Behavioral Macroeconomics and Macroeconomic Behavior†

By GEORGE A. AKERLOF*

Think about Richard Scarry's *Cars and Trucks and Things That Go.*[1] Think about what that book would have looked like in sequential decades of the last century had Richard Scarry been alive in each of them to delight and amuse children and parents. Each subsequent decade has seen the development of ever more specialized vehicles. We started with the Model T Ford. We now have more models of backhoe loaders than even the most precocious four-year-old can identify.

What relevance does this have for economics? In the late 1960's there was a shift in the job description of economic theorists. Prior to that time microeconomic theory was mainly concerned with analyzing the purely competitive, general-equilibrium model based upon profit maximization by firms and utility maximization by consumers. The macroeconomics of the day, the so-called neoclassical synthesis, appended a fixed money wage to such a general-equilibrium system. "Sticky money wages" explained departures from full employment and business-cycle fluctuations. Since that time, both micro- and macroeconomics have developed a Scarry-ful book of models designed to incorporate into economic theory a whole variety of realistic behaviors. For example, "The Market for 'Lemons' " explored how markets with asymmetric information operate. Buyers and sellers commonly possess different, not identical, information. My paper examined the pathologies that may develop under these more realistic conditions.

For me, the study of asymmetric information was a very first step toward the realization of a dream. That dream was the development of a behavioral macroeconomics in the original spirit of John Maynard Keynes' *General Theory* (1936). Macroeconomics would then no longer suffer from the "ad hockery" of the neoclassical synthesis, which had overridden the emphasis in *The General Theory* on the role of psychological and sociological factors, such as cognitive bias, reciprocity, fairness, herding, and social status. My dream was to strengthen macroeconomic theory by incorporating assumptions honed to the observation of such behavior. A team of people has participated in the realization of this dream. Kurt Vonnegut would call this team a *kerass*, "a group of people who are unknowingly working together toward some common goal fostered by a larger cosmic influence."[2] In this lecture I shall describe some of the behavioral models developed by this *kerass* to provide plausible explanations for macroeconomic phenomena which are central to Keynesian economics.

For the sake of background, let me take you back a bit in time to review some history of macroeconomic thought. In the late 1960's the New Classical economists saw the same weaknesses in the microfoundations of macroeconomics that have motivated me. They hated its lack of rigor. And they sacked it. They then held a celebratory bonfire, with an article entitled "After Keynesian Macroeconomics."[3] The new version of macroeconomics that they produced became standard in the 1970's. Following its neoclassical synthesis predecessor, New Classical macroeconomics was based on the competitive, general-equilibrium model. But it differed in being much more zealous in insisting that all decisions—consumption and labor supply by

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[1] See Scarry (1974).

[2] See ⟨http://www.gibbsonline.com/gibbsbooks.html⟩.

[3] See Robert E. Lucas, Jr. and Thomas Sargent (1979).

households, output, employment and pricing decisions by producers, and the wage bargains between both workers and firms—be consistent with maximizing behavior.[4] New Classical macroeconomics therefore gave up the assumption of sticky money wages. To account for unemployment and economic fluctuations, New Classical economists relied first on imperfect information and later on technology shocks.

The new theory was a step forward in at least one respect: price and wage decisions were now based upon explicit microfoundations. But the behavioral assumptions were so primitive that the model faced extreme difficulty in accounting for at least six macroeconomic phenomena. In some cases, logical inconsistency with key assumptions of the new classical model led to outright denials of the phenomena in question; in other cases, the explanations offered were merely tortuous. The six phenomena are:

1. *The existence of involuntary unemployment:* In the New Classical model, an unemployed worker can easily obtain a job by offering to work for just a smidgeon less than the market-clearing salary or wage; so involuntary unemployment cannot exist.

2. *The impact of monetary policy on output and employment:* In the New Classical model, monetary policy is all but ineffective in changing output and employment. Once changes in the money supply are fully foreseen, prices and wages change proportionately; real wages and relative prices are constant; and there is no impact on the real economy whatsoever.

3. *The failure of deflation to accelerate when unemployment is high:* The New Classical model produces an accelerationist Phillips curve with a unique natural rate of unemployment. If unemployment falls below this natural rate, inflation accelerates. With unemployment above the natural rate, inflation continually decelerates.

4. *The prevalence of undersaving for retirement:* In the New Classical model, individuals decide how much to consume and to save to maximize an intertemporal utility function. The consequence is that privately determined saving should be just about optimal. But individuals commonly report disappointment with their saving behavior and, absent social insurance programs, it is widely believed that most people would undersave. "Forced saving" programs are extremely popular.

5. *The excessive volatility of stock prices relative to their fundamentals:* New Classical theory assumes that stock prices reflect fundamentals, the discounted value of future income streams.

6. *The stubborn persistence of a self-destructive underclass:* My list of macroeconomic questions to be explained includes the reasons for poverty because I view income distribution as a topic in macroeconomics. Neoclassical theory suggests that poverty is the reflection of low initial endowments of human and nonhuman capital. The theory cannot account for persistent and extreme poverty coupled with high incidence of drug and alcohol abuse, out-of-wedlock births, single-headed households, high welfare dependency, and crime.[5]

[4] Most of these puzzles were dormant at the time; they were inherent in the literature, but there was no active discussion of them. Probably the most active research program in macroeconomics during the late 1960's was the development of large-scale macroeconometric models. The models of search unemployment by Edmund S. Phelps et al. (1970) appeared in the late 1960's to answer the question: what is the meaning of unemployment? But they adopted a framework of search unemployment, which was, by nature, voluntary.

[5] I have left out two important questions whose microfoundations have been developed since the late 1960's. First, why might credit be rationed? Donald R. Hodgman (1960, p. 258) makes clear that the economic theory of the early 1960's found credit rationing to be an unexplained puzzle: "Economists of a more analytical persuasion have been reluctant to accept [credit rationing] at face value because of their difficulty in providing a theoretical explanation for the phenomenon which is consistent with the tenets of rational economic behavior. Why should lenders allocate by non-price means and thus deny themselves the advantage of higher interest income?" He attributes such views to Paul Samuelson as revealed in Congressional testimony. Asymmetric information provides an excellent reason for credit rationing. (See especially Dwight Jaffee and Thomas Russell [1976] and Joseph E. Stiglitz and Andrew Weiss [1981].) A second question relating to microfoundations concerns the reasons for leads and lags in macroeconomic variables, such as durable consumption, money demand, and prices. *S-s* models with lumpy costs to making changes can explain such leads and lags (unless the variable in question is either always decreasing or always increasing). Pioneering work on the effects of *S-s* pricing has been done especially by Robert J. Barro (1972) and Katsuhito Iwai (1981). Ricardo Caballero (see, for example, 1993) has compared the leads and lags in such models with a situation with no costs of adjustment. Andrew F. Caplin and Donald F. Spulber (1987) and Caplin and John Leahy (1991) have

In what follows I shall describe how behavioral macroeconomists, incorporating realistic assumptions grounded in psychological and sociological observation, have produced models that comfortably account for each of these macroeconomic phenomena. In the spirit of Keynes' *General Theory*, behavioral macroeconomists are rebuilding the microfoundations that were sacked by the New Classical economics. I shall begin my review by describing one of my earliest attempts in this field, which led to the discovery of the role of asymmetric information in markets.

I. Asymmetric Information

I first came upon the problems resulting from asymmetric information in an early investigation of a leading cause for fluctuations in output and employment—large variations in the sales of new cars.[6] I thought that illiquidity, due to the fact that sellers of used cars know more than the buyers of used cars, might explain the high volatility of automobile purchases.[7] In trying to make such a macroeconomic model, I got diverted. I discovered that the informational problems that exist in the used car market were potentially present to some degree in all markets. In some markets, asymmetric information is fairly easily soluble by repeat sale and by reputation. In other markets, such as insurance markets, credit markets, and the market for labor, asymmetric information between buyers and sellers is not easily soluble and results in serious market breakdowns. For example, the elderly have a hard time getting health insurance; small businesses are likely to be credit-rationed; and minorities are likely to experience statistical discrimination in the labor market because people are lumped together into categories of those with similar observable traits. The failure of credit markets is one of the major reasons for underdevelopment. Even where mechanisms such as reputation and repeat sales arise to overcome the problem of asymmetric information, such institutions become a major determinant of market structure.

To understand the origins of the economics of asymmetric information in markets, it is useful to reflect on the more general intellectual revolution that was occurring at the time. Prior to the early 1960's, economic theorists rarely constructed models customized to capture unique institutions or specific market characteristics. Edward Chamberlin's monopolistic competition and Joan Robinson's equivalent[8] were taught in graduate and even a few undergraduate courses. However, such "specific" models were the rare exception; they were presented not as central sights, but instead as excursions into the countryside, for the adventurous or those with an extra day to spare.[9] During the early 1960's, however, "special" models began to proliferate as growth theorists, working slightly outside the norms of standard price-theoretic economics, began to construct models with specialized technological features: putty-clay, vintage capital, and learning by doing. The incorporation into models of such specialized technologies violated no established price-theoretic norm, but it sowed the seed for the revolution that was to come. During the summer of 1969, I first heard the word *model* used as a verb, and not just as a noun.[10] It is no coincidence that just a few months earlier "The Market for 'Lemons' " had been accepted for publication.[11] The "modeling" of asymmetric information in markets was to price theory what the "modeling" of putty-clay, vintage capital, and learning by doing had been to growth

also looked at the implications of *S-s* policy for the relation between the shifts in the ideal price and the actual price being charged. See Akerlof (1973, 1979) for analysis of the effects of target-threshold monitoring on the short-run income and interest elasticity of the demand for money.

[6] See Akerlof (1970).

[7] Frederic S. Mishkin (1976) later developed the ideas that set me on this course initially. He showed why the demand for automobiles is more volatile because cars are illiquid due to asymmetric information.

[8] See Robinson (1942) and Chamberlin (1962).

[9] For example, I could well imagine a graduate student being unaware of Harold Hotelling's (1929) model of spatial competition. I cannot remember it in the graduate curriculum and remember finding it tucked away as an appendix to Chamberlin's *Monopolistic Competition.*

[10] Conversation with Michael Rothschild in Cambridge, Massachusetts, summer of 1969. I remember the usage just as many people today may remember the first time they heard someone say they would "grow the economy."

[11] I do not have the exact date of the acceptance of this article, but I remember that it took slightly more than a year between acceptance and publication.

theory.[12] It was the first application of a new economic orientation in which models are constructed with careful attention to realistic microeconomic detail. This development has brought economic theory much closer to the fine grain of economic reality. Almost inevitably, the analysis of information asymmetries was the first fruit of this new modeling orientation. It was the ripest fruit for picking. In the remainder of this essay I shall discuss the payoffs of this new orientation for the new field of behavioral macroeconomics.

II. Involuntary Unemployment

I once had an economist friend who said that he *could not* sell his house, a complaint that I reiterated sympathetically to one of his colleagues. The colleague responded that there was only one problem: the house was unreasonably priced. At a lower price the house would sell, perhaps instantly.

New Classical economics views involuntary unemployment as a logical impossibility, like my friend's inability to sell his house. Could not an unemployed worker obtain a job if only she were willing to reduce her reservation wage? The New Classical answer is yes: unemployed workers are those searching for work (hence unemployed, rather than out of the labor force) but rejecting jobs that are available because they had expected better pay. The unemployed may be unhappy that they cannot sell their labor at the wage or salary that they would ideally like, but except for those affected by the minimum wage or union bargaining, they are voluntarily, not involuntarily, unemployed. Everyone can get a job at the market-clearing wage. In New Classical theory, periods of declining employment—business-cycle downturns—may be caused by an unexpected decline in aggregate demand, which leaves workers mistakenly holding out for nominal wages that exceed the new market-clearing level.[13] Alternatively, declining employment may be due to negative supply shocks, which cause workers to withdraw from the labor force and eschew the jobs which are available. Any account of the business cycle based on voluntary variations in job-taking faces a significant empirical difficulty—to explain why quits decline in cyclical downturns. If higher unemployment results from workers' rejection of the poor returns from work, quits should rise along with unemployment. But there are fewer quits, not more, when unemployment rises. The procyclic behavior of quits is indisputable.[14]

Instead of denying the very existence of involuntary unemployment, behavioral macroeconomists have provided coherent explanations. Efficiency wage theories, which first appeared in the 1970's and 1980's, make the concept of involuntary unemployment meaningful.[15] These models posit that, for reasons such as morale, fairness, insider power, or asymmetric information, employers have strong motives to pay workers more than the minimum necessary to attract them.[16] Such "efficiency wages" are above market clearing, so that jobs are rationed and some workers cannot obtain them. These workers are involuntarily unemployed. In the next section I will extend this reasoning to explain why involuntary unemployment varies cyclically.

The pervasive empirical finding of a wide spread of earnings for seemingly similar workers is strongly suggestive of the near ubiquity of efficiency wages. Long before the efficiency wage was a gleam in the eye of macroeconomists, labor economists had documented wide dispersion in earnings across seemingly similar jobs and among workers with apparently iden-

[12] See Robert M. Solow (1959, 1962) and Kenneth J. Arrow (1962).

[13] This theory suffers from a further theoretical difficulty. Since aggregate unemployment is readily observable with a short lag, workers should condition their expectations of prevailing wage distributions on the aggregate unemployment rate. Such conditioning would eliminate serial correlation in unemployment.

[14] This question was raised by James Tobin (1972). For some data on the countercyclical behavior of quits, see Akerlof et al. (1988). Kenneth J. McLaughlin (1991) has attempted to reconcile the procyclicality of quits with New Classical economics as follows: He defines quits as employee-initiated separations, and layoffs as firm-induced separations. In McLaughlin's model a positive productivity shock causes more workers to ask for wage increases. Since some requests are rejected, quits rise as unemployment declines. But why should firms' wage offers lag behind worker demands in the face of a positive productivity shock?

[15] An excellent concise summary of this literature is given by Janet L. Yellen (1984).

[16] The inclusion here of insider-outsider models is taking an especially broad interpretation of the concept of efficiency wages.

tical characteristics.[17] Analysis of panel data indicates that workers of the same quality receive different wages depending upon their place of work. Moreover, data show that workers who switch industries receive wage changes that are correlated with the respective wage differentials between the industries.[18] Industries with higher pay (conditional on characteristics) also have lower quit rates, suggesting that pay differences are not simply compensating differentials due to different working conditions or benefits.[19] It thus appears that there are "good jobs" and "bad jobs."

The existence of good jobs and bad jobs makes the concept of involuntary unemployment meaningful: unemployed workers are willing to accept, but cannot obtain, jobs identical to those currently held by workers with identical ability. At the same time, involuntarily unemployed workers may eschew the lower-paying or lower-skilled jobs that are available. The definition of involuntary unemployment implicit in efficiency wage theory accords with the facts and agrees with commonly held perceptions. A meaningful concept of involuntary unemployment constitutes an important first step forward in rebuilding the foundations of Keynesian economics.

But why do firms pay wages above rock bottom? In my view, psychological and sociological explanations for efficiency wages are empirically most convincing.[20] Three important considerations are: reciprocity (gift exchange theory from anthropology), fairness (equity theory from psychology), and adherence to group norms (reference group theory in sociology and theory of group formation in psychology). In the earliest "sociological" version of efficiency wage theory based on gift exchange, firms give workers above market-clearing wages and workers reciprocate in their commitment to the firm.[21] The payment of above-market-clearing wages may also be motivated by considerations of fairness: in accordance with the psychological theory of equity, workers may exert less effort insofar as their wage falls short of what is considered fair.[22] Group norms typically determine the conceptions workers form about how gifts should be reciprocated and what constitutes a fair wage. In the laboratory, Ernst Fehr and his coauthors have established the importance both of reciprocal behavior and social norms for worker effort in experimental settings.[23] My favorite version of efficiency wages is the insider-outsider model, whereby insider workers prevent the firm from hiring outsiders at a market-clearing wage lower than what the insiders are currently receiving.[24] This theory implicitly assumes that insiders have the ability to sabotage the inclusion of new workers into a firm. A detailed study by Donald Roy of an Illinois machine shop reveals the dynamics by which this may occur: In Roy's machine shop, insiders established group norms concerning effort and colluded to prevent the hiring of rate-busting outside workers. Workers who produced more than the level of output considered "fair" were ostracized by others.[25] Collusion by insiders against outsiders is a compelling motive for many firms to pay wages that are above market clearing.

An alternative version of efficiency wage theory, grounded in asymmetric information, views above-market-clearing wages as a disciplinary device. In the Shapiro-Stiglitz model, firms pay "high" wages to reduce the incentive of workers to shirk. The attempt of all firms to

[17] See John T. Dunlop (1957).

[18] See William T. Dickens and Lawrence F. Katz (1987) and Alan B. Krueger and Lawrence H. Summers (1988). Note that these studies are for the United States in a period when unionization was quite weak; it is thus unlikely to be the major factor in such wage differentials. In contrast, Dunlop's wage differentials may have been mainly the result of differentials in union power.

[19] See Krueger and Summers (1988).

[20] See Katz (1986) and Alan S. Blinder and Don H. Choi (1990). Blinder and Choi find strong evidence in favor of morale considerations for paying high wages as well as mixed evidence in favor of efficiency wages as a worker discipline device. Truman Bewley (1999) concludes that morale is an important reason for failure to make wage cuts. Carl M. Campbell III and Kunal S. Kamlani (1997) report that morale is a major reason firms do not make money wage cuts, but so is concern over quits by the best workers.

[21] See Akerlof (1982) and Matthew Rabin (1993).

[22] See Akerlof and Yellen (1990) and David I. Levine (1991).

[23] See, for example, Fehr et al. (1993), Fehr et al. (1996), and Fehr and Armin Falk (1999).

[24] See Assar Lindbeck and Dennis J. Snower (1988).

[25] See Roy (1952).

pay "above-average" wages, however, pushes the average level of wages above market clearing, creating unemployment. Unemployment serves as a disciplinary device, because workers who are caught shirking and fired for lack of effort can become reemployed only after a period of unemployment.[26]

The worker-discipline model fits the standard logic of economics more comfortably than approaches grounded in sociology and psychology. But sociological and psychological models, including the insider-outsider model, that rely on elements outside the standard economic box, probably yield a better overall explanation for involuntary unemployment. These behavioral models capture Keynes' emphasis, in the initial chapters of the *General Theory,* on equity and relative wage comparisons.

III. Effectiveness of Monetary Policy

A central proposition of the New Classical economics is that monetary policy, as long as it is fully perceived, can have no effect on output or employment. Perfectly foreseen changes in the money supply induce rational wage and price setters to raise or lower nominal wages and prices in the identical proportion leaving output and employment constant.[27] This New Classical hypothesis conflicts, however, with empirical evidence on the impact of monetary policy and the widespread popular belief in the power of central banks to affect economic performance.

A major contribution of behavioral macroeconomics is to demonstrate that, under sensible behavioral assumptions, monetary policy *does* affect real outcomes just as Keynesian economics long asserted. Cognitive psychology pictures decision makers as "intuitive scientists" who summarize information and make choices based on simplified mental frames.[28] Reliance on rules of thumb that omit factors whose consideration have only a small effect on profit or utility is an implication of such cognitive parsimony. In the wage-price context, simple rules cause inertia in the response of aggregate wages (and prices) to shocks—the exact "sticky wage/price" behavior that New Classical economists had so scornfully derided. In the New Classical critique, the inertial wage behavior hypothesized in the "neoclassical synthesis" is irrational, costly for workers and firms, hence implausible. Behavioral economists have responded by demonstrating that rules of thumb involving "money illusion" are not only commonplace but also sensible—neither foolhardy nor implausible: the losses from reliance on such rules are extremely small.

In joint work with Janet Yellen, I first demonstrated this result in the context of a model with efficiency wages and monopolistic competition. We assumed that some price setters follow the rule of thumb of keeping prices constant following a shock to demand (caused by a change in the money supply). We showed that the losses to the "rule-of-thumb" firms from their failure to readjust prices following a change in the money supply are *second-order* (or *small*),[29] whereas the impact on output of a monetary shock in this economy is *first-order*

[26] See Steven Stoft (1982), James E. Foster and Henry Y. Wan, Jr. (1984), Carl Shapiro and Stiglitz (1984), and also Samuel Bowles (1985). The worker-discipline model captures a slice of reality, but as the whole explanation for involuntary unemployment it suffers from both theoretical and empirical difficulties. Theoretically, in jobs where supervision is imperfect and workers can determine their own effort, firms with good reputations could demand that workers post bonds. These bonds would be forfeited in the event that a worker is caught shirking. As long as they remain employed by the firm, workers would receive wages augmented by the interest on the bond; the principal would be returned at retirement. This payment scheme solves the incentive problem facing the firm and is cheaper for the firm than above-market-clearing efficiency wages. Gary S. Becker and George J. Stigler (1974) make this precise suggestion. In their scheme the worker receives the bond back when he leaves the job in good standing. (Other ways to reduce wages to market clearing in similar spirit have been pointed out by Lorne Carmichael [1985] and Kevin M. Murphy and Robert J. Topel [1990].) Empirically, the discipline-device theory fails to explain why industry wage differentials are so highly correlated across occupations, so that some industries offer "good jobs" to workers in all occupations, including those where there is little scope to shirk. (See Dickens and Katz, 1987.)

[27] This logic is clearly spelled out by Donald Patinkin (1956).

[28] See Richard Nisbett and Lee Ross (1980).

[29] In this context *second-order* is the mathematical representation of the concept *small.* Correspondingly, *first-order* is the mathematical representation of the concept *significant in size.*

(or *significant*) relative to the size of the shock.[30] We dubbed the rule-of-thumb strategies employed by firms with inertial price setting "near-rational" since the losses they suffer from their departure from complete optimization are *second-order* (or *small*).

The logic of the key result—that near-rational price stickiness is sufficient to impart significant power to monetary policy—is simple. With monopolistic competition, each firm's profit function is second-differentiable in its own price so that the profit function is flat in the neighborhood of the optimum own-price. In consequence, any deviation from the profit-maximizing price causes a loss in profits that is small—second-order with respect to the size of those deviations. But if the deviations from the optimum of a large number of firms are similar—for example, if they are all slow to adjust their prices following a change in the money supply—then real balances (the money supply deflated by the price level) change by a first-order amount relative to a situation with fully optimizing price-setting behavior. This first-order change in real balances, in turn, causes first-order changes in aggregate demand, output, and employment. For example, suppose that the money supply increases by a fraction ϵ and a fraction of firms keep their prices unchanged. Each firm's losses, relative to fully optimizing behavior, are approximately proportional to the square of ϵ. If ϵ is 0.05, for example, its square is quite a small number, 0.0025, so the losses from price stickiness are apt to be small. However, assuming money demand is proportional to income, the change in real output is first-order—proportional to ϵ. (With fully maximizing behavior by all firms, the change in the money supply leaves output unchanged.) Thus small deviations from complete rationality—indeed small and *reasonable* deviations from complete rationality—reverse the conclusion that expected changes in the money supply have no effect on real income and output.[31]

Rule-of-thumb pricing behavior takes many forms. For example, staggered price (wage) models, in which firms keep nominal prices (wages) fixed for a period of time, correspond closely to descriptions of price- (wage-) setting processes.[32] In the Taylor staggered contract model, during each period, half of all firms set a nominal price which they maintain for the succeeding two-period interval.[33] A variant of the staggered contract model, due to Guillermo A. Calvo, assumes instead that a fixed nominal price is reset at randomly varying intervals.[34] New Classical economists object to both renditions of the model, on the grounds that such price setting is not maximizing.[35] Of course, they are right: instead of keeping nominal prices unchanged during a fixed interval, Taylor's and Calvo's firms would do better by establishing prices that vary within the interval in accordance with the firm's expectations of the money supply (aggregate demand). Such profit-maximizing behavior would again render money supply changes neutral. However, price-setting (wage-setting) strategies of the Taylor/Calvo type are near-rational: the small amount of nominal rigidity that characterizes these models is sufficient to allow monetary policy to be stabilizing, yet the losses relative to a strategy that varies prices within the pricing interval are second-order.[36] There are many other forms of

[30] See Akerlof and Yellen (1985a, b), N. Gregory Mankiw (1985), Michael Parkin (1986), and Olivier Blanchard and Nobihiro Kiyotaki (1987).

[31] The same results hold in a number of alternative frameworks. For example, if firms set profit-maximizing efficiency wages, nominal wage stickiness is a form of rule-of-thumb behavior with similar consequences: the losses to the firm holding wages constant are second-order, but shocks to the money supply change real variables by a first-order amount. In Mankiw's formulation small "menu costs," which are fixed costs for making a price change, inhibit price changes with effects on equilibrium output that are an order larger than the menu cost.

[32] Especially see Carlton (1986).

[33] See Akerlof (1969), Stanley Fischer (1977), and John Taylor (1979).

[34] See Calvo (1983).

[35] See Barro (1977) for this complaint about staggered contract models.

[36] See Akerlof and Yellen (1991). Technically, it turns out that the amplitude of the business cycle, as measured by the standard deviation of (log) income rises due to Taylor's staggered contracts by an amount that is proportional to the standard deviation of the pricing "error" made by Taylor's firms. Monetary policy can offset this price stickiness and reduce business-cycle volatility. But the losses realized by firms from the use of Taylor-type staggered contracts are second-order, proportional to the variance of shocks to the system. In this sense, staggered pricing has a first-order effect on both the size of the business cycle and the stabilizing properties of monetary policy. But the nonmaximizing behavior which allows monetary policy to stabilize the economy results in losses that are second-order.

near-rational rule-of-thumb behavior that render monetary policy efficacious.[37]

Near-rational, rule-of-thumb models solve the great puzzle posed by Lucas regarding the effectiveness of monetary policy with rational expectations.[38] New Classical economics finds it difficult to explain more than a fleeting relation between money and output. The new behavioral economics, with a variety of plausible near-rational behaviors, yields a robust relation between changes in the money supply and changes in output.

[37] For example, Mankiw and Ricardo Reis (2001) have recently suggested that the response of income to monetary shocks is better explained by a "near-rational" model in which prices (and/or wages) respond slowly to new information than by near-rational, staggered price models in the Taylor/Calvo style. Slow response to new information may result from the considerable managerial costs involved in gathering, processing, and sharing information involved in the price-setting process. (See Zbaracki et al. [2000], quoted in Mankiw and Reis.) The Mankiw-Reis formulation resolves three paradoxes present in rational expectations staggered price models. Sticky information yields the empirically observed long lags of response of income to changes in monetary policy (Milton Friedman [1968] and Christina D. Romer and David H. Romer [1989]); it is consistent with the surprisingly slow response of inflation to shocks found in estimates of Phillips curves (Robert J. Gordon, 1997); and it fails to yield the theoretical perversity in rational expectations staggered contract models of deflationary policies that lead to increases, not decreases, in output (Lawrence Ball, 1994).

Experimental evidence suggests that the coordination problems involved in reaching a new equilibrium may be external as well as internal to the firm. Fehr and Jean-Robert Tyran (2001) conducted experiments in which price setters were given payoffs derived from a near-rational model with monopolistic competition. They found that negative changes in the money supply caused considerable output reductions when payoffs were denominated in nominal terms. Subjects acted as if other price setters suffered from money illusion, making them, in turn, reluctant to cut prices. (A new approach to the dependence of monetary policy on coordination failure is implicit in Peter Howitt and Robert Clower, 2000.) This paper suggests that the reaction of prices to money supply changes involves the formation of expectations concerning the response of other price setters to the same shock. Fehr and Tyran's (2001) experiment points to yet another form of near-rational behavior: price setters may fully maximize, but on the assumption that other firms follow sticky, rule-of-thumb pricing behavior. Again, monetary policy is effective in changing output and employment.

[38] See Lucas (1972).

IV. The Phillips Curve and the NAIRU

Probably the single most important macroeconomic relationship is the Phillips curve. The "price-price" Phillips curve relates the rate of inflation to the level of unemployment, the expected rate of inflation, and variables affecting aggregate supply, such as the price of oil or food. The trade-offs between inflation and unemployment implicit in this relation define the "feasible set" for monetary policy and thus play a decisive role in its formulation. The Phillips curve was first estimated for Britain,[39] then subsequently for the United States[40] and many other countries.[41]

The basis of the Phillips curve is supply and demand. Phillips posited that when demand is high and unemployment low, workers can bargain for higher nominal wage increases than when demand is low and unemployment high. Firms' pricing policies translate wage inflation (adjusted for productivity) into price inflation. For policy makers, therefore, a durable trade-off exists between inflation and unemployment.

In the late 1960's, Friedman (1968) and Phelps (1968) added an important new wrinkle. They argued that workers care about and bargain for real, not nominal, wage gains: workers routinely expect and receive compensation for expected inflation, then bargain from there, demanding higher expected real wage gains at lower rates of unemployment. Again, pricing policies translate wage inflation into price inflation. The consequence of this small shift in assumption—that workers bargain for real, not nominal, wage increases—is enormous: instead of a durable unemployment-inflation trade-off, there is now just a unique "natural" unemployment rate consistent with stable inflation. With "real-wage" bargaining, the long-run Phillips curve—the unemployment/inflation combina-

[39] See A. W. Phillips (1958) and Richard G. Lipsey (1960).

[40] See Robert J. Gordon (1970) and George L. Perry (1970) for some early estimates for the United States.

[41] To give just one example, Robert J. Flanagan et al. (1983) estimated the Phillips curve for many different countries.

tions consistent with equality between actual and expected inflation—is vertical because there is one and only one unemployment rate: the "natural rate"—at which actual and expected inflation match.

To see why the long-run Phillips curve must be vertical, imagine that a central bank attempts via monetary policy to hold unemployment below the natural rate. With labor markets abnormally tight, workers demand nominal wage increases in excess of expected inflation (plus normal real wage cum productivity gains). Firms, in turn, pass the associated cost increases into prices, so that inflation exceeds what workers initially anticipated when they bargained. With unemployment below the natural rate, actual inflation therefore exceeds expected inflation. *Ex post,* workers have been fooled. So, over time, inflationary expectations, and inflation in turn, accelerates. With unemployment held below the natural rate, the consequence is ever accelerating *inflation.* Similarly, the Friedman-Phelps model predicts that a central bank attempting to hold unemployment above the natural rate indefinitely eventually causes accelerating *deflation.* Only the natural rate of unemployment yields steady inflation.

Economists accepted the natural rate hypothesis remarkably quickly after it was first proposed by Friedman and Phelps in the late 1960's. Three things conspired in its favor. First, it seemed to explain remarkably well the inflation-unemployment experience of the 1960's and 1970's. At the low unemployment rates of the late 1960's, inflation rose, which apparently drove up inflationary expectations, shifting the short-run unemployment inflation trade-off outward. Thus the 1970's began with a much less favorable unemployment inflation trade-off than the 1960's. (Analysts ignored the equally plausible explanation that as inflation increased, as it did in the late 1960's, wage bargains and price setting began to take inflationary expectations, which had previously been ignored, into account.)[42] Second, empirical estimates of the Phillips curve yielded coefficients on past inflation whose sum was not statistically different from unity. The inference was drawn that the lagged inflation terms in such estimates correspond to expected inflation, which is an autoregressive weighted average of past inflation, and that the coefficient on expected inflation in determining current inflation is one.[43] Finally, there is a bias for economists to accept rationally based null hypotheses, even though accepted only by tests with relatively low power.[44]

Economists should not have accepted the natural rate hypothesis so readily. There are both theoretical and empirical reasons to be highly suspicious. Theoretically, the natural rate hypothesis reminds me of a common diet book rule of thumb. According to that rule of thumb for every 3,200 calories extra that we eat, we gain a pound. For every 3,200 calories less, we lose a pound. This always makes me imagine twin brothers. One of these twin brothers eats just enough to keep his weight even. The other twin eats one more 100-calorie cookie per day. If the rule of thumb is right, after one year the cookie eater is 11 pounds heavier than his brother. After a decade he is 110 pounds heavier. Fifty years later, should he live so long, he would be 550 pounds heavier. Just as expected, the rule of thumb does break down when extrapolated over long time periods: more accurate renditions of the relationship between weight and calories show that the maintenance of higher weight requires extra caloric intake. Happily the twins' weights will not diverge forever. Similarly my guess is that for at least some band of unemployment rates, inflation would asymptote to a constant value rather than accelerate or decelerate indefinitely. Such a priori reasoning could be wrong, but the error from overextrapolation of the diet book rule of thumb warns us that the natural rate hypothesis is rather odd. At very low unemployment rates, the Friedman/Phelps prediction of accelerating inflation seems quite possibly reasonable and

[42] This alternative explanation was given by Otto Eckstein and Roger Brinner (1972), but did not make it into the mainstream.

[43] We should here note Thomas J. Sargent's (1971) criticism that the coefficient on lagged inflation will not equal one in an accelerationist model if the process generating inflation is stable, without a unit root.

[44] We shall see an example of such bias below when we review Summers' criticism of the acceptance of the random walk hypothesis based on failure to reject by tests with very low power against alternative hypotheses.

empirically relevant.[45] But I am suspicious about the theory's applicability when unemployment is high.

My suspicions regarding the natural rate hypothesis are supported by an empirical fact, which reveals that its applicability is not *universal.* Unemployment in the United States for the whole of the 1930's was indisputably in excess—surely *greatly* in excess—of any plausible natural rate. According to the natural rate hypothesis, price deflation should have accelerated for the whole decade. That did not happen. Prices fell for a time, but deflation stopped after 1932; there was no significant deflation for the next ten years, despite extremely high unemployment. This evidence suggests that, at least after some time, at high levels of unemployment and low inflation rates, the natural rate hypothesis breaks down. Such a failure would not be terribly serious for a theory derived from empirical observation, but it constitutes a serious flaw for a relationship derived from a priori principles, principles that are accepted because they are supposed to be always and everywhere true.

The evidence of the 1930's is not unique. Modern economies display similar characteristics. For example, Pierre Fortin estimates that from 1992 to 2000, the Canadian economy experienced almost 12 points of unemployment in excess of a very conservative, 8-percent estimate of NAIRU.[46] During that same period, inflation averaged a very low 1½ percent per year. According to natural rate theory, core inflation should have declined by roughly 6 percentage points, since a typical estimate of the Phillips curve slope is ½. Instead, inflation declined over that period by only 0.1 percent.

Econometric evidence further suggests that the natural rate theory rests on shifty sand rather than bedrock. Time-varying estimates of the natural rate show that it changes over time; but, even with allowance for such shifts, estimates of the natural rate possess high standard errors. Douglas Staiger et al. (1997) compute a 95-percent confidence interval for the U.S. natural rate which exceeds 5 percentage points; this is more than three times the standard deviation of the U.S. monthly unemployment rate over the last 50 years.

In recent papers, William Dickens, George Perry, and I have explored two behavioral hypotheses that, contrary to the natural rate model, produce a stable trade-off between unemployment and inflation at sufficiently high unemployment and low inflation rates. The first hypothesis is "pure Keynes": workers resist, and firms rarely impose, cuts in nominal pay. The second hypothesis concerns the role of inflationary expectations in wage bargains: we argue that, at very low inflation, a significant number of workers do not consider inflation sufficiently salient to be factored into their decisions. However, as inflation increases, the losses from ignoring it also rise, and therefore an increasing number of firms and workers take it into account in bargaining.

Keynes' assumption that workers resist nominal wage cuts was consistent with his intuitive understanding of psychology. The assumption also coincides with psychological theory and evidence. Prospect theory posits that individuals evaluate changes in their circumstances according to the gains or losses they entail relative to some reference point. The evidence suggests that individuals place much greater weight on avoiding losses than on incurring gains. Daniel Kahneman and Amos Tversky (1979) have demonstrated that many experimental results which are inconsistent with expected utility maximization can be rationalized by prospect theory. Downward wage rigidity is a natural implication of prospect theory if the current money wage is taken as a reference point by workers in measuring gains and losses. In support of this view, Eldar Shafir et al. (1997) found in a questionnaire study that individuals' mental frames are defined not just in the real terms hypothesized by classical economists but also exhibit some money illusion.

Numerous empirical studies document that money wages are, in fact, downward sticky. Using panel data, David Card and Dean Hyslop (1997) and Shulamit Kahn (1997) found that

[45] The occurrence of hyperinflation with low unemployment maintained sufficiently long is one prediction of the theory. The frequent occurrence of hyperinflation seems to support the theory. But these hyperinflations have occurred when governments have lost fiscal credibility (and could only pay their deficits by seigniorage). It may be the loss of fiscal credibility, not the maintenance of low unemployment, which is the cause of the hyperinflation.

[46] Observation due to Fortin in Fortin et al. (2001).

distributions of nominal wage changes are asymmetric around zero. Fortin found a remarkable pileup of wage changes at zero in Canadian data. From 1992 to 1994, when Canadian inflation was 1.2 percent and the unemployment rate averaged 11.0 percent, only 5.7 percent of non-COLA union agreements had first-year wage cuts, whereas 47 percent had wage freezes.[47] In detailed interviews in Connecticut, Bewley found that managers are willing to cut nominal wages only as a last resort.[48] To investigate whether firms cut total compensation through benefit cuts as opposed to money wage cuts, David E. Lebow et al. examined the individual industries covered by the Employment Cost Index: they found that benefit cuts are only a minor substitute for nominal wage cuts.[49] Using Swiss data, Fehr and Lorenz Goette found that even a seven-year period of low inflation and low productivity growth did not increase the frequency of money wage cuts.[50]

At low inflation there is a long-run trade-off between output and inflation if there is aversion to nominal pay cuts. Unlike the Friedman-Phelps model, in which such a trade-off is transitory, long-term increases in inflation (if it is close to zero) result in significantly less employment and more output.[51] The logic goes as follows. In both good times and bad, some firms and industries do better than others. Wages need to adjust to accommodate these differences in economic fortunes. In times of moderate inflation and productivity growth, relative wages can easily adjust. Unlucky firms can raise the wages they pay by less than the average, while the lucky firms can give above-average increases. However, if productivity growth is low (as it was from the early 1970's through the mid-1990's in the United States) and there is no inflation, firms that need to cut their real wages can do so only by cutting the money wages of their employees. Under realistic assumptions about the variability and serial correlation of demand shocks across firms, the needed frequency of nominal cuts rises rapidly as inflation declines. An aversion on the part of firms to impose nominal wage cuts results in higher permanent rates of unemployment. Because the real wages at which labor is supplied are higher at every level of employment when inflation is low, the unemployment rate consistent with stable inflation rises as inflation falls to low levels. Spillovers produce an aggregate employment impact which exceeds the employment changes in those firms that are constrained by their inability to cut wages. Thus, a benefit of a little inflation is that it "greases the wheels of the labor market."

Simulations of a model with intersectoral shocks and aversion on the part of firms to nominal wage cuts suggests that, with realistically chosen parameters, the trade-off between inflation and unemployment is severe at very low rates of inflation, when productivity growth is low. For example, a permanent reduction in inflation from 2 percent per year to zero results in a permanent increase in unemployment of approximately 2 percentage points.[52] Estimation of a Phillips curve for the United States after World War II, corresponding to the simulation model just described, gives similar results. When the Phillips curve thus estimated is used to simulate the inflation experience of the 1930's, the fit is shockingly close to actual U.S. inflation experience during the depression.[53] A comparable simulation of the standard natural rate model, in contrast, counterfactually, shows accelerating deflation throughout the 1930's.

An alternative behavioral theory also generates a permanent trade-off between inflation and unemployment at low inflation. This theory is based on the idea that because inflation is not salient when it is low, anticipated future changes in the price level are ignored in wage bargaining.[54] With monopolistic competition and efficiency wages such ignorance of inflation when it is low is near-rational.[55] The psychology of just noticeable differences and cognitive psychology both suggest that people tend

[47] See Fortin (1995, 1996).
[48] See Bewley (1999).
[49] See Lebow et al. (1999).
[50] See Fehr and Goette (2000).
[51] See Tobin (1972).
[52] See Akerlof et al. (1996).
[53] This is done by sequentially feeding in the simulated inflation of the previous period to derive adaptively the next period's inflationary expectations. The fit is so excellent that there must be a component of luck.
[54] Past inflation is incorporated indirectly because wage bargains take into account the wages paid by competitors.
[55] See Akerlof et al. (2000).

to ignore variables that are unimportant to their decisions.[56] Econometric estimates of the Phillips curve which allow for the possibility that past inflation has a different impact on current inflation when inflation is high than when it is low are consistent with this hypothesis: at high inflation, the sum of coefficients on past inflation is close to one.[57] At low inflation, this sum of coefficients is much closer to zero. Similarly, regressions using survey measures of expected inflation as an independent variable yield much higher coefficients on the expected inflation term at high inflation than at low inflation.[58] Not surprisingly then, when periods of low and high inflation are combined to estimate a nonlinear model of the influence of inflationary expectations we find that their impact depends on the recent history of inflation.

The demonstration by behavioral macroeconomics that very low inflation has the cost of permanently high unemployment and low output, has important implications for monetary policy. Most of us think of central bankers as cautious, conservative, and safe. But I consider many to be dangerous drivers: to avoid the oncoming traffic of inflation, they drive on the far edge of the road, keeping inflation too low and unemployment too high. During the 1990's, Canada had very low inflation and an unprecedented unemployment gap—close to 4 percentage points—with the United States.[59] Europe has also had high unemployment and very low inflation. Japan has gone much further, allowing deflation. Central bankers who accept the textbook version of the natural rate hypothesis should follow the advice of Oliver Cromwell to the General Assembly of the Church of Scotland: "I beseech you in the bowels of Christ, think it possible you may be mistaken." It is no coincidence that the leading survey of cognitive psychology uses this citation to demonstrate a common perceptual error: overconfidence.[60]

V. Undersaving

It is common wisdom that people save too little. To compensate for this failure, most developed country governments heavily support the elderly in retirement. In addition, a very large number of employers require and subsidize pension contributions of their employees. Many forms of saving receive tax advantage. Even with these legs up, the common wisdom is that financial assets of most households still fall considerably short of what they need to maintain their consumption in retirement.[61]

For New Classical economics, saving too little or too much, like involuntary unemployment, is an impossibility, a straightforward contradiction of the assumptions of the model. Since saving is the result of individual utility maximization, it must, absent externalities, be

[56] This formulation is also influenced by the public's mental frame regarding inflation. Robert J. Shiller (1997a, b) has elicited the differences in mental frame between the public and economists by questionnaire responses.

[57] One is not, however, necessarily the magic number for the reasons noted earlier by Sargent (1971).

[58] Such regressions address the problem suggested by Sargent that the natural rate model should produce coefficients on expected inflation that correspond to the money supply rule, and those coefficients need not be equal to unity. If expectations are observed without error, the coefficient on expected inflation with natural rate theory should be unity. Error in the expectations data should bias its coefficient downward, but it should not, as observed, result in changes in the coefficient, unless there are also changes in the error of observation between periods of high and low inflation.

[59] 3.8 percent from 1990 to 1999, according to the *Economic Report of the President* (2000, Table B-107).

[60] See Nisbett and Ross (1980). This book is one of the leading primers for the psychology of behavioral macroeconomics. Curiously, cognitive psychologists have a much more empirical basis for their theories than economists.

[61] Eric M. Engen et al. (1999, p. 97) reach the opposite conclusion. They compare the actual wealth with that derived in a calibrated optimization model. Their preferred calibration has a rate of time preference of 3 percent. With data from the U.S. Health and Retirement Survey with a broad definition of wealth to include all home equity, 60.5 percent of households have more than the median optimal wealth in the calibrated model. But I would focus on an alternative result from their simulations. If we exclude home equity investment in spendable financial capital, and assume a zero rate of intertemporal time discount, only 29.9 percent of households reach the preretirement age of 60 or 61 with more than the optimal median wealth for someone of their age (p. 99, Table 5). Like the discussants, both for empirical and a priori reasons, I view a zero rate of discount as more correct. This conforms to people's stated preference for nondeclining consumption at a zero rate of interest (see below) and it weights utility at different ages on a one-for-one basis. My choice to exclude home equity capital assumes that retirees should not have to leave their homes for financial reasons, or to reverse-mortgage them, as they get older.

just right. Behavioral macroeconomics, in contrast, has developed theoretical tools and empirical strategies to advance understanding of such time-inconsistent behavior.

A key theoretical innovation permitting systematic analysis of time-inconsistent behavior is the recognition that individuals may maximize a utility function that is divorced from that representing "true welfare." Once this distinction is accepted, "saving too little" becomes a meaningful concept. The idea can be illustrated by the ancient myth of the lemmings, who every few years are said to converge in a death march, which ends with their final plunge into the sea.[62] The alleged behavior of those lemmings reveals a distinction common among psychologists, but rare for economists. Unless the lemmings experience an unusual epiphany in that final plunge, their utility or welfare is given by one function; yet they maximize another.

Think about it: the popular view of saving, that people undersave, is similarly described. Determining whether people save too much or too little involves asking whether people, like the lemmings, have one (intertemporal) utility function which describes their welfare, but maximize another.[63] Such evidence as there is suggests potentially large difference between the two concepts. High negative rates of time discount are necessary to explain actual wealth-earnings ratios.[64] Yet, questionnaire responses on the consumption-saving trade-offs that people think they *ought to make* reveals an intertemporal discount rate that is on average slightly positive.[65]

The hyperbolic discount function, which has been used to study intertemporal savings choices, can be used to formalize the distinction between the utility function that describes actual saving behavior and the utility function that measures the welfare resulting from that behavior. The hyperbolic function captures the difficulty people have in exercising self-control. In contrast to the constant discount rates that are standard in neoclassical theory, the hyperbolic function assumes that the discount rates used to evaluate trade-offs between adjacent periods decline as the time horizon lengthens: individuals use high discount rates to evaluate options that require an immediate sacrifice for a future reward and lower discount rates when the same sacrifice is deferred into the future. Thus, they are patient in making choices requiring gratification delays when those sacrifices are deferred; but impatient in delaying gratification in the short run. Because present consumption is more salient than future consumption, individuals procrastinate about saving. The hyperbolic function accords closely with experimental findings: Human and animal subjects are far less willing to delay gratification immediately than to commit to such delays in the future.[66]

Two forms of procrastination may result from hyperbolic discounting. "Naive procrastination" occurs when an individual assumes incorrectly that her utility function will be different in the future. She mistakenly projects that, although today is salient, tomorrow will be different. She fails to see that tomorrow's self will be different from today's self, so that tomorrow will be just as salient as today once it has moved one step closer. The naive procrastinator mistakenly believes that she will save (diet, exercise, quit smoking, etc.) tomorrow, although she has not done so today, and is surprised that the sacrifices deferred today are also deferred again tomorrow. More sophisticated procrastination takes the form of preproperation, according to the terminology of Ted O'Donoghue and Rabin (1999). The preproperator has fully rational expectations about who her future self will be. She says to herself: there is no reason to save today if tomorrow is going to be especially salient. If tomorrow is especially salient

[62] My 1946 version of *The Encyclopedia Britannica* describes as fact the march of the lemmings, which "never ceases until they reach the sea, into which they plunge and are drowned."

[63] This difference is made explicit in David I. Laibson (1999).

[64] See Engen et al. (1999, pp. 157–58).

[65] See Robert S. Barsky et al. (1995, p. 34).

[66] See Robert H. Strotz (1956), Phelps and Robert A. Pollak (1968), George Ainslie (1992), George Loewenstein and Drazen Prelec (1992), Laibson et al. (1998), and Laibson (1999). In Akerlof (1991) I was regrettably unaware of earlier work on intertemporal inconsistency. In economics this includes Strotz (1956), Phelps and Pollak (1968), Richard H. Thaler (1981), and Loewenstein (1987). Loewenstein and Thaler (1989) give an excellent early review of the previous literature on dynamic inconsistency including the psychological experiments and theory. See also Ainslie (1992).

then I will spend whatever savings I have laid aside today when it was also especially salient. So I should not make the sacrifice today.

Laibson has used hyperbolic discounting as the basis of a research program on saving behavior and policy. With coauthors Andrea Repetto and Jeremy Tobacman (1998) he has simulated the effects of different tax incentive programs in a world in which consumers preproperate. They estimate that large positive welfare effects result from small changes in incentives to save which reduce the amount of preproperation. Because of this work the regulations regarding tax-advantaged 401(k) savings plans have been changed. If firms so choose, workers may now be automatically enrolled with an automatic default contribution. Adoption of such plans significantly increases plan participation and many workers maintain their contributions at the level of the default.[67]

Besides the popularity of social security and other programs that "force" consumers to save, the best evidence of undersaving is probably the observation that, upon retirement, individuals, on average, reduce consumption substantially.[68] In fact, consumption at retirement declines discontinuously.[69] Those with more wealth and higher income replacement reduce their consumption by much less. This finding is difficult to explain with the standard life cycle, exponential discounting model.[70]

Thaler and Shlomo Benartzi (2000) have devised a savings plan to overcome workers' tendency to procrastinate and have tested it on an experimental basis at a mid-size manufacturing firm: employees were invited to join a savings plan allowing them to elect, in advance, the fraction of wage or salary increases to be set aside for savings. Consistent with hyperbolic discounting, but not with the standard exponential model, workers chose relatively modest saving out of current income but committed to save large fractions of future wage and salary increases. Within a short period of time, the average savings rate had doubled.[71]

VI. Asset Markets

Keynes' *General Theory* was the progenitor of the modern behavioral finance view of asset markets. In Keynes' metaphor "professional investment may be likened to those newspaper competitions in which competitors have to pick out the six prettiest faces from a hundred photographs, the prize being awarded to the competitor whose choice most nearly corresponds to the average preferences of the competitors as a whole."[72] Thus stock markets are too volatile and also too responsive to news. This view of the stock market contrasts with the efficient markets model in which stock prices measure the present value of future returns adjusted for risk.

In the early 1980's Robert Shiller conducted a direct test of the Keynesian excess volatility hypothesis. He reasoned that if stock prices really are the predicted value of expected future returns, they should vary less than the discounted returns themselves. Shiller's insight was a direct application of a simple statistical principle: a good forecast should have lower variance than the variable being forecast. If the weather forecast has greater variance than the actual weather, the weather forecaster should be fired.[73] Using 100 years of U.S. data on stock prices and dividends, Shiller (1981) compared the variance of detrended stock prices to the variance of the detrended present discounted

[67] See Brigitte C. Madrian and Dennis F. Shea (2001).

[68] See James Banks et al. (1998) and B. Douglas Bernheim et al. (2001).

[69] Such declines might occur if retirement is associated with negative income shocks. Bernheim et al. (2001, p. 854) suggest that such an adjustment is relatively minor.

[70] Retirees, of course, obtain greater leisure, and thus one might expect a reduction in consumption as leisure is substituted for consumption. It is difficult, but not impossible, to explain, in addition, why such substitution varies systematically both with the level of wealth and with the income replacement ratio. This could occur if those with a particular taste for leisure in retirement have by choice high income replacement ratios and have accumulated high levels of savings.

[71] From 4.4 percent to 8.7 percent. This behavior is also explained by prospect theory by Kahneman and Tversky (1979). According to prospect theory the framing of decision-making is important and people resist taking losses. In this context these employees do not want to take losses in their consumption.

[72] Keynes (1936, p. 156).

[73] For example, drawing from a normal distribution, the forecast that yields the smallest squared deviation between the actual draw and the forecast is the mean of the distribution, which is a constant with no variance at all.

values of dividends.[74] He found just what Keynes would have expected: the standard deviation of (detrended) stock prices is five times larger than the standard deviation of (detrended) discounted dividends. These results have been confirmed in more sophisticated tests that properly allow for the nonstationarity of both stock prices and the present discounted values of dividends.[75]

The results of variance-bounds tests notwithstanding, belief in efficient markets was sustained by empirical results such as the finding of insignificant serial correlation in returns in monthly data.[76] Rejection of the hypothesis that returns are serially correlated suggests that the stock market follows something close to a random walk. In response, Summers (1986) showed in a model of "fads"—with serially correlated deviations from perfect markets—that serial correlation tests have very low power: the power of such tests is so low as to require 5,000 years worth of data before it could discriminate 50 percent of the time between the random walk hypothesis and a fad which would drive stock prices more than 30 percent away from fundamentals 35 percent of the time.[77]

Beyond establishing the existence of excess volatility, Shiller has also examined its possible causes. In *Irrational Exuberance* (2000), he reviews the news coverage of the stock market bubble of the 1990's and explains how the idea of a "new era" both in financial markets and the real economy was propagated. As stock prices rose, the "new economy" mantra was transmitted from person to person; individual investors acted on the opinions of the media, which exaggerated the effects of economic fundamentals such as the internet on productivity. Such stock market bubbles are common; they have occurred in many other countries and frequently over the course of history. Indeed, Kindleberger's accounts of manias and panics and Galbraith's history of the *Great Crash* of 1929 are distinguished predecessors to *Irrational Exuberance.*

A second major empirical finding that casts doubt on the rationality of the stock market is the equity premium puzzle. Over the last 200 years, the return on equity has been significantly higher than the return on bonds. For example, from 1802 to 1998 the real return on a value-weighted market equity index was 7.0 percent per annum compared to 2.9 percent for a relatively riskless security.[78] Over the last 75 years, 1926–2000, the real returns were 8.7 percent on equity versus 0.7 percent on bonds, a gap of 8.0 percent. A gap of this size is huge: Jeremy J. Siegel and Thaler (1997) calculate that a $1,000 investment made 75 years ago would have yielded $12,400 in bonds and $884,000 in stocks. This gap is so large that rejection of rationality is duck soup: With intertemporal maximization of utility, the marginal utility of consumption today should equal the expected extra utility tomorrow from forgoing one unit of consumption today. With a constant relative risk-aversion utility function, this condition implies that the expected equity premium should equal the product of the coefficient of risk aversion and the covariance between the growth of consumption and the return on

[74] He extrapolated future dividends for times beyond his period of observation. For a similar test also see Steven F. LeRoy and Richard Porter (1981).

[75] See John Y. Campbell and Shiller (1987). Although Shiller's tour de force initially seemed to clinch the case, two technical problems cast a shadow of doubt. The first problem is that detrending potentially introduces a serious bias into Shiller's procedure: neither stock price series nor dividends are stationary and a nonstationary series does not even possess a variance. The second problem relates to the shortness of Shiller's sample and his extrapolation of future dividends beyond the present. Allan W. Kleidon (1986) showed in simulated data that the difference between the variance of Shiller's detrended stock price and of his dividend series is not large enough to confidently reject the efficient market null hypothesis when returns follow a random walk. The Campbell-Shiller test allows for the nonstationarity of stock prices and dividends, provided the two series are cointegrated. This test is also valid even if firms smooth dividends.

The high volatility of stock prices could also be explained by a high frequency cycle in the expected real rate of return on stocks. But such a cycle is inconsistent with most standard classical models of the economy, where real returns are mainly determined by the state of technology, and the capital–labor ratio. In the standard classical model both technology and the capital–labor ratio change slowly.

[76] Where not insignificant in the statistical sense, such correlation seemed insignificant in magnitude.

[77] Kenneth D. West (1988) similarly demonstrated the low power of Kleidon's efficient markets test using Shiller's detrended data.

[78] See Rajnish Mehra (2001, p. 1).

stock prices. For reasonable values of the coefficient of risk aversion, however, this product is much smaller than the equity premium, thus rejecting rational consumption behavior. This rejection is known as the equity premium puzzle.[79]

Further evidence of the irrationality of stock prices comes from cross-section data. Similar to Shiller's time-series finding of excess volatility coupled with reversion to the mean in price/dividends ratios, Werner F. M. De Bondt and Thaler (1985) find reversion to the mean of stock returns in a cross section: successive portfolios formed by the previous five years' 50 most extreme winners considerably underperform the market average, while portfolios of the previous five years' 50 worst losers perform better than the market average. Other stock market anomalies, such as a 20-percent one-day decline in stock prices in October 1987 in the absence of any significant news also cast doubt on the efficient markets hypothesis.[80]

Asset markets are not only important for their own sake, they are also important because they affect the macroeconomy, through at least three channels. First, the value of assets affects wealth and, in turn, consumption. Second, the price of existing assets relative to the price of new capital—Tobin's q ratio—affects investment since investment can be viewed as an arbitrage between new capital stock and claims to similar existing assets.[81] Finally, asset values affect the chances that firms will go bankrupt. Firms close to bankruptcy find it difficult, if not impossible, to borrow, and thus commonly forgo profitable investment opportunities.[82]

VII. Poverty and Identity

If income distribution is a topic in macroeconomics, as many have professed, then behavioral economics also offers insight on the most enduring macroeconomic problem facing the United States: the disparity in income and social condition between the majority white population and the African-American minority. As a legacy both of slavery and the Jim Crow discrimination that followed it, poverty weighs especially heavily on African-Americans. The black poverty rate of 23.6 percent in 2000 was roughly triple the white rate of 7.7.[83] Despite comprising only about one-eighth of the population, African-Americans have almost one-fourth of all U.S. poverty.[84] The reality is yet more disparate than these statistics indicate because the problems of the poorest African-Americans go beyond mere poverty. They include extraordinarily high rates of crime, drug and alcohol addiction, out-of-wedlock births, female-headed households, and welfare dependency. Statistics on incarceration indicate that even the worst of these problems affect a significant fraction of African-Americans. Thus, for example, about 4.5 percent of black males are either in jail or in prison.[85] The black male incarceration rate exceeds the white male rate by a factor of eight to one.[86] And the lifetime chances of a black male youth entering prison exceeds one-fourth.[87]

[79] It is remarkable that even this weak test leads to rejection, since most theories of consumption, whether maximizing or not, would suggest considerable correlation between the rate of return on stocks and the rate of growth of consumption. For example, such a correlation occurs if consumers have a consumption function which naively depends on their wealth, or, alternatively, if the same optimism that leads to high returns in the stock market also leads to consumption binges. Jonathan A. Parker (2001) suggests a possible resolution of the equity premium puzzle.

[80] See Romer (1993, p. 1112).

[81] See the literature on q theory, especially including Tobin (1969), Summers (1981), Andrew B. Abel (1982), and Fumio Hayashi (1982).

[82] See Stewart C. Myers (1974); Michael C. Jensen and William H. Meckling (1976). Owen Lamont (1995) shows how dual equilibria may occur because of such dependence.

[83] Hispanics have a similar but less extreme history of discrimination.

[84] See ⟨http://www.census.gov/Press-Release/www/2000/cb00-158.html⟩.

[85] In 1996 there were 530,140 black male prisoners and 213,100 black non-Hispanic and 80,900 Hispanic jail inmates of both sexes. There were 462,500 male and 55,800 female inhabitants of jails. Extrapolating the black Hispanic rate at 0.3 and the male/female rate for black as the same as white yields 211,814 black males in jail in 1996. The black male population was about $\frac{1}{2}(30 + 0.6 \times 4.7)$ million $= 32.282/2 = 16.141$ million. The net result is about 4.5 percent of the African-American male population in prison or jail. Source of incarceration rates: Correctional populations of the U.S. 1996, U.S. Department of Justice, Table 5.7, p. 82. Source: ⟨http://www.census.gov/statab/www/part1a.html⟩.

[86] See ⟨www.hrw.org/reports/2000/usa/Table3.pdf⟩.

[87] This is an estimate based on incarceration rates in 1993.

Because standard economic theory, in our view, is incapable of explaining such self-destructive behavior, Rachel E. Kranton and I have developed models, based upon sociological and psychological observation, to understand the persistence of African-American disadvantage (2000). Our theory stresses the role of identity and the decisions that individuals make about who they want to be. In our theory of minority poverty, dispossessed races and classes face a Hobbesian choice. One possibility is to choose an identity that adapts to the dominant culture. But such an identity is adopted with the knowledge that full acceptance by members of the dominant culture is unlikely. Such a choice is also likely to be psychologically costly to oneself since it involves being someone "different"; family and friends, who are also outside the dominant culture are likely also to have negative attitudes toward a maverick who has adopted it. Thus individuals are likely to feel that they can never fully "pass." A second possibility is to adopt the historically determined alternative identity, which, for many minorities, is an oppositional culture. Each identity is associated with prescriptions for ideal behavior. In the case of the oppositional identity, these prescriptions are commonly defined in terms of what the dominant culture is *not*. Since the prescriptions of the dominant culture endorse "self-fulfillment," those of the oppositional culture are self-destructive. The identity of the oppositional culture may be easier on the ego, but it is also likely to be economically and physically debilitating.

This identity-based theory of disadvantage is consistent with a considerable body of evidence. For example, it captures the central findings of studies by authors such as Franklin Frazier (1957), Kenneth Clark (1965), William E. B. Du Bois (1965), Ulf Hannerz (1969), Lee Rainwater (1970), William J. Wilson (1987, 1996), and Elijah Anderson (1990). Read any African-American biography: the uncomfortable dance between acceptance and rejection invariably takes center stage.

The identity theory of minority poverty has social policy implications that depart from those derived from standard neoclassical theory. For example, the standard economic theory of crime and punishment implicitly argues for combating crime by deterrence: raise the stakes high enough, as California did with its "three strikes and you're out" law, and the potential criminal will think twice. But the prisons are full and crime has not stopped. An identity-based theory suggests, in contrast, that large negative externalities from incarceration may offset the short-run gains from deterring criminal activity through tougher incarceration policies.[88] Prison itself is a school for countercultural identity, and thus the breeding ground for future crime. Moreover, externalities in identity formation argue for programs to allay crime before it has occurred. These include, for example, effective, easily accessed drug treatment and rehabilitation programs and public jobs for inner-city youth. Identity theory suggests that the benefits of increased expenditures for schools in African-American neighborhoods with high poverty rates are likely to be substantial: African-American children have been found to be particularly responsive to differences in teacher quality and class size.[89] It may take the extraordinary teacher and close personal attention to sort through student issues concerning identity in addition to covering the standard curriculum.[90] Finally, the externalities involved in identity formation argue for affirmative action, because it is a symbol of welcome for African-Americans into the white society that has rejected them for so long.[91]

VIII. Conclusion

It is now 30 years since the revolution which began in growth theory and then swept through microeconomics. The new microeconomics is standard in all graduate programs, half of a two-course sequence. Adoption of the new macroeconomics has been slower, but the revolution is coming here as well. If there is any subject in economics which should be behavioral, it is

[88] See Steven D. Levitt (1996).

[89] See Ronald F. Ferguson (1998) on the effect of teacher quality and Krueger and Diane M. Whitmore (1999) on the effect of class size.

[90] See Lisa Delpit (1995).

[91] Glenn C. Loury (1995) has suggested that affirmative action may also have the opposite effect: it may exacerbate blacks' sense of exclusion and make them feel that they are viewed as not belonging even when they do achieve.

macroeconomics. I have argued in this lecture that reciprocity, fairness, identity, money illusion, loss aversion, herding, and procrastination help explain the significant departures of real-world economies from the competitive, general-equilibrium model. The implication, to my mind, is that macroeconomics *must* be based on such behavioral considerations.

Keynes' *General Theory* was the greatest contribution to behavioral economics before the present era. Almost everywhere Keynes blamed market failures on psychological propensities (as in consumption) and irrationalities (as in stock market speculation). Immediately after its publication, the economics profession tamed Keynesian economics. They domesticated it as they translated it into the "smooth" mathematics of classical economics.[92] But economies, like lions, are wild and dangerous. Modern behavioral economics has rediscovered the wild side of macroeconomic behavior. Behavioral economists are becoming lion tamers. The task is as intellectually exciting as it is difficult.

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[92] See John R. Hicks (1937) and Patinkin (1956).

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