

Expanding the Scope of Individual Risk Management: Moral Hazard and Other Behavioral Considerations

Robert J. Shiller

Abstract

There is a large potential for improving individual risk management through new risk management contracts and associated new index-settled derivatives. However, there are some difficult problems in designing contracts so that they will be used effectively. Individuals have idiosyncratic individual risks that can be hedged only at some real resource cost due to moral hazard. Individuals seem to exhibit behavior indicative of lack of appreciation of the principles of risk management. These problems are discussed, and some potential new risk management contracts that would make improvements in the management of major income risks are proposed.

Despite a proliferation of derivative contracts around the world in recent decades, most of the risks that people face are still not being effectively hedged. Consider, for example, the risk to personal income that the representative individual in a country has. We can obtain an impression of the potential magnitude of this risk by looking at data on income measured by per capita gross domestic products (GDPs). Estimates of the uncertainty of log present values of 54 countries' per capita GDPs are presented in Table 1, based on an autoregressive model for log per capita real GDPs with Summers–Heston [1991] annual data 1950–90, using methods developed by Campbell and Shiller [1989] and described in Shiller [1993a,b] (see also Campbell, Lo and MacKinlay [1997], Chapter 7). The conditional standard deviations of the log present values are often over 30%, indicating great uncertainty about the standard of living for the representative individual in these countries.¹

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¹The numbers in Table 1 for individual countries must be interpreted with some caution. When a longer historical time series is used for the US alone, the estimated US uncertainty rises dramatically, see Shiller [1993a]. These numbers are presented here only to get a rough indication of the typical uncertainty that countries face.

This risk is certainly not being hedged. To try to do that with any seriousness under present institutional arrangements, people would need to take massive short positions in claims on income flows that correlate highly with their own national incomes. Certainly, nations do not take massive short positions in their own stock markets. The positions would certainly have to be massive, given that present values of country's GDPs are one or two orders of magnitudes larger than values of the same country's stock market. Moreover, attempting to hedge one's national income risk by such a method cannot work well, since there does not appear to be much correlation between present values of national incomes and stock market prices, see Shiller [1993a]. Plainly, this GDP risk is just not being hedged.

The risks to present values of GDPs are not the only risks that individuals face. Individuals within a country face income risks that are larger than GDP risks, since there is also individual variation in incomes around the national incomes. Moreover, individuals also face substantial risks by holding undiversified investments, risks not always measured by changes in their reported incomes. Most people in the United States and many other countries hold a substantial fraction of their wealth in the form of their own dwellings, a single and highly speculative (given the observed behavior of local real estate markets) investment.

Cash-Settled Index-Based Futures Markets for Major Economic Risks

I have argued in my book *Macro Markets* [1993a] and elsewhere [Shiller, 1993b] that new institutional arrangements are needed that will make it possible for people to hedge their major economic risks. Markets for long term claims on income flows, such as national incomes or occupational incomes should be set up.² Moreover, futures markets for illiquid assets such as single family homes should also be created (See Case Shiller and Weiss [1993], Shiller [1993a].)

One idea for a market that would permit hedging of long-term income risks as measured by income indices was called perpetual futures. A perpetual futures contract is a cash-settled index-based futures contract designed to generate a price that is in effect a price of a claim on an infinite stream of future income index values, and to allow hedging of these present values. With such contracts, people ought to be able to buy or sell, in effect, perpetual claims on the claim on the infinite stream of the future income index. The settlement

²Robert Merton [1983] has advocated a related idea, government issuance of consumption-indexed bonds, as part of his plan for consumption-indexed public pension plans. Marshall et al. [1992] proposed creating options and swaps on business cycle variables such as consumer confidence indices.

s_t every period (paid by a short in one contract to a long in one contract) is given by:

$$s_t = (f_t - f_{t-1}) + (I_t - r_{t-1}f_{t-1}) \quad (1)$$

where f_t is the price of the futures contract at time t , I_t is the index (usually a measure of some income flow at time t), and r_{t-1} is the return on an alternative asset between $t-1$ and t , such as the one-period nominal interest rate.³ I argued [1993a] that if provisions are made in the contract that would rule out extraneous bubbles, then the futures price f_t would in effect price the claim on the income stream I_t, I_{t+1}, \dots . Note that if f_t is indeed the price of a claim on the income stream I_t, I_{t+1}, \dots then this settlement is nothing other than the excess return between investing in a claim on the income stream and investing in the alternative asset.

If perpetual futures contracts were available on national incomes, individuals in a given country could hedge some of their own lifetime income risks by taking short positions in the perpetual futures market for their own country. They could then also effectively invest in the rest of the world by taking long positions in the futures markets for other countries. The general equilibrium for the world economy, assuming utility-maximizing individuals, is described in Shiller and Athanasoulis [1995] and Athanasoulis and Shiller [1996].

Other kinds of cash-settled index futures could be used to make liquid some presently illiquid investments, notably real estate. Futures and options markets can be set up that are cash settled based on real estate price indices. Real estate futures, both commercial and residential, were created in London in 1991, unsuccessfully. In 1994 Barclays de Zoete Wedd (BZW) created Property Index Certificates (Pics) which are essentially bonds whose dividends are tied to a commercial real estate price index. In November 1996 BZW also created what are essentially UK commercial real estate index settled futures, although there is no clearing house and BZW is always one side of the contract. An industry-wide group led by AMP Asset Management (the fund management component of Australia Mutual Provident), plans to start true index-settled UK commercial real estate futures markets in 1997.⁴

A serious potential problem for any real estate derivative instruments is that, because of unmeasured heterogeneity in the actual real estate, the indices may not be reliable guides to values. These problems could be reduced if repeat sales price indices are used for settlement (Case and Shiller [1989], Case Shiller and Weiss [1991], Shiller [1991], Shiller

³Anthony Neuberger [1996] later described a similar idea, which he called "Peter Pan futures."

⁴"A Dip Into Derivatives," *Financial Times*, November 8, 1996, p. 12.

[1993a,b]).⁵ The potential improvement in real estate price indices using repeat sales methods may be especially high for individual homes, for which there are vast numbers of sales. There at present no liquid markets for home price index risk; and creating such markets would be of great importance.

Institutions to Allow Individuals to Manage their Income Risks

While futures and options contracts could be created today that would allow people with sufficient margin to hedge these risks, there are still institutional changes that must be made to allow individuals to hedge effectively.

An important problem that individuals would face in attempting to hedge their personal income risks or real estate risks on such markets is that they would generally not have the margin be able to commit to such a contract for very long. Given that both expected present values of lifetime incomes and values of single family homes can often move up or down by amounts of the same magnitude as a year's income, and given that most people do not have savings that are much more than this, they would tend to be unable to meet margin calls.

What is needed to make such markets work for individuals are retail contracts that commit them to pay out of their own future incomes if their incomes should unexpectedly increase, and to receive income if their incomes should unexpectedly decrease.

Bankruptcy laws today present an obstacle to the creation of lifetime income risk management contracts for individuals. An individual who has a favorable turn in his or her lifetime income, and who would then be on the losing end of the risk-management contract, may be able to declare bankruptcy to wipe out the contracts. Bankruptcy can be generated artificially to abrogate the contract, while preserving the basic human capital source of future income. It is also possible also that individuals can later challenge contracts on a legal principle against enslavement.

It is plausible that someday it will be legally possible for individuals to commit to pay out of their lifetime income. Governments ultimately recognize the value of having enforceable contracts, and devote resources to enforcing such contracts. This does not mean that governments need enforce all contracts that people make to pay out of their lifetime income; people who sell themselves into slavery on a bet may still be protected from their own impulsiveness. Governments need only sanction contracts that serve a sensible risk-management purpose.

⁵The Chicago Board of Trade in 1993 announced its intention to produce cash-settled index-based real estate futures based on repeat sales indices produced by our firm, Case Shiller Weiss, Inc., Cambridge MA. These plans have been put on indefinite hold, however.

Any effective risk management program for individuals would have to be managed by some institutions that package these contracts effectively for them, and market and service them. I will imagine here that the risk management contracts are offered to individuals by insurance companies, who might then hedge the risk they acquire by writing these insurance contracts in the index-settled futures markets.

Moral Hazard and Individual Risk Management Contracts

Insurance contracts for individuals that pay them when some income aggregate that is correlated with their own incomes declines, and requires them to pay when it increases, will help risk management a great deal. Moreover, retail insurance contracts that pay homeowners when the a single-family home price index for their geographic area decreases, and requires them to pay when it increases, will also help. However, retail markets for such income insurance would function much better if the settlements could be based in part on the individual's own income or own home price. Certainly, since the correlation between any income aggregate and an individual's income is bound to be less than perfect, there will be cases when the income aggregate moves up while the individual's income moves down. Since the correlation between the home price index and the individual's own home value is less than perfect, there will be cases when the home price index moves up when the individual's home price moves down. These circumstances would put the hedged individual in a doubly unfortunate position, having to pay on the futures contract at the same time that own economic well being has decreased. It would be natural in creating retail insurance contracts to specify in advance that a person in such a circumstance need not pay in full even though the income or price index has increased. Thus, it is very natural to create retail contracts that depend in one way or another on the individual's own circumstances.

If we create individual insurance contracts, then we must face up to the "moral hazard" that individuals, once their income or other measure of economic well being is insured, will "get lazy" and not work so much any more, hoping to benefit on their risk contracts from having lower earned income. Of course, there could be contract provisions against people's quitting their jobs to take long vacations, but there are still many steps that could be taken by individuals to create the appearance of lower earning potential that would be difficult for the insurer to detect. The individual could just not try as hard on the job, and thereby risk not being selected to promotion to higher paying jobs. The person could manage to lose a high-paying stressful or unpleasant job, and then substitute a more congenial low-paying job. Obviously, the insurer would find it difficult to prove in court that these changes were purposeful for benefiting from the risk management contract, and not imposed on the individual by life's exigencies.

The presence of risk-management contracts may also serve to motivate people to switch their income-producing activities to the non-market or underground sector. Thus, for example, people may work only part time, and earn the rest of their income for odd jobs paid in cash, so as to reduce their reported income for contract settlement purposes. They may add rooms to their own home or repair the roof on their own home, rather than hire professionals to do these things. Contract provisions could expressly require that such activities be reported as income-producing activities, and those who violate the contract in a major way could be subject to strict penalties. One may doubt that insurance companies could enforce such contracts well; indeed, many governments seem to have largely given up on taxing such unreported income. But private insurance companies may have some advantages over governments in this respect: they do not have to agree to insure parties whose circumstances makes it appear likely that such non-market income opportunities will be important, they do not need to worry about the appearance of inequity if certain parties appear to be unfairly advantaged by the contracts, and they do not have to worry about the political repercussions of pursuing people for not reporting such non-market incomes. Still, there will remain some risk that people who have signed income risk management contracts will, by altering the nature of their activities, succeed in underreporting their true income.

Insurance policies on the market value of an individual's home are also subject to moral hazard. If an individual knew that the house's value is completely insured, then the individual has less incentive to maintain the home properly, and may even alter the home to idiosyncratic tastes in such a way as to harm its market value.

The impact of such moral hazard can be reduced to the extent that the contract can be written in terms of factors that correlate with the individual's income or home price but which are not under the control of the individual. Let us consider how the income risk management contracts should be designed in the case where there is an imperfect indicator of the individual's earning potential, let us say the average per capita income for persons in that individual's category. We want to characterize the optimal contract, which specifies how much the payments to be made depend on the income indicator and how much on the individual's own income.

To simplify the exposition, let us consider a simple model influenced by the optimal employment insurance literature and the literature on moral hazard (e.g., Holmstrom [1978], Mirrlees [1976], and Ross [1973]). Mine is a one-period model (the period is a lifetime long). The contract payments are presumably made evenly throughout the lifetime, not all at once, though the model is represented as occurring at a point in time. All individuals have the same utility function $U(C,E)$ in terms of two parameters, which I shall call consumption (C) and ease (E). This utility function follows in the tradition of utility functions for both consumption and effort or action that are widely used in the moral hazard literature.

The individual's earned income is $Y = A + W(1 - E)$, where $A > 0$ is an indicator of aggregate per capita income for this individual's occupation or country, 1 is the total stock of ease that could be given up for the purpose of earning more income, and $W > 0$ is the rate at which income is generated by foregoing ease, the wage to sacrificing ease, so to speak. The two sources of noise are A and W , both assumed known to the individual when he or she makes the consumption and ease decision, but unknown to everyone when the risk-management contract is signed. The person signs a risk management contract with an insurer that promises to pay to that person an amount $g(A, Y)$, so that the person can have consumption $C = Y + g(A, Y) = A + W(1 - E) + g(A, A + W(1 - E))$. The function $g(A, Y)$ has two observables as arguments, the aggregate component of income A , shared by everyone and hence not subject to moral hazard influences, and the individual's own income Y . In equilibrium, W will later also be revealed to the contractor, since all individuals have the same utility function and differ from each other only in terms of W , so that there is a one-to-one correspondence between Y and W , given A . There still will be a moral hazard problem, since individuals will be consuming more ease than they otherwise would in order not to lose out on their contract returns. It will be apparent that the problem set up here closely resembles that of Holmstrom [1979].

Let us suppose, to simplify this analysis of moral hazard problems, that the insurer is risk neutral and competitive with other such insurers, so that the contract must have the property that $\mathcal{E}g(A, Y) = 0$ where \mathcal{E} is the expectations operator.⁶

For the individual who has signed a contract specifying payment $g(A, Y)$, the utility maximization problem is one without uncertainty, since the individual is supposed to know both A and Y . The utility maximizing amount of ease E is that which satisfies the Euler equation:

$$U_C(E)(1 - g_Y)W = U_E(E).$$

The problem for the contract designer, given probability distributions for both $A > 0$ and $W > 0$, is to choose the function $g(A, Y)$ in such a way as to maximize expected utility of the individual and such that $\mathcal{E}g(A, Y) = 0$. Closed form solutions of this contract designer problem for simple utility functions and for simple assumptions about the joint distribution of A and W do not in general appear to be possible to obtain. The optimal function $g(A, Y)$ will in general be nonlinear, except in special cases. Holmstrom and Milgrom [1987] have shown that in a problem like this, if utilities are additively separable and of the exponential

⁶There are other more complicated stories that could be told, where the individual is sharing risks with others, and where the expected gain from the contract depends on the covariance of its payments with other's incomes.

class, then the $g(A, Y)$ will be linear; however the exponential utility has some undesirable properties (consumption will sometimes be negative).

To illustrate the nature of the solution, I assumed a Cobb–Douglas utility function $U(C, E) = C^\alpha E^{1-\alpha}$, and I approximated the function $g(A, Y)$ with a linear function, $g(A, Y) = g_0 - g_A A - g_Y Y$, $0 \leq g_Y \leq 1$, $0 \leq g_A \leq 1 - g_Y$. (Note that shocks to A will affect settlement both directly through the g_A term and indirectly through the g_Y term, to the extent that the shock to A affects individual income Y .) Substituting $((1 - g_Y)(A + W - EW) + g_0 - g_A A)$ for C in the utility function and differentiating, we find that the optimized value of E is then:

$$E = \frac{(1 - \alpha)((1 - g_Y - g_A)A + g_0)}{(1 - g_Y)W} + 1 - \alpha. \quad (2)$$

Given that E will be so chosen, the g_0 must be chosen so that the expected payout is zero. This g_0 is thus:

$$g_0 = \frac{\left(g_Y + g_A - \frac{g_Y(1 - \alpha)(1 - g_A - g_Y)}{(1 - g_Y)} \right) \mathcal{E}(A) + \alpha g_Y \mathcal{E}(W)}{1 + \frac{1 - \alpha}{1 - g_Y} g_Y}. \quad (3)$$

The income earned by the person who is subject to the contract is:

$$Y = \left(1 - \frac{(1 - \alpha)(1 - g_A - g_Y)}{1 - g_Y} \right) A + \alpha W - \frac{(1 - \alpha)g_0}{1 - g_Y}. \quad (4)$$

So that income is positively impacted by A and W . Note that in some realizations income may be negative, but consumption will never be negative.

Average income \bar{Y} for people who share the same A can be found by substituting $\mathcal{E}W$ for W in equation (4). This might be per capita national income if the grouping to which A corresponds is a country, or average occupational income if the grouping is an occupation.

We may, using the expression for \bar{Y} , rewrite the risk sharing rule $g(A, Y)$ in terms of \bar{Y} and Y rather than A and Y . Before we do this, though, we must specify what fraction of people are covered by the risk management contract. One extreme to consider is that in which no one else is covered by the contract: this is a realistic situation when the contracts are new. In this case, we would set $g_0 = g_Y = g_A = 0$ in (4) in determining \bar{Y} , though of

course not when considering the optimal risk-sharing rule for the subject person; let us call the risk-sharing rule for this person in this case $j(\bar{Y}, Y) = j_0 - j_{\bar{Y}}\bar{Y} - j_Y Y$. Then, while j_Y equals g_Y , $j_{\bar{Y}}$ equals g_A/α ; $j_{\bar{Y}}$ is greater than g_A because aggregate income moves less than one for one with the shock to income A . For example, if A falls, then people will work harder (E will go down) and income will not fall as much as A has. Another extreme to consider in determining \bar{Y} is a situation in which everyone is covered by the contract, in which everyone has the values of g_0 , g_Y and g_A that the subject person has; let us call the risk-sharing rule in this case $k(\bar{Y}, Y) = k_0 - k_{\bar{Y}}\bar{Y} - k_Y Y$. We then have, as before, that $k_Y = g_Y$, but now $k_{\bar{Y}} = g_A / (1 - ((1 - \alpha)(1 - g_A - g_Y) / (1 - g_Y)))$. If $g_A > 0$, then $k_{\bar{Y}} < j_{\bar{Y}}$, in effect since with other people hedging, they will not need to offset shocks to their income by changing their level of E , and so shocks to A will feed more fully into income when other people are hedging. In general, $g_A \leq k_{\bar{Y}} \leq j_{\bar{Y}}$.

I wrote a computer program that performs a grid search over values of the parameters g_A and g_Y to find the parameter values that maximize expected utility. For each value of the pair g_A and g_Y , under the assumption that A and W are independently lognormally distributed the program produced g_0 , using (3) and the expression for the mean of the lognormal distribution. The program estimates for each parameter pair g_A and g_Y the expected utility by averaging 1,000,000 randomly generated utilities, using (2) substituted into the utility function and a lognormal random number generator. We may then choose the g_A and g_Y to achieve highest expected utility.

We may now go through various special cases to give us some understanding of the nature of the optimal risk-management contract. First, it should be obvious that if $\sigma_A = \sigma_W = 0$, that is if there is no risk, then g_A , $j_{\bar{Y}}$ and $k_{\bar{Y}}$ are irrelevant and $g_Y = j_Y = k_Y = 0$. It does not matter whether the contract is made to vary with the aggregate income \bar{Y} if aggregate income does not vary, but it does matter whether the contract is made to vary with own income, since this creates a distortion, altering people's behavior. If g_Y is greater than zero, then the contract functions like a distortionary tax with tax proceeds refunded, and this is welfare reducing.

If $\sigma_A = 0$ and $\sigma_W > 0$, then while g_A , $j_{\bar{Y}}$ and $k_{\bar{Y}}$ are still irrelevant, now g_Y , j_Y and k_Y are greater than zero. While making these greater than zero creates a distortion, doing this also serves a risk reduction function. If σ_W is small, then g_Y , j_Y and k_Y will also be small, since the cost of the distortion is not offset by much risk reduction. If σ_W gets very large, then g_Y , j_Y and k_Y all approach one, though they are far below one for any realistic values of σ_W .

If $\sigma_A > 0$ and $\sigma_W = 0$, then, regardless of the magnitude of σ_A , $g_Y = 0$ and $g_A = 1$, $j_{\bar{Y}} = 1/\alpha$. and $k_{\bar{Y}} = 1$. There is no need for a distortionary g_Y , and the entire shock should be hedged. Note that $j_{\bar{Y}}$ is greater than one: one ideally hedges aggregate income risks more than one-for-one, since if others are not hedged, they are working harder when income is down,

sheltering aggregate income from some of the shock to their budget constraint: to eliminate shocks to one's budget constraint, and to avoid having to work harder as do others, one needs to hedge more.

If $\sigma_A > 0$ and $\sigma_w > 0$ (there is both aggregate uncertainty and individual uncertainty) then in general g_A , $j_{\bar{Y}}$ and $k_{\bar{Y}}$ will be greater than zero, and g_Y , j_Y and k_Y will also be greater than zero. The optimal contract pays off in relation both to aggregate income risks and to individual income risks. The payoff to A risks now, however, becomes less than one to one, and $g_A + g_Y$ becomes less than one. Indeed, even if we constrain g_Y to be zero, the optimal g_A is less than one. The response to aggregate income \bar{Y} , that is the coefficients $j_{\bar{Y}}$ and $K_{\bar{Y}}$, can be either greater or less than one. Of course, at the other extreme, if we constrain g_A to be zero, then the optimal g_Y will be less than one, and welfare will be reduced.

An important lesson from this analysis is that while risk management contracts that aggregate income are useful, it is better if the contracts respond to individual income as well. The "moral hazard" problem should be thought of as a distortion problem, like the distortion imposed by taxes, and not as a problem that hampers insurance company's ability to issue income risk management contracts.⁷

The Failure of Most Current Hedgers to Hedge Properly

In addition to the moral hazard concerns discussed above, there are other concerns about human behavior patterns that may inhibit proper use of risk management contracts: the ambitious new risk management contracts proposed in this paper may seem unrealistic, given the public's slowness to adopt enlightened risk management policy, even where the institutions already exist for such risk management. Existing risk management opportunities are not generally properly exploited.

It was noted above that few people today take short positions in their own country's stock market, as would generally be optimal assuming a positive correlation between the stock market and the people's own personal incomes. Moreover, most people do not properly diversify their investment portfolio internationally, even though they could do so under contemporary institutional arrangements.

People show a tendency to wish to contract in nominal terms, rather than to have their contracts indexed to consumer price indices. People usually, in low or moderate inflation countries, seem to prefer that long-term pension payments, child support, or alimony claims

⁷The moral hazard problem that was discussed above is conceptually separate from a selection bias problem: insurance companies that offered these policies to the public would risk attracting the laziest people. Selection bias problems can be addressed using techniques already well known in the insurance industry, for example offering only group policies.

be defined in fixed dollar terms, despite the urging of economists that indexed contracts are preferable. There appear to be many reasons why people do not want indexation; a prominent reason among them seems to be an imperfect understanding of the extent of long-term risks faced, a failure to add up the short-term uncertainties to arrive at a proper measure of long-term uncertainty, see Shiller [1996].⁸

Even professional financial managers seem to behave as if they lack appreciation of long-term risks. Risks to present values of cash flows, rather than risks to cash flows in the next quarter or year, should be the centerpiece of most risk management efforts. And yet, evidence is that most risk management today concerns short-run or short-horizon concerns, except where there already exist derivative markets for the present values themselves.

Of course, portfolio managers who protect their positions in equities from stock market risk by shorting stock index futures are hedging themselves against risks to the present value of the dividends paid by the firms. Here, it is not surprising that they would be hedging present value risk, since as portfolio managers they are in the business of dealing with highly-visible and tangible risks to the stock prices.

However, the nonfinancial firms themselves, who also take positions in derivative markets to manage risks, seem less likely to concern themselves with present values, and instead their hedging behavior is transactions-driven: firms tend to hedge only the risks that are associated with specific contracts or anticipated transactions.

The Wharton School 1995 Survey of Derivatives Usage by U.S. Nonfinancial Firms (Bodnar and Marston, 1996) surveyed 350 nonfinancial firms, 176 manufacturing firms, 77 primary products firms, and 97 service firms. They asked the firms who hedged what was the most important objective of hedging strategy. The most commonly chosen answer, chosen by 48% of respondents, was managing “cash flows,” followed by “accounting earnings (42% of respondents). Only 8% chose “market value of firm” as the objective. (An additional 1% chose “balance sheet accounts as the objective.) While there is a margin for error in interpreting these answers, it appears that their choice of cash flows for their most common answer reflects a short-run concern.⁹ Their second most common answer, managing accounting earnings, appears to reflect a concern with maintaining appearances, as indeed the authors of the study interpreted this answer.

The survey also asked respondents to describe the frequency of foreign currency transactions by exposure category. Fifty percent of respondents said they frequently hedged

⁸ There is also a tendency for “money illusion,” a tendency to trust nominal, rather than inflation-corrected quantities, see Shafir, Diamond and Tversky [1997].

⁹ Some other studies have shown more encouraging views of the state of risk management by firms, Dolde [1993], Culp and Miller [1995], however these studies concentrated on rather larger firms.

anticipated transactions expected in less than one year, while only 11% said they frequently hedged transactions expected in more than a year. Forty-nine percent said they frequently hedged contractual commitments, but only 8% said they hedged their competitive/economic exposure. These results strongly suggest that firms use hedging only to deal with the most concrete and tangible risks, such as the risks that affect their immediate cash flow, and disregard more the important risks to all subsequent cash flows.¹⁰

If even the professionals running these firms are not properly motivated in their hedging strategy by long-term considerations, then it may seem just too much to expect ordinary individuals to appreciate the value of hedging vehicles that help them manage their long-term risks.

But let us not be too pessimistic. With proper “human engineering” of the instruments and proper marketing it may be possible to encourage people to move to better risk management.

Public Resistance to Individual Risk Management Devices

Even though effective risk management tools seem to have a long way to go before they are accepted by the public, there is some reason for optimism that someday people can learn to use better risk management methods. People now routinely pay for some risk management contracts that were once unknown, for example life and health insurance contracts. Progress has been made in individual risk management, and it is reasonable to hope for more progress in the future.

Public resistance to new risk management products can be dealt with in the short run by creating risk management products that are modifications of contracts that people already pay for, and that incorporate enlightened risk management provisions as add-ons to existing contracts. People may respond better to policies insuring them against adverse shocks to their incomes if these policies are presented as add-ons to their life insurance policies or pension plans. People may well respond positively to home equity insurance, and to insurance which is long term and which insures the real value rather than the nominal value of the home, if it is an option to extend an existing mortgage or insurance contract.

Adding New Risk Management Features to Existing Contracts

I shall consider here five existing contracts that individuals enter in to on which new risk-management add-ons might be useful: home mortgages, homeowner’s insurance, life

¹⁰Stulz [1995] offers a similar interpretation of the state of risk management by firms.

insurance, disability insurance, and pension plans. All of these contracts share the characteristic that they are signed at times of important lifetime decision making. These are good times for people to make other important risk hedging decisions as well, when they are thinking of important issues, and thus when legal or other counsel is already available.

Any of these five existing contracts may thus, after suitable modification, serve as the retail conduit of important new risk management schemes, and, ideally, the institutions who take the other sides of these contracts would then in turn hedge the risks they acquire by writing such contracts in new index-settled derivative markets such as income or real estate futures or options markets. Our interest here is of course in the retail side of risk management, since individuals are themselves unlikely to participate directly in financial derivatives contracts.

Home mortgages appear to be very useful instruments to take as a basis for new risk management contracts, particularly for younger individuals. It was noted above that a fundamental problem that young people face in hedging against shocks to their own future income risks is that they do not have any wealth to put up as margin in any futures contract, and they do not have much ability to commit their own future income to obtain such collateral, because of bankruptcy laws. We shall suppose that these same bankruptcy laws will also not permit mortgage contracts that they cannot also walk away from, if they will accept losing the house. But, signing a mortgage contract is costly and difficult to do, and so abrogation of such contracts is difficult, especially after the mortgage is partly paid off.

A home mortgage contract might be designed that lengthens/shortens the required stream of payments and mortgage balance if income indices corresponding to that homeowner increase/ decrease and if home prices in the homeowner's neighborhood increase/decrease, and, with less than one-to-one coverage, if the homeowner's own income and the selling price of the property itself increase/decrease. The contract might insure the homeowner against fluctuations in real estate prices, and this would tend to eliminate the disincentive that sometimes appears to sell the home if home prices fall. There is not likely to be enough value in the homeowner's commitment to the home to allow complete hedging of the present value of income risk, but there ought to be some ability to do so.

Of course, with such a contract there is a risk that young people will see an increase in their incomes just after they buy the house, so that their net worth in the contract turns negative. Even if they do not wish to walk away from the contract, they may still be in trouble should they desire to move, since they may now owe more than the value of the house. However, the mortgage contract could require the mortgage lender to transfer the terms to the next house that the person buys, to prevent a locked in effect. The contract should also specify that if the homeowner chooses to refinance the mortgage with another

lender, he or she would be required to make good on any losses incurred on the risk-management add-ons to the mortgage.

Homeowner's Insurance in its present form is perhaps a less suitable contract on which to add new risk management features because it is not naturally a long-term contract and does not pledge the property as collateral, but the contract could be altered to pledge some of the potential increased value of the house should real estate prices go up. Homeowner's insurance may be a useful contract to connect new home price risk management devices with, since the concept of homeowner's insurance might naturally lend itself in individuals' minds with home price insurance.

Disability insurance might naturally be altered so that the payment if disabled in future years takes account both of the insured's potential income, if he or she had remained employable, and possibly also the value of the insured's home. There might be an advantage to tying payments to disabled people's income to an index of the occupational class to which that person belongs, so as to reduce the moral hazard to affect disability should a decline in the individual's potential income make such moral hazard more serious a risk. On the other hand, to the extent that such moral hazard is not an important factor, disability payments might best be tied to an index of world income.

Life insurance policies would logically include a component that insures the beneficiary against adverse turns in the beneficiary's own income. Whole life insurance policies with cash value have a natural source of margin, in effect, to be used for income futures contracts.

Pension plans offer different risk-management opportunities. Retired persons with most or all of their income coming from investables would make very different use of risk management contracts. With no labor income, they do not have the same incentive to make investments that correlate negatively with labor income indices. Their expected social security receipts might, however, be expected to respond to national income risks, given the politics that determines these, and they may still have an incentive to take some risk management position in their own national income. More generally, they would ideally diversify their investments beyond just the traditional investments, and into claims on income flows such as national incomes. Pension funds investing on their behalf may do this for them.

Table 1
 Estimated Standard Deviations, Innovations and Present Values,
 Using Real Per Capita GDPs, 54 Countries (percent)

| | S(I) | S(PV) | | S(I) | S(PV) |
|-------------|-------|-------|----------------|-------|-------|
| Argentina | 9.86 | 79.58 | Kenya | 4.40 | 35.51 |
| Australia | 3.18 | 25.67 | Luxembourg | 2.40 | 19.37 |
| Austria | 3.18 | 25.67 | Mauritius | 6.20 | 50.04 |
| Belgium | 3.71 | 29.94 | Mexico | 6.01 | 48.51 |
| Bolivia | 5.45 | 43.99 | Morocco | 3.01 | 24.29 |
| Brazil | 5.86 | 47.29 | Netherlands | 4.72 | 38.09 |
| Canada | 2.56 | 29.66 | New Zealand | 2.85 | 23.00 |
| Chile | 4.90 | 39.55 | Nigeria | 10.74 | 86.68 |
| Columbia | 3.42 | 27.60 | Norway | 2.21 | 17.84 |
| Costa Rica | 6.35 | 51.25 | Pakistan | 3.07 | 24.78 |
| Cyprus | 3.22 | 25.99 | Panama | 7.08 | 57.14 |
| Denmark | 3.56 | 28.73 | Paraguay | 6.11 | 49.31 |
| Dominica | 6.75 | 54.48 | Peru | 11.06 | 89.26 |
| Ecuador | 5.89 | 47.54 | Philippines | 3.68 | 29.70 |
| Egypt | 3.33 | 26.88 | Portugal | 7.00 | 56.50 |
| Finland | 3.43 | 27.68 | El Salvador | 9.20 | 74.25 |
| France | 5.27 | 42.53 | South Africa | 8.68 | 70.05 |
| Germany (W) | 4.39 | 35.43 | Spain | 6.60 | 53.27 |
| Greece | 7.87 | 63.52 | Sweden | 3.75 | 30.27 |
| Guatemala | 6.13 | 49.47 | Switzerland | 4.33 | 34.95 |
| Guyana | 11.04 | 89.20 | Thailand | 5.02 | 40.52 |
| Honduras | 4.58 | 36.96 | Trinidad | 8.75 | 70.62 |
| India | 5.10 | 41.16 | Turkey | 3.59 | 28.97 |
| Ireland | 2.79 | 22.52 | United Kingdom | 1.14 | 9.20 |
| Iceland | 4.53 | 36.56 | United States | 1.62 | 13.07 |
| Italy | 5.08 | 41.00 | Uruguay | 4.44 | 35.83 |
| Japan | 8.38 | 67.63 | Venezuela | 9.18 | 74.09 |

Note: This table presents standard deviations computed by the author using annual data on real per capita gross domestic products 1950–90 from the Penn World Table, Summers and Heston [1991], using methods described in Shiller [1993]. For each country, a tenth-order autoregression was estimated for the change in log real per capita GDP. From the estimated autoregressive model, percentage standard deviations were derived using log-linear approximations derived in Campbell and Shiller [1989]. S(I) is the estimated standard deviation (times 100 to convert to percent) of the annual innovation in the (natural) log expected present value of real per capita GDP. S(PV) is the estimated standard deviation (times 100) of the (natural) log time t present value of real per capita GDP conditional on information as of time t . Thus, for example the estimated uncertainty for log present value of real per capita GDP in Argentina is 79.58%. The annual discount factor used for present values is 0.936.

References

- Atkeson, A., and Robert E. Lucas, "On Efficient Distribution with Private Information," *Review of Economic Studies*, **59**: 427–53, 1992.
- _____, "Efficiency and Equality in a Simple Model of Efficient Unemployment Insurance," NBER Working Paper No. 4381, 1993.
- Athanasoulis Stefano, and Robert J. Shiller, "The Significance of the Market Portfolio," reproduced, Iowa State University, 1996.
- Bodnar, Gordon, and Richard Marston, "1995 Survey of Derivatives Usage by US Non-Financial Firms," reproduced, Wharton School, University of Pennsylvania, 1996.
- Campbell, John Y., Andrew W. Lo, and A. Craig MacKinlay, *The Econometrics of Financial Markets*, Princeton University Press, Princeton New Jersey, 1997.
- Campbell, John Y., and Robert J. Shiller, "The Dividend-Price Ratio and Expectations of Future Dividends and Discount Factors," *Review of Financial Studies*, **1**: 195–228, 1989.
- _____, "A Scorecard for Indexed Government Debt," NBER working paper, 1996, forthcoming, *NBER Macroeconomics Annual*.
- Case, Karl E., Robert J. Shiller and Allan N. Weiss, "Index-Based Futures and Options Trading in Real Estate," *Journal of Portfolio Management*, Winter 1993, pp. 83–92.
- Culp, C. and Merton H. Miller, "Hedging in the Theory of Corporate Finance: A Reply to Our Critics," *Journal of Applied Corporate Finance*, **8**:121–127, Spring 1995.
- Dolde, Walter, "The Trajectory of Corporate Financial Risk Management," *Journal of Applied Corporate Finance*, **6**: 33–41, Fall, 1993.
- Financial Times*, Tuesday October 17, 1995, p. 26.
- Green, Edward, "Lending and the Smoothing of Uninsurable Income," in E. Prescott and N. Wallace, eds., *Contractual Arrangements for Intertemporal Trade*, Minneapolis, University of Minnesota Press, 1987.
- Holmstrom, Bengt, "Moral Hazard and Observability," *The Bell Journal of Economics*, **10**: 74–91, Spring 1979.
- Holmstrom, Bengt, and Paul Milgrom, "Aggregation and Linearity in the Provision of Intertemporal Incentives," *Econometrica*, **55**(2): 303–28, March 1987.
- Marshall, J. F., Bansal, V., Herbst, A. F., and Tucker, A. L., "Hedging Business Cycle Risk with Macro Swaps and Options," *Continental Bank Journal of Applied Corporate Finance*, **4**(1): 103–108, 1992.
- Merton, Robert C., "On Consumption-Indexed Public Pension Plans," in Zvi Bodie and John Shoven, editors, *Financial Aspects of the United States Pension System*, Chicago, National Bureau of Economic Research/University of Chicago Press, pp. 259–90, 1983.
- Mirrlees, James, "The Optimal Structure of Incentives and Authority within an Organization," *The Bell Journal of Economics*, **7**(1): 103–131, Spring 1976.
- Nance, Deana R., Clifford W. Smith, and Charles W. Smithson, "On the Determinants of Corporate Hedging," *Journal of Finance*, **48**: 267–284, March 1993.

- Neuberger, Anthony, "The Peter Pan Contract — A Futures Contract that Never Matures," IFA Working Paper 212–195, London Business School, May 1995.
- Phelan, Christopher, "Incentives and Aggregate Shocks," *Review of Economic Studies*, **61**: 681–700, October, 1994.
- Phelan, Christopher, and Robert Townsend, "Computing Multiperiod Information-Constrained Equilibria," *Review of Economic Studies*, **58**: 853–881, 1991.
- Ross, Stephen, "The Economic Theory of Agency: The Principal's Problem," *The American Economic Review*, **63**: 134–139, 1973.
- Shafir, Eldar, Peter Diamond, and Amos Tversky, "On Money Illusion," forthcoming, *Quarterly Journal of Economics*, 1997.
- Shavell, Steven, and Lawrence Weiss, "The Optimal Payment of Unemployment Insurance Benefits Over Time," *Journal of Political Economy*, **87**: 1347–1362, 1979.
- Shiller, Robert J., *Macro Markets: Creating Institutions for Managing Society's Largest Economic Risks*, Oxford University Press, 1993. (a)
- Shiller, Robert J., "Measuring Asset Value for Cash Settlement in Derivative Markets: Hedonic Repeated Measures Indices and Perpetual Futures," *Journal of Finance*, **68**: 911–931, July 1993. (b)
- Shiller, Robert J., "Why Are People So Indifferent to Indexation?" reproduced, Yale University, 1996.
- Shiller, Robert J., and Stefano Athanasoulis, "World Income Components: Measuring and Exploiting International Risk Sharing Opportunities," with Stefano Athanasoulis, NBER Working Paper No. 5095, April 1995.
- Shiller, Robert J., and Ryan Schneider, "Indices of Labor Income Designed for Use in Contracts Promoting Income Risk Management" NBER Working Paper, 1995.
- Shiller, Robert J., and Allan N. Weiss, "Home Equity Insurance," forthcoming, *Journal of Real Estate Finance and Economics*, 1996.
- Smith, Clifford W. and Rene M. Stulz, "The Determinants of Firms' Hedging Positions," *Journal of Financial and Quantitative Analysis*, **20**: 391–405.
- Stulz, Rene M., "Rethinking Risk Management," reproduced, Ohio State University, 1995.
- Summers, Robert, and Alan Heston, "The Penn World Table (Mark 5): An Expanded Set of International Comparisons," *Quarterly Journal of Economics*, **106**: 1–41, 1991.
- Tufano, P., "Who Manages Risk? An Empirical Examination of the Risk Management Practices of the Gold Mining Industry," unpublished working paper, Harvard University, Cambridge MA, 1995.
- Wang, Cheng, and Stephen Williamson, "Unemployment Insurance with Moral Hazard in a Dynamic Economy," *Carnegie-Rochester Conference Series on Public Policy*, **44**: 1–42, June, 1993.