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STRUGGLING TO ESCAPE FROM ASSUMPTION 14*

Benjamin M. Friedman**

At least four hypotheses, none mutually exclusive, have emerged to explain the origins of the financial crisis that began in the United States in 2007: (1) Managers of financial institutions, or their employees, may have engaged in criminal activity. (2) Principal/agent conflicts may have given the managers of financial institutions incentives to undertake activities that, though legal, nonetheless exposed their institutions and their shareholders to excessive risk that the shareholders would not have chosen. (3) The operation of government in a variety of ways – ranging from specific lender-of-last-resort actions and policies fostering homebuilding and home ownership to matters as general as limited liability – may have given both managers and shareholders incentives to put their institutions, and ultimately the taxpayers and the economy, at excessive risk. (4) Participants in the relevant financial markets, especially including mortgage borrowers, originators, securitizers and investors, may not have understood the risks inherent in the positions they and their institutions were taking. Any or all of these influences may have

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**William Joseph Maier Professor of Political Economy, Harvard University. Address: Department of Economics, Harvard University, Littauer Center 127, Cambridge, MA 02138.

been at work in creating the worst financial crisis since the depression of the 1930s, and the work needed to sort out the relative importance of each will no doubt occupy economists and other empirical researchers for some time to come.

Hypothesis (4), however – that key market participants failed to understand the relevant risks – lies outside the bounds of today’s conventionally accepted modes of economic analysis. The very first of the seminal papers under retrospective review at this conference, for example, the 1993 classic by Franklin Allen and Gary Gorton, specifies a lengthy series of assumptions underlying the authors’ analysis. The crucial one for this purpose is Assumption 14: “All agents know the structure of the model and the distributions of the random variables, but do not observe the particular realizations of random variables.”¹ The notion that some realizations are unobserved is hardly restrictive. By contrast, the assumption that all agents (act as if they) know the processes that govern those realizations, including the structural relations among them as well as the distributions of the underlying random influences – in other words, the standard “rational expectations” assumption that has governed most economic analysis for the past four decades – is the heart of the matter.

Although economists have long been aware of evidence, in part from psychology and other fields, that contradicts the standard full-rationality assumption (hence the burgeoning field of “behavioral finance”),² the convention nonetheless has been to maintain the assumption that whatever departures exist do not matter for macroeconomic outcomes. But the recent financial crisis clearly had macroeconomic consequences. In the United States the subsequent downturn in real economic activity was the steepest since the 1930s. The loss of wealth, in the value of both houses and equity claims to the stock of corporate capital, also set a post World War II record.

The real dislocations in many markets, beginning with but not limited to residential construction, remain readily apparent. If expectations by market participants that violated Allen and Gorton's Assumption 14 were a significant factor underlying the crisis, they certainly did have macroeconomic implications. The further implication that follows is that attempting to analyze the crisis while maintaining this assumption – or, perhaps more important, assessing potential new policy measures and regimes while doing so – is a highly limited endeavor and may ultimately prove fruitless.

Although it is too soon to evaluate the evidence systematically, by now there has been a steady accumulation of indications that during the run-up to the crisis many key market participants, including not just individuals of modest wealth but highly paid professionals working at major financial institutions, indeed did not understand the risks they were facing. At the broadest level, the evaluations that the major credit rating agencies applied to securities backed by home mortgages, especially subprime mortgages and especially those issued in 2006 and 2007, were strikingly at variance with the subsequent default experience of the underlying loans.³ Many forms of derivative contracts priced against these and similar securities also appear, in retrospect, to have been widely mis-priced. At a more technical level, recent research has shown that the “copula” models many firms used to price these and other related securities had serious analytical flaws.⁴ To be clear, the question at issue is not what was, or should have been, the market's best estimate of any given future outcome; it is the assessment, and hence the pricing, of the *risk* associated with those outcomes.

Accumulating anecdotal evidence further drives home that it was often the largest firms – the ones whose managers and employees should be most likely to think and behave as the

standard rationality assumption indicates – that made the biggest mistakes. The losses on derivatives contracts incurred by insurance giant AIG, which in September 2008 forced U.S. taxpayers to put \$182 billion into rescuing the firm, represent one well known example. Another is Merrill Lynch, which in December 2007 sold off its portfolio of mortgage-backed securities at a loss of \$18 billion. In September 2008 the firm was taken over by Bank of America, which was apparently acting under pressure from the U.S. Treasury Department. Merrill’s internal estimate of the value at risk on this portfolio was \$92 *million* – smaller by more than two orders of magnitude.⁵

Other large, well known firms made similar errors, often with similar resulting need for rescue. Royal Bank of Scotland, which the British government took over in October 2008, incurred losses of \$15 billion on its portfolio; the firm’s internally estimated VaR was \$22 million – nearly three orders of magnitude smaller. Zurich-based UBS, which the Swiss government had to rescue that same month by setting up a classic “bad bank” called the StabFund, lost \$38 billion; the VaR that UBS had estimated was \$636 million.⁶ U.S. investment bank Morgan Stanley, which survived intact (albeit with substantial loan support from the Federal Reserve System after the firm hurriedly converted itself to bank form), lost \$14 billion on its portfolio; its estimated VaR was \$83 million.

Was the decline in house prices and the consequent sequence of events that precipitated the crisis simply an extraordinary event that could not, and therefore should not, have been factored into the risk structure market participants saw themselves facing? To repeat, the issue here is not what market participants should have *expected*, but what *risk* they should have attached to their expectations. Perhaps what happened in the U.S. mortgage market was the

proverbial “six-sigma,” or even “ten-sigma,” event. No one goes out of his or her way to avoid being struck by lightning on a clear day, or being crushed by an unseen piano falling to the sidewalk from an upper-story window.

But the history of financial crises that have occurred just within recent decades has thrown up too many supposed six- (or ten-) sigma events to be credible. Many people made the same claim when Long Term Capital Management had to be rescued in 1998, in the midst of the “Asian financial crisis” and the turmoil surrounding Russia’s debt obligations. Before that the same notion emerged after a series of problems involving real estate and leveraged buy-out transactions impaired many of the country’s banks in the late 1980s and early 1990s, and before that in the “Latin American debt crisis” of the early 1980s. When six-sigma events occur with this frequency, they are not six-sigma events.

One of the most senior officials at Citigroup, which was involved in each of these episodes, has publicly expressed a similar view. In the early stages of the most recent crisis, Citi took losses totaling \$55 billion, more than any other bank. It was also centrally involved, with losses that at times became institution-threatening, in each of the prior crises. Looking back over this decades-long series of mishaps, and referring not just to Citi but to other banks as well, William Rhodes, the chairman of Citibank and senior vice chairman of Citigroup at the time of the most recent crisis, subsequently referred to “flawed analyses” and wrote, “Clearly, time and time again, economic and market trends were not accurately assessed.” Referring more specifically to Citi’s real estate losses in the early 1990s, Rhodes quoted the bank’s then-CEO John Reed as saying “we did not understand the risks in the financial environment or the work that Citibank was undertaking within it.”⁷

At a more formal level, we also have both evidence and models for the kind of systematic error that many of these episodes, including the most recent crisis, appear to represent. Another of the seminal contributions under review at this conference, Jose Sheinkman and Wei Xiong's 1993 paper, today looks prescient in exactly this regard. Sheinkman and Xiong based their analysis on "heterogeneous beliefs generated by agents' overconfidence." And they referred in turn to Michael Harrison and David Kreps's earlier (1978) insight that "when agents agree to disagree and short selling is not possible, asset prices may exceed their fundamental value."⁸ (One could readily extend the result to cases in which short selling is merely restricted, or expensive.) As they acknowledged, today there is ample evidence, again much of it from the psychology and behavioral literatures, of systematic overconfidence in a wide variety of settings.

Why, then, has the economics profession – especially the profession's macroeconomics wing – been so reluctant to abandon Assumption 14? I believe two forces are at work.

First, abandoning or even seriously weakening the full-rationality assumption would be deeply subversive of the all-important role of markets in allocating scarce resources, including, most importantly for purposes of this conference, the role of the financial markets in allocating capital investment. As is often the case, most of the attention in the wake of the recent crisis has focused on the financial losses that investors, banks, and other institutions took on the assets they held that declined in value. But the essential role of the financial markets in a capitalist economy is to allocate the economy's scarce investment capital. (The financial markets serve other functions as well, such as operating the payments mechanism and providing liquidity and various forms of insurance; but in notable contrast to the allocation of capital, there are well established public utility models for each of these.) Mispricing of assets and subsequent losses to their

holders matter in themselves, but they are also – and more fundamentally – the financial reflection of an underlying misallocation of real resources.

In the most recent crisis, for example, the greatest amount of discussion has focused on the losses investors incurred on their holdings of mortgages, mortgage-backed securities and related derivative instruments. But the fact that the mortgages were overpriced means that the corresponding interest rate was too low, with the result that Americans built and bought far too many houses – millions of which are now empty or unpaid for, or financed with unserviced debt and facing potential foreclosure. Similarly, in the aftermath of the “dot.com” bubble of the late 1990s, most of the attention focused on the losses investors incurred on their positions in telecom stocks. But the fact that the stock prices were too high meant that the cost of capital to the firms issuing them was too low, with the result that firms in the industry laid hundreds of millions of mile of fiber-optic cable that have never been lit and probably never will be.

Second, abandoning the full-rationality assumption poses a major analytical challenge. A familiar maxim holds that you can’t beat something with nothing. The full-rationality assumption provides a way of disciplining analysis in which forward-looking behavior is of the essence – as is inevitably the case when the economic setting of interest encompasses speculative securities markets. For all the debate over “rational” expectations since the introduction of this methodology into macroeconomics nearly four decades ago, and even despite substantial research into models of “limited” (or “bounded”) rationality, there is today no readily evident alternative to provide a comparable discipline on such lines of research.

Here again, the literature following from one of the seminal papers under review in this conference serves as an example. Implicit in Ben Bernanke and Mark Gertler’s 1989 paper

(although they did not emphasize the point in just this way) was the idea that a decline in the net worth of *either* banks *or* their borrowers would diminish banks' willingness to lend, all else equal, and hence would trigger both a decline in lending volume and an increase in lending rates, and via both of those mechanisms would depress real economic activity. (The effect stemming from a decline in borrowers' net worth reflects the role of collateral in loan arrangements.) The idea is important for purposes of this conference's inquiry in that it provides a way of understanding the positive feedback running from rising/declining asset prices to rising/declining economic activity and net worth, and on to further rising/declining asset prices. Much work since then – for example, the pair of now-classic 1997 papers by Bengt Holmstrom and Jean Tirole and by Nobuhiro Kiyotaki and John Moore – has fleshed out the micro-foundations of this mechanism. More recent work – for example, the 2011 paper by Mark Gertler and Peter Karadi, and the 2010 paper by Andrea Gerali and co-authors on the Euro-area – has brought this line of analysis to bear more directly on pertinent issues of monetary policy, including policy in a crisis like the recent one.

But all of this analysis – the original idea from Bernanke and Gertler, the subsequent micro-foundations, and the more recent applications to monetary policy in the crisis – rests on the full-rationality assumption. To the extent that market participants' failure to understand the risks they were incurring, either personally or on behalf of the financial institutions for which they worked, was central to what happened in the crisis, therefore, this entire line of research, and others like it too, are unlikely to get at the essence of the matter. They are, in effect, handcuffed by Assumption 14.

Macroeconomics sorely needs a disciplined alternative to the full-rationality assumption,

and when one emerges it will represent a fundamental revolution in economic methodology comparable to the rational expectations revolution of four decades ago. As was the case then, economists will look back at the years of accumulating evidence and wonder that the full-rationality assumption ever held sway – just as people four decades ago remarked that the pre-rational expectations literature seemed to imply that policymakers could “fool all the people all the time,” or that economic agents regularly “left \$50 bills lying on the sidewalk.” But the profession is not there yet.

What kind of progress, then, can we make while we wait for this analytical lacuna to be remedied? Several new directions, at both the positive and the normative levels, seem possible despite this overarching impediment to more fundamental progress.

To begin, it is important to recognize that while price stability (a low mean and small variance for whatever measure of an economy’s inflation is taken to be most relevant) is an important policy objective in itself, it is not sufficient to guarantee favorable, or even acceptable, macroeconomic outcomes more generally. As James Tobin often said, there are worse things than three percent inflation. The American economy has just experienced some of them.

Second, in the wake of the worst financial crisis since the 1930s – involving the collapse of major financial firms, large-scale declines in asset values and the consequent destruction of citizens’ wealth, the interruption of credit flows, the loss of confidence both in firms and in credit market instruments, the widespread fear of default by counter-parties, and ultimately the need for extraordinary (in both scale and scope) intervention by central banks and other governmental institutions – it is also important to acknowledge that “market discipline” enforced by creditors is not sufficient to prevent financial institutions from taking actions that, collectively, prove

publicly harmful. There is therefore a need for regulation and/or supervision of financial institutions to prevent what amounts to a straightforward externality. Indeed, the importance of just this externality and the consequent need for regulatory measures to contain it have a distinguished pedigree in economics. Adam Smith, writing the *Wealth of Nations* in the aftermath of Scotland's worst banking crisis in two generations, favored not only restrictions on how banks could fund themselves but also limits on the interest rates they could charge on loans. Smith explained that he favored these measures for the same reasons he favored laws requiring firewalls between houses in Edinburgh.

The experience of the crisis and the subsequent downturn in real economic activity made clear the limited capacity of monetary policy, even including the "unconventional" measures that many central banks have taken in this episode, to correct such a situation once it is in progress and especially once short-term interest rates have reached the zero lower bound. Further, a growing body of research casts doubt on the usefulness of potential rules that would relate the central bank's interest rate setting to levels of asset prices with an eye toward arresting the crisis while it is still developing. The resulting danger for economic thinking is analogous to what led macroeconomics to focus on "real" business cycle theories. The logic there was that (a) everyone knows that monetary shocks are the only demand shocks worth considering, but (b) the evidence increasingly indicated that fluctuations in the money stock, however measured, are not systematically related to fluctuations in economic activity, and therefore (c) demand shocks as a category must be irrelevant for economic fluctuations. Today an all-too-familiar presumption in macroeconomics is that monetary policy is the only policy worth considering; if monetary policy

cannot do much about asset price bubbles and their consequences, the analogous logic would imply, then no policy is worth considering. Smith knew better. So should we.

What policy measures do we then require? With the 2010 Dodd-Frank legislation now behind us, the most pressing need is to move forward with stricter capital requirements on leveraged financial institutions, especially including those that, on account of size or “interconnectedness” or both, pose potential systemic risks. Importantly, however, effective reform of capital requirements is not merely a matter of specifying higher stated capital ratios or even more finely tuned capital ratios pegged to the riskiness of the assets on an institution’s balance sheet. Two more elements are needed. One is accounting reform. As the experience of some of the largest U.S. institutions in the crisis revealed, often what matters for capital adequacy is not the numerical ratio but the quantity to which it applies. Assets hidden off the balance sheet are, in effect, subject to zero capital requirement regardless of the stated required ratio.

The other missing element is clearly specified resolution procedures. The Dodd-Frank legislation usefully expanded the government’s resolution *authority* to include endangered financial institutions other than banks (for example, bank holding companies, broker/dealers and insurance companies), but it did not lay out what procedures the relevant agencies would use, within that authority, if such an institution becomes undercapitalized. In general, requirements are effective only if some consequence follows on the failure to meet them. Capital requirements are no different. It is precisely the awareness of the consequences of failing to do so that should keep institutions in compliance.

As the crisis has also made clear, however, there is also a deeper principle of *political economy* at work. In a democracy like America's, if the voters elect to public office individuals who do not believe in regulation, and those office holders appoint people of like mind to head the principal agencies that constitute the nation's regulatory apparatus, then there will not be effective regulation regardless of the prevailing statutes and rules. The public may or may not get the regulation it deserves, but it does get the regulation it chooses.

Finally, in the wake of the recent crisis it is also worth asking a yet more fundamental question that is also implicit in the entire subject of asset price "bubbles," and that is likewise intimately connected to the implications of the full-rationality assumption in economics: Is our financial system serving us well, as judged by both the way it does its job and what it costs us to do that?⁹

As much recent literature has emphasized, especially in the United States the financial system has always been large and in recent years it has gotten substantially larger. To recall, the essential function of the financial system in a capitalist economy is to allocate scarce investment capital. Seen in this perspective, the U.S. economy's mechanism for allocating its capital has been getting more expensive not just absolutely but compared to the total returns earned on the capital being allocated. From the 1950s through the 1980s, profits earned by financial firms (not counting insurance companies and firms in the real estate business) represented 10 percent of all profits earned in the U.S. economy. In the 1990s financial firms' share of total profits rose to 22 percent. And in the first half of the last decade – that is, until just before the crisis – these firms' share of all U.S. profits reached 34 percent.¹⁰

Further, this significant share of the profits earned by U.S. business is far from the total cost of running the economy's financial system. That cost also includes the salaries financial firms pay to their work force and the rents they pay for their office space (including the rental equivalent for firms that own their own buildings), as well as more mundane elements like all the associated utility bills, travel tickets and advertising budgets. Like its share of economywide profits earned, the finance industry's share of all U.S. wages and salaries paid has also been rising in recent decades. Fifty years ago it was 3 percent; more recently it has been 7 percent.¹¹ The standard argument is that these high salaries (including the eight-figure bonuses for those at the top) are necessary to attract the talent that enables these firms to do their job. If this is true, it means that the economy's capital allocation mechanism is inherently all the more expensive to operate. The same principle applies to the financial sector's other expenses. It may be true that without lavishly furnished offices in choice locations, or lots of prime-time television advertising, the capital allocation mechanism would not be able to serve its function. But if so, this means that the necessary cost of running it is all the greater.

And, here as elsewhere, the basic principle of a market economy holds: expenses paid are the counterpart of resources used. At my university, for example, more than one-fourth of the graduates in recent classes have gone to work at investment banks, hedge funds, private equity firms and the like. These talented and energetic young people could be doing something else. If they are not really needed in the financial firms that employ so many of them – if what they do there actually adds little or no economic value – then something is seriously wrong with yet another market that allocates our economy's resources (in particular, the labor market). But if

the financial sector *is* the best place to use their talents and energies, that need is yet another part of what makes our economy's capital allocation mechanism so expensive to run.

At the same time that the financial sector has been growing ever more expensive to operate – absorbing a larger fraction of the economy's total profits, claiming a larger share of the most talented workers, and so on – the economy's performance has been disappointing. Wholly apart from the recent housing bubble and all of the economic costs associated with its demise (costs which must be subtracted from the economic benefits the financial sector delivers), there is less about which to cheer in the aggregate gains accruing to capital investment either. How much of the disappointing performance of U.S. productivity growth in recent experience is due to poor allocation of capital? The truth is that no one knows.

An important task for the economic profession, therefore, is to gain some well-grounded quantitative understanding both of how good a job the financial sector is doing at allocating our economy's investment capital and of what it is costing on an all-in basis. Neither is the focus of today's conference – at least not directly – but any measure of the overall cost must include the risk of the occasional melt-downs to which asset price bubbles expose us. And the answers we find may turn out to bear on how much longer we will be willing to continue to constrain our analysis within the confines of Assumption 14.

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Notes

1. Allen and Gorton (1993), p. 817.
2. See, for example, Thaler (1993, 2005).
3. See, for example, Foote et al. (2008) and Gerardi et al. (forthcoming).
4. See Jarrow et al. (2008) and Jarrow and van Deventer (2008).
5. Here and below, figures on losses incurred and firms' internal estimates of value at risk are from *The Economist*, "Hall of Shame," August 7, 2008, and van Deventer (2011), in both cases taken from the respective firms' annual reports and other filings.
6. See Zimmermann and Szelyes (2011) and the 2009 and 2010 *Accountability Reports* of the Swiss National Bank (2009 report, section 6.5; 2010 report, section 6.7). The amount that the SNB transferred to the StabFund was \$40 billion.
7. Rhodes (2011), pp. xxviii, 31.
8. Sheinkman and Xiong (1993), p. 1184.
9. See Friedman (2010) for a fuller development of this line of argument.
10. Data are from the U.S. Department of Commerce.
11. See Philippon and Reshef (2007).