian economic advisors dominated American government circles. One advisor, Arthur Okun, answered the question of how to guide aggregate-demand management with another empirical relationship. "Okun's Law" states that there is an approximately linear, inverse relationship between the growth of output and changes in the unemployment rate. Okun's Law has not received extensive theoretical investigation or development, but has remained an important rule of thumb for policy-makers.

26.2.3 Macroeconometric models

Structural macroeconometric modeling began before World War II (Tinbergen, 1939). Although Keynes was deeply skeptical of the econometric enterprise, the model-builders quickly incorporated the Keynesian framework. Nearly every postwar model is an elaboration on the simple IS–LM/aggregate-supply framework. In part, this is a testament to the flexibility and breadth of that framework and, in part, a reflection of the mutual adaptation of the Keynesian model and the national-accounting conventions that governed data collection.

The pivotal figure in the history of econometric model-building was Lawrence Klein, a close student of *The General Theory*. Klein took advantage of recent developments in structural econometrics due to Trygve Haavelmo and the Cowles Commission. Building on Tinbergen's work, by 1950 Klein formulated and estimated three models of the interwar US economy. Working with Arthur Goldberger, Klein developed a seminal model of the postwar US economy in 1955, a model with 20 stochastic equations and five identities that was used for forecasting and policy analysis. Meanwhile, Tinbergen supervised the creation of a series of increasingly sophisticated models of the Dutch economy. Working with a group at Oxford University, Klein developed a model for the UK economy. (For the early history of macroeconometrics, see Morgan, 1990; Hendry and Morgan, 1995.)

Macroeconometric model-building and its supporting activities (see section 26.2.4) dominated macroeconomic research in the 1960s. In both the USA and the UK, researchers continued to elaborate Klein's model. Three models represent pinnacles of American model-building in the late 1960s. The largest was the Social Science Research Council (SSRC)/Brookings model, which ultimately included about 400 stochastic equations. The MPS (Massachusetts Institute of Technology/University of Pennsylvania/SSRC) model was similar to the Brookings model, but included a rich financial sector. Finally, the Data Resources Incorporated (DRI) model – similar in scope to the other large models – was the most important commercial macroeconometric model. DRI found a significant market for model-based forecasts and policy analysis, as well as for the macroeconomic database that it maintained to support its model. By the early 1970s, macroeconometric models had been constructed for virtually all developed, and for many developing, countries (see Bodkin, Klein, and Marwah, 1991).

26.2.4 Microfoundations of macroeconomics: individual equations

In *The General Theory*, Keynes rationalized the key aggregate relationships such as the consumption function and the investment function with reference to individual behavior. In *The Keynesian Revolution* (1947), Klein emphasized the desirability of securing the microfoundational underpinnings of each of these functions. A reciprocal effort to develop the econometrics of individual equations of the large macromodels and their theoretical, microeconomic underpinnings was a substantial focus of research in this period.

The consumption function presents the clearest case. Keynes had admitted a large number of potential factors into the analysis of consumption and savings. These included precaution, bequests, time preference, considerations of expected, or life-cycle, income and consumption patterns, capital gains and losses, fiscal policy, expectations, and the average level of real wages (consumption and income were measured in wage units). But early attempts to model consumption empirically assumed that the static consumption was linear in disposable income and that the marginal propensity to consume was less than the average propensity to consume. This implied that over time – as the economy became richer – the average propensity to consume should be falling, and that cross-sectionally richer people should have a lower average propensity to consume than poorer people. Research by Simon Kuznets suggested that, while these implications might be true in the short run and cross-sectionally, in the long run (decade to decade) the marginal propensity to consume and the average propensity to consume were equal and approximately constant.

James Duesenberry (1949) reconciled the long-run time series with (i) the short-run time series and (ii) the cross-sectional data by modeling consumption as a function of individuals' past incomes and those of their social group. As income rises over time, individuals reset their standard of prosperity and so, on average, do not come to regard themselves as high income unless their income rises faster than those of their social peers. Despite the empirical evidence that he offered, the economics profession viewed Duesenberry's "relative-income hypothesis" as unsatisfactory because of its appeal to sociological facts that were not accounted for as the outcome of an explicit individual optimization problem. Building on joint work with Kuznets, Milton Friedman (1957) modeled consumption as an intertemporal optimization problem in which the budget constraint was the implicit return on the present value of all future income (labor and nonlabor). Almost simultaneously, Franco Modigliani and Richard Brumberg (1954) modeled consumption in a nearly equivalent manner, focusing on the stock of implicit wealth rather than the flow of income from the same present-value calculation.

On the assumption that people prefer consumption streams that are steadier than their income streams, the "permanent-income/life-cycle model" suggests that Kuznets's puzzles result from mismeasurement. The average and marginal propensities to consume from permanent income are equal and constant. Transitory fluctuations in income little change permanent income or consumption. Permanent income is not directly observed, as it depends on individuals' expectations of future income. The responsiveness of consumption to measured income is lower in the short run since transitory components dominate, and higher in the long run when they tend to cancel out. Similarly, in the cross-section, some observed individuals experience transitory income higher (lower) than their permanent income and so have lower (higher) consumption than individuals with permanently high (low) income. Thus, the measured marginal propensity to consume is lower than the permanent marginal and average propensity to consume that is observable in the long-run time series.

Friedman's investigation of the consumption function also revived interest in the role of expectations, largely ignored since Keynes's *The General Theory*.

Friedman's method of modeling expectations of future income through a geometrically weighted sum of past incomes proved easy to rationalize as partial adjustment to past prediction errors and was widely applied in other contexts.

Other constituent functions of the Keynesian macromodel received similar treatment in the 1950s and 1960s. William Baumol and Tobin, for instance, modeled the transactions and speculative demands for money (Laidler, 1993), while Dale Jorgenson, among others, modeled the microfoundations of investment.

Research into the microfoundations of individual relationships derived much of its cachet from its relation to research into large-scale macromodels. Both were driven from center stage with the emergence of general equilibrium microfoundations as the dominant research program in macroeconomics, although they remain of considerable practical interest to this day.

26.2.5 Microfoundations of macroeconomics: general equilibrium

One of Keynes's main criticisms of the "classics" was their failure to account for the interdependence of production and consumption decisions. He offered instead an aggregate general equilibrium system. The IS–LM model reinforced the general equilibrium nature of the Keynesian model. Nevertheless, beginning with Wassily Leontief's early critique of *The General Theory*, many economists questioned the consistency of the Keynesian model with the microeconomic general equilibrium model.

Don Patinkin addressed the two main problems in his *Money, Interest, and Prices* (1956). First, the standard Walrasian general equilibrium model is essentially a barter model. Walras had introduced money through an aggregate relationship similar to a standard quantity-equation for money, but this did not account for the individual behavior of money holders in a manner analogous to other supply and demand relationships in the model. Patinkin argued that money was held for its services and should be valued like other real goods. Patinkin entered real money balances (M/p) into the individual utility functions of an otherwise Walrasian model. Patinkin wrote nearly simultaneously with the publication of the proofs of the existence of a general equilibrium in systems without money. He assumed – but did not prove – the existence of an equilibrium with money. Frank Hahn later showed that, in general, there is no solution to Patinkin's system, because the price deflator can change discontinuously as relative prices adjust in the *tâtonnement* process through which equilibrium is established. Patinkin's solution has remained influential at an aggregate level, but was unsuccessful in providing true microfoundations (see Hoover, 1988).

Patinkin also isolated the second problem: the Walrasian system assumes that quantities adjust to prices under the assumption that no trades are made until a market-clearing price vector is established, yet the Keynesian model assumes that quantities respond to quantities (e.g., the consumption function relates consumption to income, not to prices) or that markets do not clear. Patinkin examined the labor market closely in light of these problems. They were taken up

in more generality by Clower (1965). He argued that, if producers and consumers knew that markets would not clear, they would incorporate quantity constraints into their decisions. For example, a worker who knew that he could not purchase as many goods as he liked at the current price would supply less labor at a given real wage than he would if the goods supply were infinitely elastic at that price. Clower argued that prices are often set away from their market-clearing values, so that quantity rationing is the norm. Ubiquitous rationing accounts for such Keynesian relationships as the consumption function and the aggregate-supply function. Axel Leijonhufvud (1968) constructed an elaborate historical reinterpretation of Keynes's *The General Theory* on the basis of Clower's analysis.

Robert Barro and Herschel Grossman (1971) provided the most influential formal model of Clower's analysis. They simplified the analysis by assuming that prices were fixed by forces outside the model. Their "fixed-priced" model is notable for importing the representative-agent approach from growth theory. With no serious account of how to construct economy-wide aggregates from the choices of individual agents, this move was a serious retreat from the original goal of the microfoundational program. Although the fixed-price model was quickly supplanted in the United States, it became highly developed in Europe (e.g., Malinvaud, 1977) and remains influential.

26.3 The Debate Over Money and Monetary Policy, 1956–1982

26.3.1 Diminishing the importance of money

Although the title of Keynes's masterwork included *Money* and *Interest*, early postwar Keynesians emphasized fiscal policy over monetary policy. Although not accurate as exegesis, Hicks (1937) famously justified his judgment that "the General Theory of Employment is the Economics of Depression" by the "*special* form of Mr. Keynes's theory" in which the LM curve is infinitely elastic (later referred to as the "liquidity trap"). Empirical research in prewar Britain also suggested that the investment function and, hence, the IS curve were nearly interest-inelastic. A horizontal LM curve and a vertical IS curve together imply impotent monetary policy.

As well as underwriting the weakness of monetary policy, the Radcliffe Report to the British Parliament (1959) argued that the existence of numerous close substitutes for currency and checking accounts implied that the velocity of circulation for any narrow monetary aggregate would be highly unstable, rendering it both hard to define a practicable concept of money and to control the real economy with any particular monetary aggregate. The report advocated targeting interest rates as the only practical monetary policy.

The Radcliffe Report reflected the "new view" of money. John Gurley and Edwin Shaw (1960) and Tobin, among others, advocated replacing the simple money/bond dichotomy of the Keynesian system with a fuller account of the wide spectrum of financial assets. Tobin (1969) especially tried to link the financial system

to the real economy through a variant on an idea of Keynes's that is often referred to as "Tobin's q": the ratio of the market value of a real asset to its replacement cost. When q is greater than unity, it pays to invest; when it is less than unity, it is better to hold financial assets. Working with William Brainard, Tobin engaged in a heroic attempt to adapt the new view to the econometric macromodel.

26.3.2 Emphasizing the importance of money

The University of Chicago was relatively immune to Keynesian ideas and, through the 1930s and 1940s, continued to teach the classical quantity theory of money, despite Keynes's criticisms. Milton Friedman reinvigorated the Chicago tradition in an edited volume, *Studies in the Quantity Theory of Money* (1956), and, especially, in his own contribution to it, "The quantity theory: a restatement." Rather than Irving Fisher's transaction version of the quantity theory, Friedman adopted the "Cambridge" or income version which, given the existence of national-income accounts, proved easier to implement empirically. In itself, Friedman's demand function for money is perfectly compatible with Keynesian analysis. The differences between Friedman and the Keynesians center on his insistence that: (i) markets clear in the long run; (ii) the demand for money is a stable function of a few variables, even if the unconditional velocity of circulation is highly variable; and (iii) the supply of money is easily controllable by the monetary authorities. The quantity of money is unimportant for real outcomes in the long run as markets clear, but most short-run cyclical real fluctuations can be blamed on bungled monetary policy.

Friedman and his colleague Anna Schwartz won many converts to their view that monetary policy is the principal cause of cyclical fluctuations with the magisterial *Monetary History of the United States* (1963). The *tour de force* was their account of the Great Depression as an unintended monetary contraction. Peter Temin (1976) argued that this explanation required that interest rates rise along with falling output, but that, in fact, interest rates fell. While no one Keynesian offered a complete reassessment of US monetary history, the debate in the 1960s was highly empirical, focusing on the stability of money demand compared to the stability of Keynesian multipliers, the predictive power of monetary policy compared to fiscal policy, and the independent controllability of the money supply. These heated debates often hinged on what counted as acceptable econometric methods and, in a climactic battle over the causal direction between money, on the one side, and output and prices, on the other, became intensively methodological.

26.3.3 Monetarism

In the end, the war was fought to a draw in the sense that neither side won many converts. Yet, under the sobriquet *monetarists*, the quantity theorists did establish themselves as an intellectually formidable alternative to the previously dominant Keynesians.

The monetarist assumption of the long-run neutrality of money stood in direct conflict to a long-run tradeoff between inflation and unemployment implied by a

simple Phillips curve. In 1967 Edmund Phelps developed a model in which the Phillips curve emerged in an expectations-augmented form: aggregate demand stimulus accelerated inflation, but reduced unemployment only until expectations adapted to the new policy. Independently, in his presidential address to the American Economic Association that same year, Friedman argued that monetary policy could affect real output only in the short run. In the long run, the Phillips curve was vertical at a "natural rate of unemployment" determined by tastes, technology, resources, and institutions. The natural-rate hypothesis received a strong boost when, in the early 1970s, inflation and unemployment rose simultaneously in most developed economies.

Adopting an old Chicago theme due to Henry Simons, Friedman and other monetarists, such as Karl Brunner and Allan Meltzer, advocated that monetary policy be conducted according to simple, fixed rules. The rationale was partly libertarian (the government should not manipulate people's behavior), partly based in the Phillips curve (expectations are more accurately formed when policy is easily understood), and partly an expression of distrust in econometric models (the lags between monetary actions and their real effects are long, variable, and poorly modeled, and attempting to exploit them often leads to perverse outcomes). Monetarists preferred a rule that targets a relatively narrow monetary aggregate (the monetary base, or "M1"). Market interest-rate rules would, they argued, be unstable: if the target were too low, inflation would increase, cutting real interest rates and further increasing inflation.

Although much has been made over the differences between monetarists and Keynesians (see Mayer, 1978), monetarists were at ease with Keynes's highly aggregated framework and showed little interest in the effort to develop general equilibrium microfoundations. Mainstream Keynesians easily adopted the idea of the natural rate or – as many preferred to call it – the *n*onaccelerating *i*nflation *r*ate of *u*nemployment (*NAIRU*). The most important differences were (i) whether deviations from the natural rate – logically, belonging to the Marshallian short-run – in practice lasted a short time (as the monetarists thought) or a long time (as the Keynesians thought) and (ii) whether aggregate-demand policy could reliably and effectively offset these deviations.

Monetarism influenced – and continues to influence – central banks around the world. Especially important are the monetarist notions that monetary policy can effectively target only nominal quantities and, therefore, ought to target inflation, and that central banks should be independent of political control and follow transparent rules. Beyond this, a strict monetarism was attempted in the US only for a brief time between 1979 and 1982, as a response to high and accelerating inflation. The experiment collapsed as a result of the instability of the link between the target variable (the monetary base) and the money stock (M1) and the instability of the demand for money in the face of financial innovation (Judd and Scadding, 1982). While advocating some monetarist principles, the Federal Reserve resumed interest-rate targeting in 1982.

During Margaret Thatcher's premiership, monetarism became highly influential (and hotly contested) in the United Kingdom. In a paper that was circulated in British policy circles long before its publication, David Hendry and Neil Ericsson

(1991) launched a stinging attack on the empirical adequacy of Friedman and Schwartz's *Monetary Trends* (1982). This volume – a sequel to their earlier *Monetary History* that extended its reach to the UK – had given substantial support to British monetarists. Friedman and Schwartz's (1991) reply was equally biting – its tone recalling the American debates of the 1960s. As well as proving hard to implement, monetarism came to symbolize Thatcher's conservative economic policy – monetary and nonmonetary – generally.

26.4 The Battle of the Schools, 1970–1990

26.4.1 The New Classical challenge

While monetarism challenged the Keynesian mainstream mainly over empirical judgments and policy prescriptions, the New Classical macroeconomics attacked its theoretical foundations. Its leading light, Robert Lucas, sought to combine the Chicago tradition in monetary policy with the developing program in general equilibrium microfoundations. Lucas and Leonard Rapping's intertemporal, market-clearing model of the labor market sought to show that fluctuations in employment could be analyzed without invoking rationing notions such as involuntary unemployment. Lucas, therefore, felt justified in rejecting the fixed-price approach and tying macroeconomics solidly to the dominant Walrasian general equilibrium model.

Lucas's program was clearly laid out in a paper presented to a Federal Reserve conference in 1970. Surprisingly, his first target was not the Keynesians, but his teacher – Milton Friedman. Lucas argued that if expectations were formed adaptively, as Friedman typically supposed, then during the infinite time it takes expectations to converge to the true values, there would continue to be real, though diminishing, effects on employment and output. A Phillips curve that is vertical only in the infinitely long run is not really vertical for policy purposes.

Lucas replaced adaptive expectations with John Muth's *rational-expectations hypothesis*. The rational-expectations hypothesis can be formulated in various ways. Lucas preferred to see it as "model-consistent expectations": what people are modeled to expect is what the model itself predicts. People with rational expectations would still make mistakes, but their mistakes would be unsystematic, uncorrelated, and therefore unpredictable. Adding the rational-expectations hypothesis to a simple monetarist macromodel eliminated persistent deviations from the natural rate, effectively collapsing the long run into the short run. In Lucas's account, only unanticipated money-supply shocks could have real effects.

Lucas and, later, Thomas Sargent and Neil Wallace, demonstrated in aggregate macroeconomic models with clearing factor markets and rational expectations that monetary policy was incapable of guiding the real economy. Policies controlling any nominal quantity could have real effects, but they could not have *systematic* real effects and were, therefore, useless to the policy-maker. Lucas took the argument further, constructing a model in which prices are the only

conveyers of information and unsystematic monetary policy shocks can generate an apparent Phillips curve tradeoff between output and inflation.

Lucas demonstrated that rational expectations add force to a general result of the microfoundations program: as the underlying decision problems of individual agents changed, the estimated aggregate relationships captured in macroeconometric models would also change. Agents with rational expectations would incorporate changes in systematic monetary policy into their decision problems, so that the aggregate relationships would shift with each shift in policy. This argument, known as the "Lucas critique," was held by some to explain observed instabilities in macroeconometric models and was widely regarded as proof that microfoundations, in which the analysis was grounded in the fundamental parameters governing tastes and technology, were essential to a successful empirical macroeconomics. In practice, however, most New Classical models employ some variant on the representative agent and eschew serious microfoundations.

The business cycle, with its persistent (serially correlated) fluctuations in real output and employment, was a challenge for the New Classical macroeconomics. In 1975 Lucas showed that persistent fluctuations would be generated through the optimal readjustment of the capital stock to output deviations initiated by monetary shocks. By the early 1980s, the balance of empirical evidence failed to confirm that monetary surprises account for most real fluctuations. Following the lead of Finn Kydland and Edward Prescott, the New Classical school largely abandoned the monetary-surprise model of business cycles in favor of the real business cycle model, in which shocks to technology (total factor productivity) or other real factors are propagated through optimal capital adjustment and the intertemporal substitution of labor supply. (See Hoover (1988) for a survey of the New Classical macroeconomics and Hartley, Hoover, and Salyer (1998) on the real business cycle program.)

26.4.2 The VAR program

While the Lucas critique questioned the microfoundational basis of large-scale macroeconometric models, they were besieged on another front as well. The dominant econometric tradition relied on structural econometric models in which economic theory was used to identify (or render causally interpretable) the estimated relationships. Another tradition had long existed side-by-side structural models: time-series econometrics appealed less to *a priori* theory. Crude time-series methods had been used in support of monetarism in the 1960s. In 1972 Christopher Sims initiated a large literature when he applied Granger-causality tests to US data to demonstrate the temporal priority of money over output – a result widely interpreted to support monetarism.

Sims's manifesto of 1980, "Macroeconomics and reality," attacked structural macroeconometric models for relying on "incredible" identifying assumptions. He proposed instead to rely on unrestricted, dynamic, reduced-form specifications known as "vector autoregressions" (VARs). These were used to forecast the effects of shocks to various macroeconomic variables *ceteris paribus* (impulse

responses) or to attribute the variance of a variable of interest to its own variance and that of other variables in the VAR (variance decomposition).

Thomas Cooley, Stephen LeRoy, and Edward Leamer, among others, pointed out that Sims employed implicit identification in adopting particular causal orderings among the contemporaneous variables in order to compute impulse responses and variance decompositions. These stood in as much need of justification as any identifying restrictions. Sims conceded the point. Since the mid-1980s "structural VARs" – that is, VARs with an explicit contemporaneous causal order – have become a mainstay of macroeconomic research. How to achieve credible identification of the contemporaneous structure remains a fraught question (the VAR program is surveyed by Hoover, 1988).

26.4.3 The Keynesian reaction

The early New Classical economics of Lucas, Sargent, and Wallace threatened the Keynesian conception of the economic problem as one of sub-optimal output and employment that could be mitigated by aggregate-demand management. The striking innovation of the rational-expectations hypothesis was, however, too attractive to dismiss: people may not form expectations precisely rationally, but could a serious economic analysis rely on easily corrected misperceptions of policy as its *modus operandi*? Keynesians first reacted by attacking the assumption that markets clear continuously. Stanley Fischer and Phelps and John Taylor presented models in which wages and prices could not adjust rapidly to clear markets because of preexisting contracts. This gave aggregate-demand policies real short-run effects, although money was neutral – and the Phillips curve was vertical – in the long run (Hoover, 1988).

The New Classicals asked why agents would enter into such sub-optimal contracts. While one response was to say – whether obviously optimal or not – such contracts do exist, by the early 1980s the "new Keynesians" felt an obligation to supply microeconomic rationales for various sticky prices. George Akerlof and Janet Yellen argued that small deviations from optimal prices would have only second-order effects on profits, although first-order effects on output and employment. Gregory Mankiw and others demonstrated that small costs of price adjustment ("menu costs") could turn Akerlof and Yellen's "near rationality" models into fully rational models in which prices were nonetheless sticky.

Solow, Akerlof, Joseph Stiglitz, and Carl Shapiro, among others, explored "efficiency-wage" models in which worker efficiency depends on the wage rate, giving employers an incentive to hire fewer workers but to pay them a higher-than-market-clearing wage. These models explain involuntary unemployment and sticky real wages but not sticky nominal wages, which is what is needed to explain effective aggregate-demand policies. Laurence Ball and David Romer showed that combining the real-wage stickiness with menu costs can produce larger – and more realistic – responses of output to aggregate-demand policy (on efficiency-wage models, see Akerlof and Yellen, 1986).

Stiglitz and Andrew Weiss initiated research into credit-rationing as an optimal market outcome. The central idea was that borrowers and lenders have

differential information about the borrowers' risks of default. Lenders might prefer to charge lower interest rates but to ration available funds. Higher market-clearing rates could cause the most credit-worthy borrowers to withdraw, skewing the pool of remaining borrowers toward higher average risk. Monetary policy, on this view, operates not only through the opportunity cost of investment, but through a "credit channel" in which an increase in central bank reserves permits banks to relax their lending constraints and to finance the investment projects of firms with otherwise limited access to credit markets.

Although the new Keynesian program of finding microfoundations that explain various aspects of aggregate sub-optimality as consistent with individual optimization remains active, the new Keynesians have never offered a systematic vision or a comprehensive model of the economy analogous to that of the New Classicals or of Keynes himself. (For references on new Keynesian macroeconomics, see Mankiw and Romer, 1991.)

26.5 Macroeconomics at the Turn of the Millennium

It is probably too soon to attempt the history of macroeconomics in the past decade. Nevertheless, there appears to be a surprising *détente* in the battle of the schools. The New Classical insistence on microfoundations has been adopted by almost all mainstream macroeconomists. And most have accepted microfoundations in the form of the representative–agent model or some near variant, despite the fact that a plausible case has never been offered for how any such agent could legitimately represent millions of economic decision-makers (see Kirman, 1992; Hartley, 1997). New Classicals have generally been forced to concede that without sticky prices or wages their models cannot reproduce the empirical fluctuations observed in the economy, although how to explain this stickiness remains an open question.

Empirical methods also now transcend the schools. Structural VARs are widely employed by New Classicals, Keynesians, and even heterodox macroeconomists. "Calibration" methods, which eschew econometric estimation in favor of informal comparisons of summary statistics from numerical simulations to the analogous statistics for actual data, were first adopted by the real business cycle sect of the New Classical school. Although it remains controversial, calibration is no longer restricted to real business cycle modelers (for a discussion of calibration methods, see Hartley, Hoover, and Salyer, 1998).

Empirical methods are now divided more on geographic than ideological lines. European time-series methods are typically more structural than structural VARs, but derive much of that structure from attention to statistical properties rather than from highly refined theoretical considerations (for surveys of macroeconometric methods, see Hoover, 1995).

On macroeconomic policy, there is now general agreement that monetary policy can have important, systematic real effects in the short run. But there remains active disagreement over whether the economy is sufficiently self-adjusting in the short run that active management should be eschewed.

Finally, perhaps because the 1990s were less turbulent and more prosperous than the 1970s and 1980s, macroeconomists have turned their attention once more to the macroeconomics of growth and, especially, the role of technical change and social and political institutions in the growth process (for a survey, see Barro, 1997). So far, no clear scholastic divisions have appeared in the economics of growth similar to those that plagued the macroeconomics of the short run from the monetarist insurgency through the heyday of the new Keynesians.

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