

An Agenda for Reforming Economic Theory¹

Joseph E. Stiglitz²

Economics is in a sorry state of affairs. Most of the economics profession failed to predict the most important economic event to occur in the history of modern “scientific” economics. If economics is a science, it is presumably to be judged by its ability to predict. It has, by and large, failed that test. The fact that it can do a good job in predicting, say, economic growth when everything is “normal”—when output this year is likely to be somewhere between 2.5% to 3% greater than it was last year—is little comfort. When it counted most, it failed miserably.

Worse still, the standard paradigm gave rise to a set of policy prescriptions that also have failed miserably. For instance, the standard paradigm led monetary theory to be guided by six precepts, all of which are questionable:

1. *Price stability is necessary and almost sufficient for economic stability.* This view underlay the focus on price stability by monetary authorities.^{3,4} We now know (and we should have known then) that monetary authorities, in focusing on the economic distortions arising from the fact that with inflation, relative prices may be “out of equilibrium,” were focusing on something that was a “fourth order effect” relative to those that were consequent to financial instability. The good news is that there has already been substantial change in some quarters, with monetary authorities beginning to recognize the importance of financial fragility. Yet standard macro-models really have no financial sector. One cannot summarize the financial sector in a “money demand equation.” One has to have both a banking sector⁵ and a non-banking (shadow banking) sector.
2. *There is no such thing as a bubble,* implying of course that monetary authorities do not have to worry about bubbles. Bubbles, in this view, were inconsistent with

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² University Professor, Columbia University and Chair of the Committee of Global Thought; co-president of the Initiative for Policy Dialogue; Chair of Brooks World Poverty Institute, Manchester; and Chief Economist of the Roosevelt Institute.

³ It does not provide a full justification of inflation targeting, which entails a “theory” of adjustment and shocks, as well as normative models for evaluating alternative adjustment processes. While much of the work in support of inflation targeting has focused on the impact on the credibility of monetary authorities in simplistic monetary models, inflation targeting cannot be justified within more general theories. This itself is an important area for research.

⁴ Discontent with inflation targeting models had been growing before the crisis, especially in developing and open economies, some of which saw three quarters or more of inflation arising out of prices of imported goods that would only be affected by monetary policy through impacts on exchange rates.

⁵ There is some work in this area. See, e.g. Bruce Greenwald and Joseph E. Stiglitz, *Towards a New Paradigm in Monetary Economics*, Cambridge University Press, 2003.

- “rational markets.” This view ignores the long history of bubbles⁶; but it even ignored modern theory, which showed that one can have bubbles even with rational expectations.⁷
3. *Even if there were a bubble, one can’t tell until after it breaks.* Of course, one can’t be sure that there is a bubble until after it breaks, but all policy is made under uncertainty—and one could (should) have been pretty sure that there was a bubble, as housing prices soared relative to incomes. This poses a key future research question: optimal design of policy in the presence of uncertainty.
 4. *Even if the Fed realized that there was a bubble, it didn’t have the tools to deal with the problem.* It was repeatedly said, “The interest rate is a blunt instrument,” suggesting that this key weapon should focus on maintaining (CPI—not asset) price stability. But the Fed had tied its own hands. It had many other tools. For instance, in the housing market it could control the loan to value or loan to income ratios. Even if these instruments didn’t prevent the bubble entirely, they would have prevented the bubble from growing as big as it did.
 5. *Even if the Fed had the tools, it shouldn’t use them.* The Fed shouldn’t intervene in the market. But setting interest rates is a massive intervention.⁸ The theory of optimal intervention does not say that there should only be “one” intervention.⁹ The conclusion was that, because ex ante intervention was costly:
 6. *It was better to “clean up” after the bubble breaks than to interfere in the market before.* This was, of course, predicated on the belief that markets, by themselves, are by and large efficient, and therefore, if there were a bubble, it and its consequences would be minor. It was a policy conclusion not based on any general theory or empirical evidence. Few believe that today. But remarkably, it was not unlike the policies that had been advocated by the IMF and US Treasury for years for the developing countries: even if unfettered markets lead to crises, and even if financial market liberalization and integration lead to an increase probability of crisis through contagion¹⁰, it is better to clean up the mess afterwards than to deal with the externalities ex ante.

Economists and their models provided support to these flawed precepts, which guided central bankers around the world for a quarter century.

Fortunately, while the prevailing paradigm may have provided misguided advice, over the past quarter of a century (and more) a variety of models and tools have been developed that hold out the prospect for theories which provide better guidance for reforms in the financial (and non-financial) sectors.

⁶ See, e.g. Charles P. Kindleberger, *Manias, Panics, and Crashes: A History of Financial Crises*, Basic Books, 1978.

⁷ Dilip Abreu and Markus K. Brunnermeier, “Bubbles and Crashes,” *Econometrica*, 71(1), January 2003, pp. 173–204.

⁸ This is an example of the kind of intellectual incoherence that has marked much of the “conventional wisdom.”

⁹ Frank P. Ramsey, “A Contribution to the Theory of Taxation”. *Economic Journal*, 37, 1927, pp. 47–61.

¹⁰ This is another example of the intellectual incoherence of much of the prevailing policy discourse: while contagion—an externality—justified the massive bail-outs, the presence of these key externalities did not lead to prescriptions ex ante for reducing their impact.

Some Methodological Observations

The standard models have failed. Many of the underlying assumptions always seemed implausible; yet the prevailing methodology was dominated by “as if” modeling. True, most individuals may not be able to solve complex intertemporal optimization problems of the kind that they are assumed to solve in the standard model, but they behave *as if* they do, which is all that counts. Yet, *all* of the predictions of the model need to be tested. And many of the predictions of the model—such as those concerning the micro-economic behavior of the constituents (firms and households) are inconsistent with the empirical evidence.

Micro-foundations for macro-economics. The standard paradigm takes as its methodological foundation that macro-economic behavior has to be derivable from underlying micro-economic foundations. That proposition *seems* on the face of it uncontroversial. Yet, in carrying out that research agenda, further assumptions were imposed—entailing assuming *particular* micro-economic foundations (competitive equilibrium, rational expectations, etc.) and the “representative agent model”—and it is here that most of the problems arise.

As economists attempted to reconcile macro- and micro-analyses, two tacks were taken.¹¹ One was to take the standard competitive model and derive from it macro-properties. The new classical and real business cycle models (and their descendants) took that course. The other was to re-examine the standard micro-foundations (e.g. perfect information assumptions) and to use those to derive macro-models more consistent with the way the macro-economy actually seemed to behave. Hopefully, the crisis will provide more impetus to the latter approach and show the weaknesses of the former.

Outside the standard paradigm’s devotees, it was widely viewed that the paradigm always claimed more “virtue” than it deserved. For instance, in the absence of the “representative agent” assumption (all individuals are identical) virtually any aggregate function can be consistent with the standard competitive model.¹²

The failings of the RA model. The representative agent model means that the aggregate behavior and individual behavior are basically the same. But high-level (macroeconomic) systems may possess new and different properties than the low-level (microeconomic) systems on which they are based (much as water has different properties from the atoms of hydrogen and oxygen that constitute it). These arise from interactions, but the representative agent, by assumption, precludes interactions.

Assessing critical assumptions. In developing a critique of the standard paradigm—and in thinking about what alternative theoretical formulations are most promising—one of

¹¹ See Greenwald and Stiglitz, “Externalities in Economies with Imperfect Information and Incomplete Markets,” *The Quarterly Journal of Economics*, 101(2), May 1986, pp. 229-64.

¹² See Hugo Sonnenschein, “Market Excess Demand Functions,” *Econometrica*, 40(3), May 1972, pp. 549-63; Rolf R. Mantel, “On the Characterization of Aggregate Excess Demand,” *Journal of Economic Theory*, 7, 1974, pp. 348-53; and Gerard Debreu, “Excess Demand Functions,” *Journal of Mathematical Economics*, 1, 1974, pp. 15-21.

the difficult tasks is ascertaining which of the many assumptions are the most critical—most responsible for its unsatisfactory results. Is it the “representative agent” assumption, the assumptions about competition, about rational expectations, or those related to ignoring distinctions between risk and uncertainty?

Many of the failures of the model I believe derive from the representative agent assumption, partially because that assumption precludes an analysis of many of the key issues for policy. With a single individual, there can be no (a) information asymmetries (unless the individual suffers from acute schizophrenia, inconsistent in spirit at least with the hypothesis of rationality); (b) meaningful financial markets (with only one individual, there is no one to lend to and no one to borrow from); or (c) externalities (with no one else in the economy, there is no one to be injured by my actions). There are no problems of “control,” of how to resolve differences in views about what, for instance, the firm should do. There is no possibility of predatory behavior—the individual can only prey on himself. In short, many of the key problems posed by the crisis simply cannot be addressed within the representative agent model. It is not that it makes the wrong assumptions about behavior; the behaviors under examination are precluded by assumptions.

Later, I will have more to say about which of the other assumptions in the standard paradigm are critical. For now, I want to note a few other difficult methodological problems.

Deep market irrationality. The first is that there are several aspects of the behavior of the economy that seem so patently inconsistent with any model of rationality that attempting to construct a model predicated on rationality that explains such behavior is almost doomed from the start. I pointed out one example almost 40 years ago—the dividend paradox¹³: there were ways of distributing funds from the corporate sector to the household sector that entailed the payment of fewer taxes. Since then, there have been innumerable attempts to explain the paradox, none of which I find convincing. Most telling, as the appreciation of the point has grown, a smaller fraction of funds distributed from the corporate sector to the household sector have been in the form of dividends. The market seems to have “learned.” But the process has been slow and the learning incomplete.

The Modigliani-Miller theorem explained why leverage doesn’t matter.¹⁴ Taxes provide a little wrinkle, but these cannot explain observed patterns of corporate finance.¹⁵ More

¹³ See J.E. Stiglitz, “Taxation, Corporate Financial Policy, and the Cost of Capital,” *Journal of Public Economics*, 2(1), 1973, pp. 1-34, February. For a discussion of other tax paradoxes—and other aspects of firm behavior that are hard to reconcile with the standard models, see J. E. Stiglitz, “Ownership, Control and Efficient Markets: Some Paradoxes in the Theory of Capital Markets,” in *Economic Regulation: Essays in Honor of James R. Nelson*, Kenneth D. Boyer and William G. Shepherd (eds.), Michigan State University Press, 1982, pp. 311-341.

¹⁴ Franco Modigliani and Merton Miller, “The Cost of Capital, Corporation Finance and the Theory of Investment,” *American Economic Review*, 48(3), 1958, pp. 261–297. For a general equilibrium version, see J. E. Stiglitz, “On the Irrelevance of Corporate Financial Policy,” *American Economic Review*, 64(6), December 1974, pp. 851-866.

important are the costs of bankruptcy.¹⁶ Once bankruptcy costs are taken into account, firms would/should limit their leverage so as to limit the risk of bankruptcy. Yet in looking at the behavior of firms (and especially financial firms) *who are supposed to understand risk*, there seems to be no understanding of the Modigliani-Miller theorem. They pushed for more leverage because that gave a higher return on equity. But risk was simply being created elsewhere, and as the risk of bankruptcy increased, the value of the firm was (or should have been) decreasing. Market participants should have realized this. Interest rates paid on debt should have increased. (One way of partially reconciling these observations with rational markets is that the value of the subsidy from the government was increasing. But while this may provide part of the explanation, I think it unlikely to provide all of the explanation. Neither those running these financial institutions, their regulators, nor their investors really grasped the import of the Modigliani-Miller theorem. For regulators, the implications are clear: from a general equilibrium point of view, there are *no* gains and ample costs for allowing the banks to have high leverage.)

The so-called incentive compensation schemes provide a third example: it is easy to write down a model of an optimal incentive structure, incorporating information about performance of the firm and other firms in the industry. Few of the observed compensation schemes are consistent with these theories predict. Even earlier, in much simpler contexts, it was noted that while many incentive schemes are linear, the only utility functions for which that will be the case have other properties that make them implausible.

In short, I think it is likely to be a fruitless effort to reconcile or explain these and many other observed aspects of the economy within a model of full rationality.

Modeling irrationality. Secondly, there is a fundamental difficulty in formulating fully articulated models of “irrationality” and instability: if we can easily describe the “irrationality,” market participants should be able to do so. Someone could then presumably exploit the irrationality for profit, and the irrationality could not persist.

Similarly, if there were a “regular” or “predictable” instability, regulators should/could presumably take actions to offset it. The latter was part of the critique of standard business cycle literature; with cycles of regular periodicity, presumably both firms and government would take offsetting stabilizing actions. In short, the models did not seem fully coherent.

This leads one naturally (if one wants to limit oneself to models with high degrees of rationality) to think about models in which there is uncertainty about the model itself,

¹⁵ Information (signaling and self-selection) can also affect the choice of corporate financial policy, but in the cases under discussion here, these do not seem to have played an important role. See J.E. Stiglitz, “Taxation, Corporate Financial Policy, and the Cost of Capital,” *Journal of Public Economics*, 2(1), February 1973, pp. 1-34; and Stiglitz, “The Corporation Tax,” *Journal of Public Economics*, 5(3-4), 1976, pp. 303-311.

¹⁶ J.E. Stiglitz, “A Re-Examination of the Modigliani-Miller Theorem,” *American Economic Review*, 59(5), December 1969, pp. 784-93.

about the adequacy of its description of the world, or in which there is always a residue of fundamental uncertainty: perhaps the world has changed in a way in which this is not a bubble. (Alternatively, different individuals may have different information and therefore different beliefs about when the bubble will break.)

Ideologies: the social construction of beliefs. But, again, this may be pushing the notion of rationality too far and putting too little emphasis on the “sociology of beliefs,” on how people form their beliefs. It is not just their observations; belief systems are a social construct and arise in part from interactions.¹⁷ I described earlier in the paper a belief system that affected monetary policy; but it also affected market participants. Part of a research program attempting to provide the basis of a better regulatory system has to be directed at increasing our understanding of the evolution of beliefs and the impact of belief systems on behavior and economic equilibrium.

(Part of the task here is to get the fine balance between models in which any belief system is a possible equilibrium and the rational expectations models that are overly constrained. These include models in which expectations are approximately correct and in which there are systemic misperceptions, justified on the basis of well-supported behavioral studies.¹⁸)

Economists have long recognized the importance of one set of beliefs: expectations about the future. But even here, there is a fundamental dichotomy between many prevailing policy perspectives and much of the work in economics.

The mystique of confidence. In most crises, the IMF (U.S. Treasury, etc.) talks about the importance of restoring “confidence,” with little theory or empirical evidence on the determinants of confidence. By contrast, in standard economic models, confidence plays no (independent) role at all: beliefs are affected by observable variables. Part of the controversy over the handling of this crisis and the East Asia crisis a decade ago was precisely over the determinants of confidence and the effect of this variable on behavior. If budget deficits are the primary determinant of confidence, and confidence the primary determinant of investment, it follows that the first priority of governments should be to lower the deficit. But there are two obvious objections to these hypotheses: if markets

¹⁷ There is a nascent literature in economics on this subject. See, e.g. Avner Greif and Guido Tabellini, “Cultural and Institutional Bifurcation: China and Europe Compared,” *American Economic Review*, forthcoming, and Karla Hoff and Joseph E. Stiglitz, “Equilibrium Fictions: A Cognitive Approach to Societal Rigidity,” *American Economic Review*, forthcoming.

¹⁸ As Hoff and Stiglitz put it in “Equilibrium Fictions” (ibid.) “... perception is shaped by cognitive frames; the infinite set of potentially observable data and the infinite ways in which that data could be processed are limited by the finite set of *socially* constructed categories that are a part of what are called *ideologies* (or *belief systems*). Incorporating this perspective helps explain why institutional change can be so difficult and societies so rigid. A set of beliefs that may have been functional at one time, but is no longer so, can persist after the economics/technology that had led to the adoption of the beliefs has changed. We show that allowing for “equilibrium bias” in perceptions may explain the existence across societies and persistence across time of very different ideologies. This approach allows for a larger and more robust set of equilibria than can be supported by a RE model. On the other hand, the set of equilibria in our approach is much more constrained than the “animal spirits” equilibrium, which presumes that virtually any set of beliefs could be sustained.”

are rational, surely they do not look just at deficits but at what the money is spent on. The deficit fetishism so evident in the market (and conservative policymakers) is seemingly inconsistent with any coherent theory of rationality. More generally, presumably markets look at *real variables*, like unemployment and output. Keynesian theory emphasized that deficit spending can (and usually does) contribute to aggregate demand, thus to output, and thus to confidence.

This highlights, however, an important research agenda: better models of the determinants of confidence, and a better understanding of how such variables affect aggregate behavior. Some work has already begun.¹⁹ This suggests the expectations and confidence measures as revealed by surveys do have an effect on markets and behavior, even when controlling for all observable variables, contrary to the RE hypothesis; that expectations of different groups are different (consistent with models of differential information but inconsistent with RA models); and that forecasts of even the best forecasters can be improved by including observable data (again undermining hypotheses concerning RE).

The Units of Analysis

There are two more methodological issues to which I want to call attention. The first is the unit of analysis. Individuals are the ultimate source of our interest; but in economics, collectives are typically the units of “action” or decision-making—households (usually comprised of more than one individual), firms, and political entities. We somehow have to aggregate individuals to describe the behavior of these organizations. As Arrow long ago pointed out, that kind of aggregation is not easy.²⁰ In the standard theory of the firm, all shareholders wish the firm to do the same thing—maximize shareholder value. But as Grossman and Stiglitz showed, when the strong assumptions of complete markets are dropped, there is essentially never shareholder unanimity.²¹

Equilibrium and disequilibrium

Most of economic analysis is based on equilibrium theories. The phenomena that are of most interest in the context of a crisis are “out-of-equilibrium behavior.” Should we think of such situations as “short-run equilibrium paths” restoring the economy to a longer-term equilibrium? Or as stochastic equilibrium—in which the economy is never in full, long-run equilibrium, and in which there can, in fact, be an equilibrium level of disequilibrium?

¹⁹ Giselle Guzmán, “Using Sentiment Surveys to Predict GDP Growth and Stock Returns,” in Lawrence R. Klein (ed.), *The Making of National Economic Forecasts*, Edward Elgar, 2010.

²⁰ Kenneth J. Arrow, “A Difficulty in the Concept of Social Welfare,” *Journal of Political Economy*, 58(4), August 1950, pp. 328–346.

²¹ Sanford J Grossman and Joseph E. Stiglitz, “Stockholder Unanimity in Making Production and Financial Decisions,” *The Quarterly Journal of Economics*, 94(3), May 1980, pp. 543-66.

Informationally efficient markets

The efficient market hypothesis has played a central role in the development of economic theory and policy, in spite of the theoretical and empirical critiques of claims concerning market efficiency over the past 30 years. For many, the crisis can be seen as a confirming refutation of that hypothesis. In the discussion below, however, I want to emphasize that “rational expectations” (with different individuals having different information) may still be a good working hypothesis. That is, with rational expectations—but with the other market failures we describe—there is an important role for government intervention. As a research strategy, I think it makes sense to identify those market failures that arise even under the efficient markets hypothesis and those which are intrinsically related to problems of expectation formation. In one case, there can be clear policy prescriptions. The other raises deeper problems: how are we to evaluate outcomes (e.g. ex ante or ex post expected utility; are there systematic misjudgments; on the basis of whose judgments do we formulate policy?) While policy is more difficult, it is not impossible: we may still be able to identify systemic behaviors that give rise to excess volatility and to design policies that curb such behavior.

Rationality

By the same token, I have not said much about the assumption of “rationality” that underlies much of the standard paradigm. Modern behavioral theories have uncovered systematic irrationalities, and when these can be identified (even if they cannot be fully explained), they need to be incorporated into the analysis. But economists typically mean by rationality only a much weaker concept: consistency. They do not assess whether the behavior uncovered is really that which is in the individual’s own best interests. But, ironically, that means that the concept, in spite of its wide use, may be of only limited relevance for intertemporal decision making. Individuals cannot make repeated choices between consumption at age 20 and at age 50; they make those choices only once. We can make stronger hypotheses (e.g. that the individual has an additively separable utility function with a time invariant contemporaneous utility of consumption) and test the consistency of behavior with that much stronger hypothesis. But there is no reason to believe that individuals’ behavior would be described by such a function and little concern if it did not.

While I have been critical of much of the recent theorizing, e.g. using dynamic stochastic general equilibrium models, I want to end this section with a compliment: I do think that policy measures (both macro- and regulatory) have to be addressed with dynamic models, within general equilibrium models and within models in which risk is central. The problem is, in part, that because even “toy” models are complex, there is a need for extensive simplifications, and the simplifications have left out almost everything that is important. Any modeling involves trade-offs, but these models have made the wrong trade-offs. We may, in the short run, have to content ourselves with models that are richer in, say, describing the financial sector, but less complete (though not necessarily less accurate) in describing intertemporal behavior.

Some general concerns

In the preceding paragraphs, I have discussed briefly several of the key methodological issues in developing alternative theories. The following general observations guide the construction of the reforms in, say, regulatory policies and the models which underlay them.

1. *Markets are not, in general, efficient, even when all market participants are rational, have rational expectations, and all markets are competitive.*²²
2. *Whenever risk markets are incomplete and information is imperfect (there are information asymmetries), pecuniary externalities matter and are pervasive. Actions that affect prices affect the well being of others. A particular example—which is key in understanding collateral-based crises such as the current one—is that individuals in their lending and borrowing decisions take the prices of real estate (in each state of nature) as given, even though (collectively) their actions affect the magnitude of the collapse of real estate prices.*
3. *Whenever there are externalities, there is a role for government intervention to mitigate the consequences.*
4. *It is not, in general, the case that price interventions are always the optimal form of intervention.*
5. *In economies with information imperfections, agency problems are pervasive. But whenever there are agency problems, individuals' interests are typically not perfectly aligned with those whose interests they are supposed to represent. Private market solutions to address agency problems may not be socially efficient; and in any case, private market solutions exist under the “umbrella” of a legal structure. There are alternative legal structures (laws governing corporate governance), and some may lead to “better outcomes” than others.*

Key Modeling Challenges

In the following paragraphs, I want to describe a few of the key modeling challenges, what I view as key ingredients that have to be incorporated in any model that is going to describe economic fluctuations or be the basis of a well-designed regulatory or monetary framework. As I have already noted, a good macro-model has to incorporate a better model of the banking and non-banking sector—the traditional LM curve is totally inadequate. Finance is concerned with information, and thus at the center of any financial model must be theories of imperfect and asymmetric information. Market failures, and especially externalities, provide the grounds for regulation. Such market failures are pervasive, and the purpose of the model is to capture the most important and to provide insights into how to mitigate these failures.

²² See Greenwald and Stiglitz, “Externalities in Economies,” *op. cit.*, and the subsequent literature. Similarly, bubbles and herding behavior can exist even with rational expectations.

Bankruptcy and default

In traditional economic models, bankruptcy and default play no role. With perfect information, one might expect that individuals not lend to someone beyond his ability to pay.²³ But bankruptcy is central to finance. If there were no problem of default, everyone could borrow at the T-bill interest rate. If there were no risk of default, there would be no problem of liquidity—anyone who was solvent could get funds up to the amount that he could repay. There could be no liquidity crises.²⁴

Heterogeneous agents

Individual (firm) differences matter. If we are concerned, for instance, about bankruptcy, then average net worth may be of little concern; it is the fraction of firms (households) that are heavily indebted that matters. So too, redistributions matter. Only in models with extreme “linearity” can we ignore such differences. Heterogeneity is also obviously important if we are to have models with borrowers and lenders, if we are to have differences in beliefs, or if we are to understand how idiosyncratic shocks that might hit some individuals (firms) might still have macro-economic consequences.

Interlinkages

Individuals (households, firms) interact with each other, and macro-economics should explore the consequences of those interactions, e.g. coordination failures.

As we have noted, one central aspect of these interrelationships are those related to credit. One can model a credit network consisting of households, firms, and banks. Agents are linked by “inside” credit (e.g. credit relationships connecting firms belonging to different layers of the same industry, or connecting banks on the interbank market) and “outside” credit (i.e. credit relationships connecting agents belonging to different sectors, i.e. banks and firms).

Balance sheets and financial flows are, of course, central in understanding links among agents in the firm-banking sectors within a network theory framework. But this literature has called attention to aspects that previously received little notice.

As we have noted, one cannot understand credit markets and credit interlinkages—or liquidity crises—without an understanding of the risks of bankruptcy. As the net worth

²³ That is, obviously, a simplification: in models with agency problems, mortgage companies might lend even if they knew that there was a large probability of non-payment, if they could sell the securities to others and garner fees for themselves.

²⁴ By the same token, the distinction often made between problems of liquidity and insolvency rests on implicit assumptions about information (putting aside problems of contract enforcement.) If there were perfect information that a bank, say, were solvent, it would have access to funds. It is only because others are not sure that it is solvent that it cannot get access to funds. Typically, the firm (bank) believes that it is solvent, but others are less convinced. In this crisis, many banks believed that the market had underpriced their assets, and with the “correct” price of their assets they were fully solvent. But that was predicated in the belief that there had not been a big bubble that had been the basis of much of their lending.

of a firm decreases, the interest rate which it has to pay—to compensate for the risk of bankruptcy—increases. As a result, in stochastic models there is an effect which Battison *et al* call “trend reinforcement,” the likelihood of a further decline in firm net worth is increased.²⁵

There are at least three fundamental features of the real world mechanisms based on the effects of shocks on the network of credit relationships that are ignored by the RA (representative agent) approach.²⁶

First and foremost, by construction, the shock which gives rise to the macro-economic fluctuation is uniform across agents. The presumption is that idiosyncratic shocks, affecting different individuals differently, would “cancel out.” But in the real world, idiosyncratic shocks can well give rise to aggregative consequences; such shocks can be the source of an “epidemic,” giving rise to financial distress, the effects of which diffuse throughout the economy and can often translate into a contraction of real GDP. In other words, in a financial network, idiosyncratic shocks usually do not cancel out in the aggregate, especially if the shocks hit crucial nodes (hubs) of the network. Studying when that may be the case—and how the structure of the network affects the aggregative impacts—should be a prime focus of macro-economic analysis.

Second, the aggregate (RA) view does not (cannot) capture the fact that the spreading of a financial disease may proceed at different speeds in different parts of the macroeconomics. For some agents, financial robustness may be procyclical, while for other agents it is financial fragility that may be pro-cyclical.

Last but not least, in a credit network, a shock (bankruptcy) in one firm (bank) can lead to an avalanche of bankruptcies. Suppose, for instance, that a firm goes bust. Both the suppliers and the banks, which did business with the bankrupt firm, will be adversely affected by the default. The deterioration of the bank’s financial condition due to the borrower’s bankruptcy may be absorbed if the size of the loan is small and/or the bank’s net worth is high. If this is not the case, the bank could go bankrupt. If the bank survives, however, it will restrain credit supply and/or make credit conditions harsher, raising the interest rate on loans across the board for all its borrowers. Therefore, the default of one agent can bring about an avalanche of bankruptcies. While the proximate cause of the bankruptcy of a certain firm in the middle of the avalanche is the interest rate hike, the remote cause is the bankruptcy of a firm at the beginning of the avalanche that forced the banks to push interest rates up. The interest rate hike leads to more bankruptcies and eventually to a bankruptcy chain: “the high rate of bankruptcy is a cause of the high interest rate as much as a consequence of it.”²⁷

²⁵ Stefano Battiston, Domenico Delli Gatti, Mauro Gallegati, Bruce Greenwald, and Joseph E. Stiglitz, “Liaisons Dangereuses: Increasing Connectivity, Risk Sharing, and Systemic Risk,” NBER Working Paper No. 15611, January 2009.

²⁶ This section is excerpted from Mauro Gallegati and Joseph E. Stiglitz, “Heterogeneous Interacting Agent Models for Understanding Monetary Economies,” *Eastern Economic Journal*, forthcoming.

²⁷ Another important example of indirect interaction can be appreciated by arguing along the following lines (Greenwald and Stiglitz *Towards a New Paradigm*, *op. cit.*; Domenico Delli Gatti, Mauro Gallegati, Bruce Greenwald, Alberto Russo, and Joseph E. Stiglitz, “Business Fluctuations in a Credit-Network

An avalanche of bankruptcies therefore is due to the positive feedback of the bankruptcy of a single agent on the net worth of the “neighbors,” linked (directly or indirectly) to the bankrupt agent by credit links of one sort or another.

Bankruptcy cascades may be of different size depending not only on the magnitude of the shock but also on the topology of the network. Some network designs may be good at absorbing small shocks, when there can be systemic failure when confronted with a large enough shock. Similarly, some topologies may be more vulnerable to highly correlated shocks. When the corporate and/or the banking sector are polarized, the vulnerability of the network to a shock (i.e. systemic risk) increases when there is a highly connected agent, because his default, due to a relatively rare event, may generate a non-negligible cascade of bankruptcies.

The key point of bankruptcy cascades is that they are a consequence of, and give rise to, externalities, and whenever there are externalities, there is an important role for government.

Structure, risk diversification, contagion, and systemic risk

Financial stability depends on the shocks to which individuals (firms) are exposed and the structure of the financial (economic) system. Regulations can affect both. Capital and financial market liberalization have arguably exposed many developing countries to increased shocks from the outside.

Standard models argue that the more widely shared risks, the better the performance of the economic system. This notion was central to the push for securitization. At the same

Economy,” *Physica A*, 370, 2006, pp. 68–74). Suppose that the equilibrium interest rate on loans is determined by a large number of credit contracts in a market for bank loans. Suppose moreover that, due for instance to a financial crisis, a non-negligible number of borrowers goes bankrupt. A loss due to non-performing loans shows up on the banks’ balance sheet. Banks react to this deterioration of their financial conditions by restraining the quantity of new loans and/or making credit conditions harder for the borrowers. This leads to a sudden increase of the market interest rate. The surviving agents who are currently looking for a loan on that market are indirectly affected through the increase of the interest rate by the aggregate solvency (determined by the crisis and the associated bankruptcies) of the borrowers. With credit now being more expensive because of the adjustment process of the market price of credit, i.e. the interest rate, the agent will be more cautious in getting into debt. This is true also of the other agents, of course. A tendency to reduce indebtedness will spread among borrowers. This second round effect plays a stabilizing role, attenuating the upward dynamic pattern of the interest rate.

In this example, however, this is not the end of the story. In a setting characterized by heterogeneous financial conditions, the increase of the interest rate is likely to be lethal to those firms which were already on the verge of bankruptcy because of an extremely low level of net worth. In other words, these firms could be pushed out of the market. The balance sheets of the lenders will be negatively affected by this new wave of bankruptcies, so that they will react by pushing up even further the interest rate. This too is a second round effect, but it plays a de-stabilizing role, exacerbating the upward dynamic pattern of the interest rate. In conclusion, there are two types of second-round effects at work here: the first one is essentially a negative feedback effect with a stabilizing role, while the second one is a positive feedback effect with a destabilizing role. This is one part of what can be defined as a financial accelerator.

time, concerns have been raised about “contagion,” the notion that a downturn in one country could lead to that in another. This is, of course, a result of some form of linkage—and often financial linkages. Most of the standard models provide no insights into the problem of contagion, and most policy analyses (e.g. those associated with the IMF) have compartmentalized their thinking: before crises, they focus on the benefits of risk diversification; only in the midst of a crisis does the emphasis switch to the risk of contagion.

Obviously, any model attempting to design a regulatory system for the financial system has to incorporate simultaneously both the benefits and the costs of financial integration (similar issues arise domestically within a country).

Recent work has provided a general analytic framework within which we can analyze the optimal degree (and form) of financial integration. Of particular concern are linkages that give rise to the risk of systemic failure.²⁸ The intuition behind why integration *is* desirable was based on “convexity”: with convex technologies and concave utility functions, risk sharing is always beneficial. Thus, the more globally integrated the world economy, the better risks are “dispersed.” But if technologies are not convex, then risk sharing can lower expected utility. While simplistic models typically employed in economics *assume* convexity, the world is rife with non-convexities—of which bankruptcy (discussed earlier) is a key example.²⁹

A key aspect of the structure is the nature of linkages among firms and financial institutions. Recent research has shown that, for instance, the extent and form of linkages that are optimal from a private perspective may not be socially optimal—there are externalities.³⁰

²⁸ The concept of systemic risk does not even seem to have been well developed within the standard literature. J. E. Stiglitz, “Risk and Global Economic Architecture: Why Full Financial Integration May Be Undesirable,” *American Economic Review*, forthcoming.

²⁹ Those concerned with designing electric networks have worried about analogous problems. With an integrated electric grid, the excess capacity required to prevent a blackout can be reduced; alternatively, for any given capacity, the probability of a blackout can be reduced. But a failure in one part of the system can lead to system-wide failure; in the absence of integration, the failure would have been geographically constrained. Well-designed networks have circuit breakers, to prevent the “contagion” of the failure of one part of the system to others.

³⁰ For instance, Mauro Gallegati, Bruce Greenwald, Matteo G. Richiardi, and Joseph E. Stiglitz, “The Asymmetric Effect of Diffusion Processes: Risk Sharing and Contagion,” *Global Economy Journal*, 8(3), 2008; and Battiston *et al*, “Liaisons Dangereuses,” *op. cit.*, provide a general characterization of diffusion processes, allowing analyzing both risk sharing and contagion effects at the same time. Interdependencies in real and financial assets are beneficial from a social point of view when the economic environment is favorable and detrimental when the economic environment deteriorates. In the latter case, private incentives are such that too many linkages are formed, with respect to what is socially desirable. The risk of contagion increases the volatility of the outcome and thus reduces the ability of the financial networks to provide the putative benefits associated with risk sharing. This analysis helps us understand the role of securitization in the current crisis—beyond the absence of transparency about the characteristics of the underlying assets that the multiple layers of financial intermediation fostered.

Control

One of the reasons that bankruptcy (and systemic risk that can give rise to a cascade of bankruptcies) is important is not just the bankruptcy costs themselves. Assets do not disappear, but organization capital does, and this can be of great moment. Bankruptcy gives rise, moreover, to changes in control of assets and not always in ways that are efficient.³¹

The broad issue of control of assets plays little role in standard theory. Assets are always deployed in ways which maximize returns. But in models in which individuals differ either about intertemporal preferences, risk aversion, or, more importantly, risk assessments, or more broadly knowledge, information, and competency, who controls the firm can make a great deal of difference.

Earlier, we noted the importance of agency problems in understanding modern economies, including and especially the financial sector. While the problems of the separation of ownership and control has been recognized for two thirds of a century,³² the problems have become perhaps more severe, especially when there are “chains” of agency problems, with those investing in firms investing on behalf of others.

Many of the problems observed in the financial market may, in part, be a result of these control/corporate governance problems. They help explain perverse incentives, lack of transparency, and even the excesses of risk taking. And they also provide insights into understanding the consequences of regulations. Changing organizational incentives (e.g. by taxation) may not have the same impact that it would in a firm managed by its owner.

Systemic risk

One of the reasons that we should be concerned with systemic risk is, of course, the large costs associated with it. But another is the fact that if a firm is, say, too big or too intertwined to fail because of systemic risk, there is a high risk of a bail-out. Knowing this reinforces the earlier argument that firms may have an incentive to engage in interlinkages and other behaviors which increase the likelihood of systemic risk.

A key problem is the credibility of commitments not to bailout a bank which poses the risk of systemic failure. This is true whether or not there is “resolution authority.” If that commitment is not fully credible, there are incentives at play to increase systemic risk and therefore increase the likelihood of a bailout. Moreover, the benefits of a potential bailout are felt even before the bailout occurs, in the form of lower cost of capital for all firms that are potentially too big to fail. The benefits are enjoyed not just by the firms who are bailed out but also by all who might be. That is why it is imperative to take regulatory measures to reduce the risk of too big/too intertwined to fail problems from arising and to impose additional burdens on the too big to fail institutions to offset the benefits that a potential bailout confers upon them.

³¹ See Greenwald and Stiglitz, *Towards a New Paradigm*, op. cit.

³² Adolf Berle and Gardiner Means, *The Modern Corporation and Private Property*, Macmillan, 1932.

Irrational exuberance

Most of the issues that I have addressed so far can be analyzed within frameworks of rational expectations. Other phenomenon cannot be—including many of the bubbles and bursts that have marked the market economy. There are systematic ways in which individuals behave “irrationally,” and important work in psychology and social psychology that provides insights into these patterns of behavior. It is important that this work be incorporated into our modeling of macro-economics, if we are to design regulations that prevent a recurrence of crises such as that which we have just experienced.

Concluding Comments

The standard paradigm failed not only to predict the crisis but also to provide insights into the design of a regulatory framework that would make a recurrence less likely. I have focused my remarks around a number of key ingredients that have to be incorporated into any model hoping to provide guidance on regulatory issues. I have not tried to relate these models to particular regulatory issues—transparency, incentives, structure, products, behavior. I have discussed these issues at length elsewhere.³³

The crisis has been a grand testing ground for alternative theories. The standard model has been found wanting. But so too have many other models.³⁴

A major concern in regulation is the adverse effect on innovation. To assess those impacts, there are a further set of models (beyond the scope of this paper) that will be required, those that focus on the determinants of innovation, both the pace of innovative activities and the direction. But even without a closer look at these models, the concerns about adverse effects on innovation may be exaggerated: Not only did financial markets not do a good job in allocating resources and managing risk, but by and large, they also did not do a good job in innovation—at least innovating in ways that would enhance the stability, efficiency, and well-being of society. The innovations were more directly for regulatory, accounting, and tax arbitrage—undermining the overall performance of the economy.

There is a large agenda ahead, but one which, fortunately, is well underway.

³³ See, for instance, J.E. Stiglitz *Freefall: America, Free Markets, and the Sinking of the World Economy*, New York: WW Norton, 2010.

³⁴ See, e.g. J. E. Stiglitz, “Evolutionary Theory and the Current Economic Crisis,” paper presented to American Economic Association meetings, Atlanta, January, 2010.