

**Animal Spirits or Complex Adaptive Dynamics?
A Review of
George Akerlof and Robert J. Schiller
Animal Spirits (Princeton, 2009)**

Herbert Gintis*

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1 Introduction

In his epoch-making *General Theory* (1936), John Maynard Keynes noted that concerning investment decisions, “most, probably, of our decisions to do something positive, the full consequences of which will be drawn out over many days to come, can only be taken as the result of animal spirits—a spontaneous urge to action rather than inaction, and not as the outcome of a weighted average of quantitative benefits multiplied by quantitative probabilities.” Because of the propensity of investors to base decisions on variables other than “market fundamentals,” the aggregate investment function of an economy will tend to be erratic. Indeed, even today, it is virtually impossible to predict aggregate investment successfully, although the other sources of aggregate demand and supply are relatively well understood. Keynesian economic policy suggested that government use anti-cyclical spending and taxation to counter the vicissitudes of aggregate investment. While countercyclical monetary policy might also have the same effect *via* the interest rate, Keynes’ theory of the “liquidity trap” suggested that investment is quite insensitive to the interest rate. Experience bears out Keynes on this point, at least for large shortfalls in aggregate demand. In an economic downturn, it is critical that the monetary authority ensure a high level of liquidity to avoid artificial curbs on the willingness of businesses to invest, but liquidity itself is not sufficient to restart profitable investment.

It is not hard to see that Keynesian analysis, if correct, applies to all sorts of shocks to the economy, not just fluctuations in investment. Indeed, such automatic

*Santa Fe Institute and Central European University.

stabilizers as progressive income taxation, unemployment compensation, and accelerated depreciation schedules can act as shock absorbers, smoothing out economic fluctuations. In the past, at least for normal-size fluctuations, active government intervention has been generally ineffective because it takes the government too long to get into action, and by the time it passes the appropriate legislation and the effects have reached producers and consumers, the economy has already come out the other end of the business cycle. Moreover, Keynesianism was compromised by the long stagflationary period of the 1970's: according to Keynesian theory, there is a trade-off between inflation and unemployment, whereas during this period there was both high unemployment and rampant inflation in the United States.

A whole new school of "rational expectations" emerged in the 1970's that held that markets always are in equilibrium, unemployment was always voluntary (because all workers had to do is accept lower wages), and active government intervention is part of the problem, not the solution Lucas (1981). While this brand of macroeconomic theorizing became dominant in the profession, it is important to understand that there is nothing in standard economic theory that proves that markets are always in equilibrium, or that they are necessarily efficient, or that regulation is unnecessary. It is true that a cabal of Chicago economists, thrust into the limelight by the electoral success of Ronald Regan, offered a far-fetched free-market ideology that had no solid theoretical support, and was rejected by most economists.

The subprime mortgage meltdown that began in 2007 and dominates the macroeconomy today shows to the general public that the Chicago crowd was wrong, but most economists knew that all along. The really stunning fact about the current macroeconomy is that disequilibrium in the home mortgage market could so seriously compromise the American financial system. Even those who foresaw the housing crisis did not predict so massive a credit collapse, one leading to levels of government intervention that would have been inconceivable even in the recent past. The basic contribution of Akerlof and Shiller's book is to show the importance not only of Keynesian animal spirits, but also other ways in which human decision-making affects the macroeconomy that violate the canons of neoclassical economic theory.

I think *Animal Spirits* is true to the spirit of John Maynard Keynes, if not the letter, in stressing that we cannot understand the macroeconomy without having a theory of how humans make decisions. The reader who is only interested in the current crisis and has read the *New York Times* or *Wall Street Journal* regularly, however, will not learn much from this book, since the current crisis is discussed in more than passing only in an Appendix to Chapter 7 and in Chapter 12. Rather than writing a complete contemporary analysis, the Akerlof and Shiller put to-

gether papers mostly from the 1990's, with up-to-date commentary. This strategy works well, at least for non-experts. Indeed, all readers can gain from Akerlof and Shiller's defense of behavioral macroeconomics.

2 Animal Spirits vs. Rational Expectations

The behavioral economists' idea that there is something quirky about human decision-making that explains macroeconomic dynamics lies in diametrical opposition to the hitherto dominant Chicago "rational expectations" school of macroeconomic theory, whose major critique of traditional Keynesianism was the latter's incompatibility with the rational actor model. The Keynesian notion that there is a stable marginal propensity to consume out of income, that investment is based on animal spirits, that prices are downwardly rigid because of money illusion, and that social convention prevents unemployed workers from driving down wages by competing with employed workers, were, according to the Chicago School, ill-founded assumptions incompatible with rational choice.

The school of behavioral macroeconomics to which Akerlof and Shiller belong was waiting in the wings for a chance to tell their (compelling) story, and the current crisis is just what they were waiting for. There is much data in support of Keynesian-like economic behavior, and the supposed superiority of "rational expectations" theory indeed rings hollow.

For instance Stein and Song (1998), based on the sample period 1955-1973, show that the consumption function exhibits a marginal propensity to consume of 0.86, while for the sample period 1974 to 1991, the marginal propensity to consume rises to close to unity. Of course, what matters more for policy purposes is how families react to tax rebates and other episodic changes in income. Here, the aggregate marginal propensity to consume appears to be an overstatement. Less than half the 2001 tax rebates, for instance, were spent, the remainder going into saving and debt reduction. The rebates of 2008 indicate a somewhat higher marginal propensity to consume. Indeed, between May and July of 2008, \$90 billion of stimulus payments were distributed to U.S. families. Broda and Parker (2008) found that families that received these payments increased consumption spending by 3.5%, and the overall effect on nondurable consumption in the second quarter of 2008 alone was 2.4%, and they estimate that this would rise to 4.1% in the third quarter of 2008. These facts do not support the "rational expectations" consumption function, according to which spending should not be affected at all, given rational life-cycle consumption planning. Rather, it indicates that counter-cyclical tax policy can be a potent stabilizing force, provided government can respond quickly to new economic conditions.

Behavioral game theory has also given us critical insights into human behavior, many of which mesh well with the Keynesian perspective. Daniel Ellsberg (1961) has shown that human decision-makers have a strong distaste for uncertainty, as opposed to riskiness, a propensity that might well explain the reluctance to invest when the future becomes uncertain (Segal 1987). Similarly, loss aversion (Kahneman et al. 1991, Tversky and Kahneman 1981, Genesove and Mayer 2001) may explain why some prices, such as residential houses, remain sticky downward and transactions decline instead of prices. Finally, we know a lot more about the psychological aspect of wages than in Keynes' time. Not only are wages affected by gift-exchange (Akerlof 1982, Fehr and Tougareva 1995, Fehr et al. 1998a, Fehr et al. 1998b, Charness and Haruvy 2002, Fehr and Schmidt 2006) and the desire to maintain labor discipline (Gintis 1976, Shapiro and Stiglitz 1984, Bowles 1985, Gintis and Ishikawa 1987, Bowles and Gintis 1993), but also are an employer's signal of satisfaction with work performance. For instance Loewenstein and Sichertman (1991) showed that in an experimental setting, workers prefer a rising wage schedule over time to either a flat or a declining wage schedule, despite the fact that for a given total amount of wages paid, the declining schedule has a higher present value. Moreover, in an especially thorough survey of employers, Bewley (2000) corroborated a deep reluctance of firms to cut wages in a recession, on the grounds of hurting worker morale.

3 Complexity and Regulation

Despite this corroborating evidence, however, the major thesis of the book is only partially correct in attributing macroeconomic instability to human foibles. The authors say in conclusion that "if we thought that people were totally rational, and that they acted almost entirely out of economic motives, we too would believe that government should play little role in the regulation of financial markets, and perhaps even in determining the level of aggregate demand." (p. 173). In fact, there is nothing in economic theory that says that rational individuals interacting on markets will produce either stable or socially efficient outcomes. The Walrasian general equilibrium model, which is the canonical framework for investigating macroeconomic behavior on a theoretical level, shows that in the absence of market externalities, there are market-clearing equilibria that are Pareto-efficient. However, as has been long understood, this model has absolutely no attractive dynamical properties.

In Walras' original description of general equilibrium (Walras 1954 [1874]), market clearing was effected by a central authority. This authority, which has come to be known as the "auctioneer," remains today because no one has suc-

ceeded in producing a plausible decentralized dynamic model of producers and consumers engaged in market interaction in which prices and quantities move towards market-clearing levels. Only under implausible assumptions can the continuous ‘auctioneer’ dynamic be shown to be stable (Fisher 1983), and in a discrete model, even these assumptions (gross substitutability, for instance) do not preclude instability and chaos in price movements (Saari 1985, Bala and Majumdar 1992). Moreover, contemporary analysis of excess demand functions suggests that restrictions on preferences are unlikely to entail the stability of tâtonnement (Sonnenschein 1972,1973; Debreu 1974; Kirman and Koch 1986).

It has been a half century since Debreu (1952) and Arrow and Debreu (1954) provided a satisfactory analysis of the equilibrium properties market economies, yet we know virtually nothing systematic about Walrasian dynamics. This suggests that we lack understanding of one or more fundamental properties of market exchange. There are thus slim grounds for Akerlof and Shiller to attribute macroeconomic fluctuations wholly to “animal spirits” that would not exist were economic actors “rational.”

An alternative perspective that deserves consideration is that the market economy is a complex nonlinear system (Blume and Durlauf 2005, Beinhocker 2006, Miller and Page 2007), which by its very nature is subject to volatility because the probability distributions underlying stochastic behavior have the “fat tails” characteristic of complex systems (Crutchfield et al. 1986, Saari 1995, Farmer and Lillo 2004). In effect, as Axel Leijonhufvud once remarked, neoclassical economic theory models “smart people in unbelievably simple situations,” while the real world is populated by “simple people [coping] with incredibly complex situations.” The complex adaptive economy is never in equilibrium, but is continually subjected to shocks, both exogenous and endogenous, that affect its short-term movements. There are frequent local nonlinear resonances that lead to significant deviations of economic variables (prices, quantities, wages, asset prices) from their equilibrium values even in the absence of strong aggregate or systematic perturbations to the system.

There have been notable contributions to the notion of economies as complex systems in recent years. These include Brian Arthur’s work on increasing returns (Arthur 1994), Peyton Young and Mary Burke’s analysis of crop sharing (Young and Burke 2001), evolutionary models inspired by Nelson and Winter (1982) and Hodgson (1998), William Brock and Stephen Durlauf’s study of social interaction (Brock and Durlauf 2001), Edward Glaeser, Bruce Sacerdote and Jose Scheinkman’s treatment of crime (Glaeser et al. 1996), Samuel Bowles’ treatment of institutional evolution (Bowles 2004), Robert Axtell’s study of firm size (Axtell 2001), Alan Kerman and his colleagues models of financial markets (Kirman et al. 2005), and models of the evolution of other-regarding preferences

(Gintis 2000, Bowles et al. 2003) and the agent-based simulation of general equilibrium and barter exchange

Inspired by this literature, and with the knowledge that a key means of understanding complex systems with emergent properties that cannot (yet) be analytically modeled, I turned to computer modeling, which can provide important insights. When I subjected the Walrasian general equilibrium model to an agent based simulation (Gintis 2007), I found that there is a robust tendency towards market clearing equilibrium, but this is always offset by highly volatile movements in prices, wages, capital demand, and other macroeconomic variables. This volatility is due to the inherent stochasticity of complex systems, not to the “animal spirits” of economic actors. For instance, Figure 1 illustrates the fluctuations in demand and supply in my agent-based simulation with no exogenous shocks.

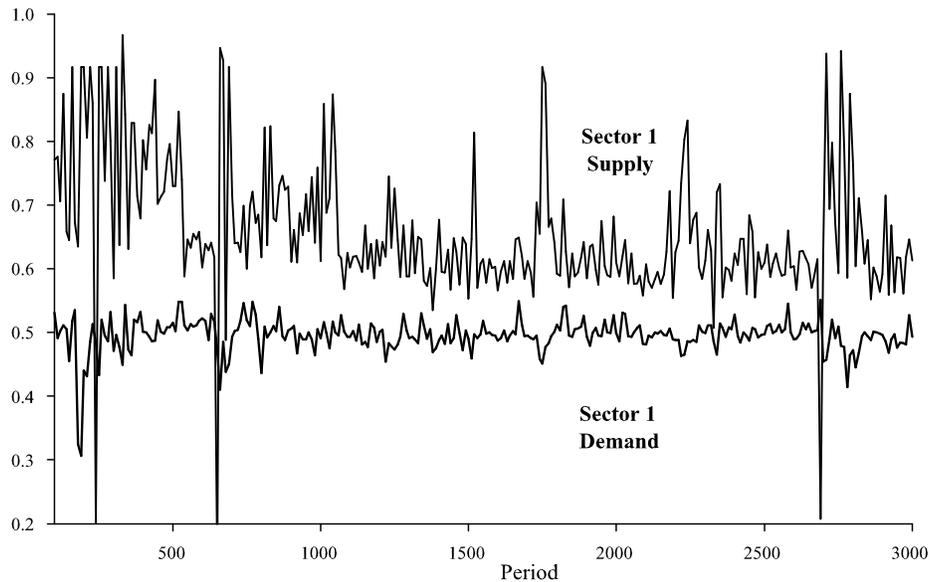


Figure 1: Demand and Supply in Sector 1 of a Multi-Sector Economy. Note that there is considerable period-to-period volatility. Excess supply averages about 8% of average supply.

This analysis suggests that when the simulated economy experiences a system-wide shock of moderate proportions, it should return to its long-run state after a certain number of periods, which we may call the *relaxation time* of the dynamical system. This is in fact the case. For instance, I simulated a four-sector economy with 2000 agents, and ran the economy for 3,000 periods. After each 500 periods, the firms in the economy were all subjected to a technological shock, taking the

form of the optimal firm sized k^* falling from 35 to 14. This shock persisted for 10 periods, after which the original value of k^* was reestablished. Figure 2 suggests that the economy recovers its high efficiency price structure after a few hundred rounds. Figure 2 shows that efficiency is severely compromised by the shocks, but is restored within two hundred rounds.

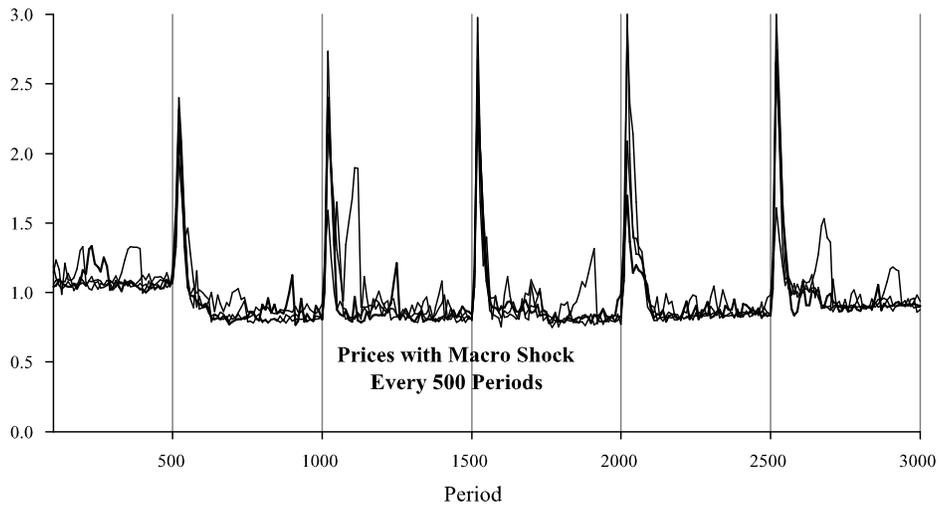


Figure 2: Relaxation Time in a Four Sector Economy Subject to Macro Shocks. Every 500 periods, the economy sustains a shock whereby each firm’s optimal size is reduced from 35 to 14. The shock lasts for 10 periods, after which the original optimal firm size is restored. Note that goods prices stabilize after a few hundred periods, and are approximately equal across all runs.

4 Conclusion

Akerlof and Shiller do not have enough evidence to assert confidently that people are driven by irrational animal spirits to produce market volatility. People imitate the successful, both in my agent-based model and in real life. This is generally quite rational behavior, but it can produce “behavioral cascades” that are destabilizing (Bikhchandani et al. 1992, Edgerton 1992). If someone is doing well and someone else is not, the latter copying the former is the rational thing to do. The fact that behavior this leads to economic volatility suggests the need for market regulation. As Keynes observed, the investment process is a sort of beauty contest in which the winner is not the one who picks the most beautiful, but rather is the one

who pick what others consider the most beautiful. This is not because people are irrational, but rather because the success of one's investment plans depend on others' investment decisions, and there is no objective measure of the interpenetrating beliefs of investors.

Consider, for instance, a recent experimental result of Nobel prize-winning economist Vernon Smith and colleagues (Hussam et al. 2008). The authors report that when they impose a large increase in liquidity and dividend uncertainty to shock the environment of experienced subjects who have converged to equilibrium, a financial bubble is rekindled. They suggest that in order for price bubbles to be extinguished, the environment in which the participants engage in exchange must be stationary and bounded. Experience alone is not robust to major new environment changes in determining the characteristics of a price bubble. Of course, there is no reason for the investment environment in real economies to be ergodic, since changing technology, social organization, and the configuration of international economic forces render economic dynamics a continual structural novelty.

Akerlof and Shiller have given us a useful book, especially for the non-expert, but it would be sad if the debate over the renovation of the American economy revolved around the quiriness of human decision-making, and ignored the inherent incapacity of an improperly regulated economy to produce socially desirable outcomes, however "rational" the economic agents.

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