RADICAL FINANCIAL INNOVATION

By

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Radical financial innovation is the development of new institutions and methods that permit risk management to be extended far beyond its former realm, covering important new *classes* of risks. This paper compares past such innovation with potential future innovation, looking at the process that produced past success and the possibilities for future financial innovation.

Radical Financial Innovation[1]

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The basic principles of risk management, pooling, diversification and hedging, inherently suggest much more dramatic and effective reduction of risks than we now observe offered by our institutions of insurance, securities and banking, or by any other institutions. To achieve such risk reduction, some radical financial innovation will be required.

By radical financial innovation I mean innovation that permits risk management to be extended far beyond its former realm, covering important new *classes* of risks. This is innovation that changes the assumptions about what can be insured, hedged or diversified, and that has major impact on human welfare. It involves the "routine innovation" that Baumol argues in his book [2002] that oligopolistic firms see as part of their regular survival strategy, but it goes beyond that. It is a form of innovation that requires changes in society that go far beyond one firm. In my recent book *The New Financial Order: Risk in the 21st Century* I used the word "radical" to refer to such financial innovation, using the term "radical" in the sense of *radix*, root, rather than "left wing," as the word has come to be used.

Radical innovation requires serious experimentation, serious effort to find the precise form of financial or insurance structure that will perform well, serious effort to educate the potential clients about the new risk management tool, a commitment by the innovators to make

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the innovation work, and an involvement with other institutions and thought leaders to make the variety of changes possible to make the innovation work. After the utility of a radical financial innovation is demonstrated, the innovation tends to be copied all around the world, just as are engineering innovations such as automobiles or airplanes after they are invented.

I wish to argue here that there has been radical financial innovation in the past and that, continuing what we have seen in the past, there will be radical financial innovation in the future. This will be a continuation of a long trend towards greater application of the principles of risk management.

To continue this trend over coming decades, applications of the newly appearing information technology will play a major role, as will also the improved understanding of behavioral finance that has been arising in response to developments in psychology applied to finance.

 In this paper, I will review some of the main areas where risk management can advance, and I will compare past advances with future advances, looking at the nature of innovation that produced past success and the possibilities for major future innovation, in each of these areas.

Incompleteness of Existing Risk Management

According to the intertemporal capital asset model as developed by Robert Merton [1973] and as developed further by Douglas Breeden [1979], complete risk sharing in a stochastic endowment economy with nonstochastic preferences would imply that real consumption fluctuations are perfectly correlated across all individuals in the world. This result follows since with complete risk management any fluctuations in individual endowments are completely

pooled, and only world risk remains. But, in fact, real consumption changes are not very correlated across individuals. As Backus Kehoe and Kydland [1992] have documented, the correlation of consumption changes across countries is far from perfect. In fact, the correlation of consumption changes across countries is even lower than the correlation of income changes across countries; the presence of any effective risk sharing, let alone complete risk sharing, would at least suggest the reverse.

Individuals do not succeed in insuring their individual income risks. [Cochrane, 1991]. Moreover, individual consumption tends over the life cycle tends to track individual income over the life cycle [Carroll and Summers 1991], even though different people may have very different life-cycle income patterns that have little or nothing to do with aggregate risk. Risk management advice given to individuals tends to be focused on the short term, and to neglect such longer-run considerations as risk in future reinvestment rates [Merton, 2003].

Another way of observing that risk management has a long way to go is to note that the risk management institutions that we do have tend to be directed towards managing some relatively small risks, or risks with relatively small probabilities. An extreme case is flight insurance, which insures a passenger against the risk of an airplane crash [Eisner and Strotz 1961]. Other risk management institutions have an inordinate importance today compared to when they were first invented. Life insurance was very important in past centuries when life expectancies were in the 40's and when parents with young children frequently died; today the deaths of young parents against which life insurance insures is relatively rare. Fire insurance was very important in past centuries before the advent of modern fire departments, when candles and fireplaces were the norm around houses, now too the risk of loss of a house by fire is relatively

small.   We have well-developed institutions for risks that were important long ago, and not for the significant risks of today. This gap reflects the slowness of invention to adapt to the changing structure of economic risks.

According to a theoretical model developed by Stefano Athanasoulis and myself, [Athanasoulis and Shiller 2000, 2001, analogous models in Athanasoulis,1995, and Demange and Laroque, 1995], the most important risks to be hedged first can be defined in terms of the eigenvectors of the variance matrix of deviations of individual incomes from world income, that is, of the matrix whose ijth element is the covariance of individual I's income change deviation from *per capita* world income change with individual j's income change deviation from *per capita* world income change. Moreover, the eigenvalue corresponding to each eigenvector provides a measure of the welfare gain that can be obtained by creating the corresponding risk management vehicle. So, a market designer of a limited number N of new risk management instruments would pick the eigenvectors corresponding to the highest N eigenvalues.

Using a calibrated-estimated variance matrix for the period since World War II, and some conventional assumptions about individual utilities, we found that institutions that swap risks between major groupings of people would have enormous welfare gains. Even one or two well-chosen swaps just among the people in the G-7 countries would improve their welfare by several percentage points. There could be myriads of risk management contracts that provide risk management going beyond the G-7 countries, where risks appear to be larger, or extending down to the individual level, would suggest the possibility of massive gains in human welfare. And yet little such risk management is in evidence today.

Obstacles to be Overcome by Financial Innovation

The ideal of risk sharing developed by Kenneth Arrow, in which there is a market for every risk and a price for every state of nature, is an abstract ideal that cannot be approached to any significant extent without an apparatus, a financial and information and marketing structure. The design of any such apparatus is far from obvious. There are unique challenges that designers of risk management devices face, challenges that have different origins from those faced by engineers who must design bridges or airplanes.

Risks can be very difficult to measure, the probabilities can be hard to determine, the outcomes may be hard to verify, asymmetric information problems and the associated selection bias, and moral hazard created by the risk management may create costs that make the risk management impossible to achieve in practice.

Major economic risks evolve amidst a continually changing economic structure, whose parameters can never be known with the kind of precision envisioned by those actuarial scientists who conceived of life insurance.

Beyond all these purely economic problems, there are also problems of human behavior, a human difficulty appreciating risks and a weakness of will to take measures against them. The "risks as feelings" theory [Loewenstein *et al.*, 2001] draws on neurological theory to describe the human weaknesses as regards risks. Human ability to take action requires emotional pathways in the brain that must be triggered if action is to follow. Mechanisms that drive people to take action against immediate risks, for example, the risk of falling from a high place, are well designed through repeated experience over the course of human evolution. But the human brain does not have the same kind of reaction to risks that are revealed only by abstract calculation or that

unfold gradually over many years. These generate intellectual, but not strongly emotional, concerns, and there may be little impetus to take action against these risks. Risk management devices need to be designed so that people will use them.

Human behavior is also vulnerable to inconsistencies when confronted with making decisions involving choices among risks. Kahneman and Tversky [2000] have shown in a number of experiments that people's decisions in choices among risks can be easily influenced by changes in framing, by changes in the context, presentation or environment that accompanies the decision problem. Risk management devices have to be designed so that people will tend to use them properly.

Financial innovators have had to overcome the obstacles to all of these problems. The institutions of risk management today, of insurance, securities and banking, represent centuries of experience with these obstacles, and a significant body of knowledge about them. The successes of risk management to date have depended on their knowledge of the nature of the underlying institutions and patterns of human behavior.

Managing Livelihood Risks

Initial efforts to manage risks to livelihoods were confined to the kinds of risks that could readily be verified as not due to moral hazard with the information technology of the day: life insurance and disability insurance. Deaths and disabilities are objective events. Suicides or self-mutilation to collect on policies are relatively unlikely. That is why initial efforts at insurance to manage the livelihoods of families covered these risks and not the more difficult-to-measure risks to the economic value of ones labor income.

But, as I argued in *The New Financial Order*, it is incumbent upon us to use our better understanding of risk management and our better understanding of psychological barriers to risks to develop much more comprehensive policies against livelihood risks.

The life insurance industry first came into its own in the 17th century when the first elements of probability theory were understood. It was in that century that the first life tables were developed, reflecting a conceptualization that made possible the first understanding of actuarial science.

However, the application of the principle of insurance was slow to get started. Initially, only certain very narrow risks were insured, such as the risks death, of ships sinking or homes burning down. Gradually, the list of insurable risks has expanded. Life insurance was extended with disability insurance, and fire insurance was extended to cover other risks associated with ownership in property, such as floods or accidents. But, still some of the most critical risks are still not insured. The risk that is covered by life insurance—essentially that a parent with young children dies—is not so great, compared to the risk that the parent suffers economic misfortune such as a loss of career opportunities.

Even when these limitations were accepted, life insurance and disability insurance were hard sells, and until the middle of the 19th century, very few such policies were sold. Studies of the marketing of insurance in the 19th century outline a number of limiting factors that were eventually overcome by better marketing and design of life insurance policies.[3]

One problem is just a basic reluctance to pay to prevent a loss when one has the probability of getting by without any loss. According to the prospect theory of psychologists

Kahneman and Tversky, people are "risk lovers" when it comes to losses. Kahneman and Tversky mean by this that people have an impulse, when facing a situation involving possible losses, to try to get away scot-free, without any loss at all. People are tempted to accept large potential losses in exchange for the possibility, the hope, of having little or no losses.

One of Kahneman and Tversky's experiments will illustrate this risk-loving behavior. They asked their subjects to consider a choice between two bad situations. They were asked to assume that they have no way of avoiding both situations, they have only the possibility of choosing which they disliked less. The first situation was an 80% chance of losing $4000, and a 20% of losing nothing. The second situation was a 100% chance of losing $3000. Their subjects showed a strong preference for the first situation: 92% of their subjects made this choice. By conventional canons of rational behavior, this is the wrong choice. People should prefer the sure loss of $3000, since it is less than the expected loss of $3200 (=$4000×0.8) in the other situation, and is less uncertain. By conventional theory of rational behavior, people should view the larger potential loss of $4000 as particularly serious to them, since it reduces their income to the point where the value of a dollar to them is much higher, and they should therefore, in making their choice, give high weight to the possibility of such a bad outcome. But, instead, people seemed to want to be affected by the 20% chance of losing nothing in that situation.

This behavior creates problems for marketers of any kind of insurance. Paying an insurance premium is a sure loss. Not buying the insurance offers the possibility of getting away scot free, with no loss at all. Prospect theory therefore offers a psychological explanation for people's tendency to underinsure.

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[3]See Stalson [1969] and Zelizer [1983].

Of course, people do buy some insurance even if they do not insure enough and do not insure against all risks. Moreover, note that 8% of the Kahneman and Tversky subjects made the "right" choice, which would suggest that there is a market for insurance among at least that fraction of the population. But, if we are to secure a substantial fraction of the population in risk sharing, we must try to deal with the psychological obstacles in the design of the risk management device.

The risk-loving behavior described by prospect theory is not a sure thing, and indeed all of the implications of the theory are only tendencies in behavior, not entirely predictable behavior. One explanation of the varied outcomes across subjects can be had in terms of uncertainties of framing.

Framing in psychology refers to the point of view from which an individual assesses a situation. In the case of the experiment described above, the question suggested that the point of view from which to judge the situations was one's current income. The quantities were identified as "losses." But, some people might choose a different framing. Some might view the situation from the standpoint of the $4000 maximal loss. Then, the first situation is a 20% chance of getting $4000, an 80% of getting nothing. The second situation is a sure gain of $1000. When viewed from this standpoint, the normal risk-averse behavior for gains would, according to their theory, make the second choice much more attractive.

Since different people, or people in different circumstances, out of habit or suggestion, choose different framing, we get different choices. The Kahneman-Tversky framing interpretation for the variation in answers suggests that those people who make the "rational" choice, the choice that is less risky, do so because of chance suggestions or associations, not any

careful thought or intelligible reasons. The Kahneman-Tversky interpretation suggests that promoters of risk management devices might encourage the use of these devices by structuring the description or appearance of the product, and managing a publicity campaign, so as to suggest a loss point of reference, rather than the status quo frame of reference.

An important milestone in the development of life insurance occurred in the 1880s when Henry Hyde of the Equitable Life Assurance Society conceived of the idea of creating long-term life insurance policies with substantial cash values, and of marketing them as investments rather than as pure insurance. The concept was one of bundling, of bundling the life insurance policy together with an investment, so that no loss was immediately apparent if there was no death. This innovation was a powerful impetus to the public's acceptance of life insurance. It changed the framing from one of losses to one of gains. Hyde's invention was copied all around the world.

It might also be noted that an educational campaign made by the life insurance industry has also enhanced public understanding of the concept of life insurance. Indeed, people can sometimes be educated out of some of the judgmental errors that Kahneman and Tversky have documented. There is some evidence that people may tend to give answers that are more in accord with standard notions of rational behavior if they have had the experience of someone's thinking through with them the issues. The psychologist Gigerenzer [1991] repeated some of Kahneman and Tversky's experiments after carefully reasoning with their subjects about their choice and making sure that they understood all of the consequences of their choice. The reasoning with these subjects was done so as to be something other than a mere suggestion of a new point of reference. Gigerenzer found that people made, much more often, the rational choice. The Gigerenzer interpretation of the risk-loving impulse suggests that promoters of risk

management devices might encourage the use of these devices by working to educate people about the true consequences of their actions. But doing this inevitably requires the involvement of others: opinion leaders, professional or labor organizations, and schools. Thus, radical financial innovation cannot be pursued by individual firms alone. These examples of the design of life insurance institutions, and of the properly marketing of them, need to be carried forward if we are to carry livelihood risk management into a more comprehensive insurance on livelihoods, and to form a pervasive element of our lives. In my book [2003] I discussed some important new forms that livelihood insurance can take in the 21st century, to manage risks that will be more important than death or disability in coming years. But, making such risk management happen will require the same kind of pervasive innovation that we saw with life insurance.

Managing Risks to Homes

Risks to homes are of extreme importance, since the home comprises the most significant component of wealth for most people, and loss of the home, or loss of value of the home, can be devastating. People rely on their homes for more than just housing services. Houses are also a store of value that may play a significant role in their risk management, and sold and consumed either in a bad economic draw or, after retirement, to make up for lost income. Thus, a decline in home value can represent a significant welfare loss.

With the information technology of the 1600s, when insurance on homes was first conceptualized and pursued on a systematic basis, the insurable risks were necessarily limited to risks whose outcomes could reasonably be confirmed and moral hazard limited with the information technology of that day. The risk of fire was the predominant risk that could be

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insured at that time. As the centuries progressed, the information technology and the associated legal system improved, so that more kinds of home risks could be insured. By the twentieth century, fire insurance was renamed homeowners insurance to reflect the wider class of risks that it covered.

Still, the major cause of risk to home value, the risk of change in the price of a home, has never been an important insurance institution. Today, when we can confirm with our repeat sales price indexes using electronic databases of home prices and associated characteristics, that whole cities can decline in value by 30% in a matter of a few years, we are much more concretely aware of such risks, and in a position to extend homeowners insurance to cover such risks.

The first home equity assurance program was launched in the Village of Oak Park, Illinois, in 1977. The plan was created by the Village and subsidized by the taxpayers in the Village. To enroll for the program, an Oak Park homeowner needed only pay for an appraisal of the value of the home, after which the home was covered for 80% of any loss on later sale as measured by the selling price or a second appraisal. The original spur for this innovation was something rather different from pure risk calculations, and this motivation was to help prevent the decline of home prices at a time of racial change. Oak Park residents, who saw an influx of minority home buyers, worried that there could be a speculative price collapse in the city as a sort of self-fulfilling prophecy, as people sold merely because they thought that home prices would drop at a time of racial change. Oak Park today is a successfully racially integrated community and it has not seen Village-wide home price declines.

The designers of the Oak Park program were in entirely new territory—there being no examples of home equity assurance programs in the past. They were confronted by design

decisions that they resolved as best they could with their limited resources.

They were well aware that they needed to deal with various forms of moral hazard, and they attempted to do so by a number of terms in the insurance contract. The Village reserved first refusal to buy the house, in order to prevent non-arms-length sales being contracted at below-market prices. There were provisions about time on the market, a demand that the home be listed with the Oak Park River Forest Board of Realtors Multiple Listing Service, and a provision that a certified appraiser was to be called in at sale to estimate how much value was lost due to failure to maintain the property. These provisions complicated the process and imposed costs on both homeowners and on the insurance plan. The Village was running risks with this pioneering program, including that the Village itself would have to buy a substantial number of its homes. It was the high idealism of Oak Park to welcome minorities into a stable town that stimulated them to take these risks.

With the original Oak Park program, since the program was designed to prevent loss of home value due to racial change, the program was designed so that it was narrower than a program representing the risk of price declines of homes. The ordinance that created the program said that "The purpose of this program is not to protect against a regional or national decline in the single-family housing market. Therefore, in the event of a general decline in the value of single-family homes in the Chicago-Cook County-Metropolitan Area single-family home market, the President and Board of Trustees of the City of Oak Park reserve the right to review, revise and suspend payments under the Equity Assurance Program."[4]

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[4]"Ordinance Providing for an Equity Assurance Plan for Single Family Residences in the Village of Oak Park," 1977, p. 1. http://www.newfinancialorder.com/ordinance.pdf.

The designers of the Oak Park program were trying to limit the risk to the town of Oak Park, so as to keep the cost of managing the risk low. Unfortunately, they did not have a rigorous way to do this, since in 1977 there were no reliable home price indexes for the city, county or metropolitan area. A weakness of this program as it was initiated then was that the program was vaguely defined, depending on some unspecified judgment in the future. This was a weakness of the information technology of the day, for there was nothing better that they could do to prevent these problems when there were no good indexes.

Making the policy suspendable at the discretion of the Village also limited the success of the program, since the eagerness of home buyers to purchase the insurance would be reduced. According to experiments of Kahneman and Tversky, people are relatively less interested in risk-management products that afford only partial protection against loss; they view partial insurance, or probabilistic insurance as they define it, with relative indifference. Kahneman and Tversky demonstrate this human tendency by tabulating responses to the following question:

> "Suppose you consider the possibility of insuring some property against damage, e.g., fire or theft. After examining the risks and the premium you find that you have no clear preference between the options of purchasing the insurance or leaving the property uninsured.
> It is then called to your attention that the insurance company offers a new program called probabilistic insurance. In this program you pay half of the regular premium. In case of damage, there is a 50 per cent chance that you pay the other half of the premium and the insurance company covers all the losses; and there is a 50 per cent chance that you get back your insurance payment and suffer all the losses. For example, if an accident occurs on an odd day of the month, you pay the other half of the regular premium and your losses are covered; but if the accident occurs on an even day of the month, your insurance payment is refunded and your losses are not covered.
> Recall that the premium for full coverage is such that you find this insurance worth its cost.

Under these circumstances, would you purchase probabilistic insurance?"[5]

When presented with this question describing a quite unusual form of insurance, 80% of their respondents said no, only 20% yes. People behave as if they view the prospect of cutting the probability of loss in half as of less value than the prospect of cutting it in half again, to zero.

The aversion to probabilistic insurance is, as Kahneman and Tversky noted, troubling because really all insurance is probabilistic, there is no way to avoid all risks. The difference apparently has to do with framing. If we are thinking of a single risk, without considering others, we will be attracted much more to a policy that eliminates this risk completely. But if we are considering this risk among others, so that buying this same policy does not eliminate the combined risks altogether, then the policy will appear less attractive. The design of new risk management vehicles can be more successful if a single product protects against a set of risks that appears to the client to be comprehensive.[6]

Another problem with home equity insurance has to do with money illusion, the tendency to confuse nominal price changes with real price changes [Fisher, 1928, Shafir Diamond and Tversky 1997]. At the time of creation in Oak Park in 1977, inflation in the United States was running at double-digit ranges. At this rate, the price level would double in less than ten years. The real concern of homeowners was then to have been that their home price did not keep up with inflation. And, yet, the Oak Park program only protected the nominal value of homes, not the real value. One of the most pervasive problems facing financial innovators is overcoming the

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[5]Kahneman and Tversky [1979] pp. 169-70.

[6]For example, Bodie [2003] proposes bundling together retirement annuities and long-term care insurance, so that people approaching retirement can perceive a single product as covering their most important risks.

public misunderstanding of inflation, and the public's general failure to demand indexation [Shiller, 1997]. The problem can best be solved if we adopt, and promote widely through society, a new system of economic measurements, that is, indexed units of account representing important economic concepts, so that we can break the habit of public thinking in nominal terms [Shiller, 2003]. But, such a new system of measurements is another invention that must overcome the same sort of obstacles to purely financial invention.

Programs along the lines of the Oak Park program were created in Southwest Chicago, Illinois, Northwest Chicago, Illinois, Aurora Illinois, Patterson Park/Baltimore Maryland, Ferguson Missouri, Flourissant Misouri, and Pittsburgh Pennsylvania. As is the case with successful inventions, there is copying of the original invention in other places, and, as with other inventions, there tends to be a geographic spread of the concept. The home equity insurance concept spread from its origin in Oak Park Illinois to other towns in Illinois, and then to further cities and towns in the eastern half of the United States. Still today, as far as I have been able to determine, such policies have not spread beyond the United States.

The spread has been slow and none of the original home equity insurance plans wrote a lot of policies within their communities. The Oak Park and the other policies persuaded no more than a few percent of homeowners to sign up for the insurance. When I spoke to an administrator of the Oak Park program for possible reasons that the program did not capture a larger share of homeowners, she offered that the program did not have a substantial marketing budget and that homeowners may have had unfounded fears that submitting the results of a new appraisal to the Village might result in their property taxes being raised. She also thought that homeowners merely were inertial, postponing indefinitely the steps that would be needed to become enrolled

in the program.

Another problem that has inhibited the spread of home equity insurance programs is the moral hazard problem that was not fully addressed by Oak Park. The risk is that people will neglect to maintain their house, or will alter it in such a way that its market value declines. The concept of relying on an appraiser to estimate the amount of neglect at the time of the home sale is fraught with difficulties, since ways of reducing home value are multifaceted and hard to quantify or observe well. As Allan Weiss and I argued [1994], this moral hazard can be dealt with by making the policies settle on indexes of home prices, rather than on the actual home price itself. Since the homeowner can have virtually no influence on a city or neighborhood index, there is little moral hazard.

The first home equity insurance policies that were created to be settled on an index were a part of a joint project between Yale University, the City of Syracuse New York, and the nonprofit Neighborhood Reinvestment Corporation, with a subsidy from the U. S. government. Starting in 2002, homeowners in Syracuse could buy the insurance policy with a one-time-only payment of 1.5% of the value of the home, and then they would be insured for a period of thirty years against any decline of home value, at time of sale, as measured by the citywide price index.

The Syracuse home equity insurance program is an important example that may one day be copied by private insurance companies. And yet, still, there are obstacles that limit its spread as of today. After a year of offering such policies in Syracuse, less than one hundred homeowners have signed up for policies. Still some design elements remain to be worked out in the framing or marketing dimensions to encourage people to enroll.

Managing Country Risks

The risks that individual countries face, particularly developing countries, have repeatedly dominated international news. Less-developed country debt crises are regular events, and they are unquestionably connected to changes in the economic fortunes of the countries.

There do not seem to be any well-developed institutions whereby a less developed country can buy insurance against its macroeconomic risks. Each country is expected to bear its own risks alone. The consequence of this lack of risk sharing is tragic: countries that start from a low living standard cannot afford economic failure. The existing institution of international lending provides some element of risk management for a country in the sense that, should the country find itself in great economic difficulty, it may expect to see the debt rescheduled or eliminated altogether. And yet this is a very disorderly system. Defaulting on national debt is not something that is achieved smoothly or reliably, and the default on the debt can disrupt the economy for many years.

One idea, applicable to small countries whose economies are dominated by certain commodities, is, at the date of the initial issuance of the debt, to tie their national debt to the prices of these commodities. Such debt arrangements, with what are called "value recovery rights," have actually been made by Mexico, Venezuela, Nigeria and Uruguay in the 1990s, though, surprisingly, the practice has not spread widely. Mexico has issued bonds tied to the price of the oil that it exports. Caballero [2001] has recently argued that Chile, a major copper exporter whose GDP has shown a substantial correlation with world copper prices, should index its debt to copper prices. But still Chile is not issuing such bonds.

Indexation of debt or other securities to macroeconomic variables has been mentioned at

various times in the past. Brainard and Dolbear [1971] spoke of creating risk management contracts related to occupational incomes. Merton [1983] described consumption-linked national debt as a part of an improved pension plan system. In a *Business Week* article, Norman Bailey [1983] advocated converting defaulted debt into a share of exports. Krugman [1988], and Froot, Scharfstein and Stein [1989] considered whether a defaulting country should index its debt to commodity prices or, alternatively, to its GDP, and worried about the moral hazard problems associated with the latter. Barro [1995] described bonds indexed to aggregate consumption as a vehicle for his scheme for optimal intertemporal national debt management. Recently, Borensztein and Mauro [2002, 2003] at the International Monetary Fund have advocated less-developed-countries sovereign debt tied to the country's own nominal GDP.

In my book *Macro Markets* [1993] I argued that a system of markets should be created that, just as the stock exchange is a market for long-term claims on corporations' incomes, should be a market for long-term claims on all major aggregate income flows: gross domestic products, occupational incomes, and service flows from commercial and residential real estate. The creation of a market for a wide array of income flows would provide an a major step forward in terms of opportunities for comprehensive risk management, as well as provide price discovery for major risks that are invisible today.

Issuance of instruments whose payouts are linked to GDP, or to other indicators of that GDP, of a country, whether these instruments are called securities or shares or bonds, could do a great deal to reduce country risk, and promote welfare. But, it has been difficult to get such markets started.

There are a few examples. Bulgaria issued sovereign debt in 1994 whose repayment was

tied to its own GDP to international investors, with the help of Citibank. This has helped

Bulgaria manage with rather disappointing economic growth overall since 1994. The idea of

GDP-linked debt was copied by Bosnia and Herzegovinia and Costa Rica, but despite some

advocacy, [Dreze 2000], has not spread further. Proposals have recently been aired that

Argentina should create GDP-linked debt as part of its post-crisis debt restructuring [Varsavski

and Braun, 2002]

Another indicator of macroeconomic risks is real estate risks. When Karl Case, Allan

Weiss and I tried to persuade futures exchanges to create new contracts for single-family home

prices [Case *et al.* 1993], our efforts yielded only very limited immediate success. We did

manage to persuade the Chicago Board of Trade to issue a press release in 1993 announcing

tentative plans to create indexed-based futures markets for single family homes, but they never

carried out these plans. Nine years later, other exchanges (Cityindex.co.uk and IGIndex.co.uk) in

the United Kingdom succeeded in creating futures markets for real estate in the United Kingdom.

The creation of these markets took a long time, and was not accomplished by the people we

talked to. Efforts to interest exchanges in creating markets either for real estate or for GDP never

really resulted in much reaction.

Recently, markets for macroeconomic aggregates were created, as part of the efforts of a

New York company Longitude, LLC, created by Jeffrey Lange and Andrew Lawrence; from a

theory developed by Lange and Economides [2001]. Their trading system has been implemented

by Deutsche Bank and Goldman Sachs in their new Economic Derivatives Market. They began

trading U. S. nonfarm payroll, a monthly economic indicator in October 2002. But, at the present

time their market is very short term and does not provide price discovery for the price today of a

long-term claim on a macroeconomic aggregate.

Allan Weiss and I secured a patent [1999] for a security, that we called macro securities that might provide a way for a broad investing public to take positions on long-term claims on indexes, such as home prices by city or gross domestic product by country. Our invention was to set up a framework whereby an exchange stands ready automatically to issue or redeem pairs of shares, a long and a short share, that together bear no risk, but that can be sold separately, the separate components entailing risk. The exchange invests the proceeds of its sale in safe investments such as the money market. The exchange sets up a cash account for both members of the pair, and keeps the balance in the long security's account proportional to the index by shifting funds between the long and short accounts. The exchange pays both the long and short interest on their respective cash account balances.

Thus, the exchange has created a security whose dividends rise and fall with the index, and a security whose dividends move opposite the index. The design is more user-friendly to investors than current futures markets are, and the form of these securities is familiar: it would appear like an ordinary stock. A person wishing to hedge an economic risk that is measured by an index can take either a short or long security to offset this risk, and doing so does not require any more attention or expertise than buying a stock today.

We have been working with, with the help of Sam Masucci and a number of people at the American Stock Exchange to develop macro securities. At this point have completed the legal work to make these securities salable to accredited investors, and there is a good prospect of creating securities that can be marketed to general retail investors, eventually to be traded on the American Stock Exchange.

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Still, the envisioned initial applications for these securities are to more familiar risks, such as stock prices or commodities, because of the formidable marketing problems in getting consumers interested in hedging the more important risks to livelihoods and homes. The trouble has been that our efforts to innovate to allow management of unconventional, and important, risks winds up, at least at first, applied to conventional risks.

Conclusion

The history of invention shows that formidable obstacles stand in the way of implementing simple ideas, but that innovations in design can eventually make them possible. I have stressed here that some of the most important obstacles are psychological, and that proper innovation can achieve better psychological framing of the innovations. Achieving this involves both design and marketing progress.

Achieving radical financial innovation is never easy. Doing so requires careful attention to design, experimentation to find the right design, and extensive marketing, and it requires cooperation from more of our society than just the isolated innovating firms that Baumol has stressed.

Historic changes in our risk management institutions are no more frequent than historical innovations in science or engineering. But, once such workable innovations are found, however, they eventually will be copied all over the world.

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