

# **Limited Participation and Consumption-Saving Puzzles: A Simple Explanation**

Todd Gormley, Hong Liu and Guofu Zhou\*

First draft: January 2006  
Current version: February 2008

---

\*All authors are from Washington University in St Louis. We thank Thorsten Beck, Jian Cai, John Campbell, Phil Dybvig, Michael Faulkender, Cam Harvey, Juhani Linnainmaa, Mark Loewenstein, Costis Skiadas, Rong Wang, Kangzhen Xie, and seminar participants at Washington University in St. Louis for their helpful comments. All remaining errors are our own.

Corresponding Author: Professor Hong Liu, Olin Business School, Washington University, St. Louis, MO 63130. Phone: (314) 935-5883 and e-mail: liuh@wustl.edu

# Limited Participation and Consumption-Saving Puzzles: A Simple Explanation

## Abstract

In this paper, we show that the existence of a large, negative wealth shock and the lack of insurance against such a shock can explain both the limited stock market participation puzzle and the consumption-saving puzzle that are widely documented in the literature. This result holds for a general class of investor preferences and stock market characteristics, no matter how unlikely such a wealth shock is. This explanation for limited participation does not require nonstandard preferences, transaction costs, or a positive income beta with short-sale constraints; nor does this explanation of the low consumption, high saving puzzle require income growth or demographic shifts. Moreover, we show that an increased availability of insurance can dramatically increase both stock market participation and current consumption, and significantly decrease saving. We conduct an extensive empirical analysis and find strong empirical support for these results.

*Journal of Economic Literature* Classification Numbers: D11, D91, G11, C61.

Keywords: Limited participation, Insurance, Saving, Consumption

As Campbell states in his 2006 presidential address: “Textbook financial theory implies that all households, no matter how risk averse, should hold some equities if the equity premium is positive.” In contrast, less than 50% households in the U.S. participate in the stock market and far less in many other countries.<sup>1</sup> More importantly, this limited participation has a significant impact on the equilibrium risk premium, diversification discount, liquidity, and market crashes.<sup>2</sup> In a growing and parallel literature, it is also well documented that relative to their income, households in developing countries consume less and save more than those in developed countries (e.g., Cao and Modigliani (2004)). For example, China’s per capita income ranks below 100th in the world, but its saving rate has been among the highest worldwide in recent decades. These high saving rates persist despite efforts in many of these countries to reduce their dependence on foreign demand for economic growth by promoting domestic consumption and discouraging saving.<sup>3</sup>

There exist several explanations for the limited participation puzzle. Many of these explanations rely on nonstandard preferences where nonparticipation can be optimal for investors with ambiguity or disappointment aversion (Dow and Werlang (1992), Ang, Bekaert, and Liu (2005), Epstein and Schneider (2005), and Cao, Wang, and Zhang (2005)). There are only a few explanations based on traditional, rational agent models. In particular, the decision to not invest in the stock market can be optimal if individuals face modest transactions costs (Vissing-Jrgensen (2002)), or if there exists both learning and short-sale constraints for those investors whose income

---

<sup>1</sup>See, for example, Mankiw and Zeldes (1991), Haliassos and Bertaut (1995), Heaton and Lucas (2000), and Guiso, Haliassos, and Jappelli, (2003).

<sup>2</sup>See, for example, Basak and Cuoco (1998), Cao, Hirshleifer and Zhang (2005), and Huang and Wang (2007).

<sup>3</sup>E.g., Dr. Zhou Xiaochuan, the Governor of the People’s Bank of China, states the reduction of savings rates and increased domestic consumption as an explicit goal of the Chinese government in its attempt to foster a more balanced growth path (foreword of Aziz, Dunaway, and Prasad (2006)).

has a positive correlation with the stock market (Linnainmaa (2005)). However, Cochrane (2005) challenges the transaction costs explanation by pointing out that “people who do not invest at all *choose* not to do so in the face of trivial fixed costs.” And, the latter explanation cannot explain why investors do not buy stocks with negative correlations with their income to hedge the risk.

Regarding the low-consumption-high-savings (LCHS) puzzle of developing countries, there also exist a variety of potential explanations. Cao and Modigliani (2004) offers an explanation based on income growth, demographic structure, and inflation. Chamon and Prasad (2006) argues that a combination of credit constraints and households’ growing desire to purchase large durable goods may explain the high savings rates observed in China. It is unclear, however, whether any of these explanations can explain the LCHS puzzle of developing countries in general.

The first contribution of this paper is to provide a new explanation of both the limited participation puzzle and the LCHS puzzle. In contrast to the existing literature, our explanation does not require nonstandard preferences, fixed costs, or a positive income beta with short-sale constraints; nor does it require income growth or demographic shifts to justify either the limited participation or the LCHS puzzle. Specifically, in a simple two-period consumption, saving, and investment model, we show that if there exists a negative wealth shock state where an investor needs all current wealth to finance subsistence level consumption, then a rational investor does *not* participate in the stock market at all – even if the probability of such a shock is arbitrarily small.

The basic intuition behind this result is that the investor has to save almost all of his initial wealth to hedge against this negative wealth shock, which may include events such as the loss of a job, a bad health shock (such as long term disability), or

bequest requirement in the event of a death. This result holds for general standard preferences, general stock market characteristics, and general wealth processes. He will not buy any stocks for the fear that their value may go down when the wealth shock occurs. He will not short any stocks either, because stock prices may go up when the negative shock happens. As a result, he will not participate in the stock market at all, no matter how high the risk premium is. More generally, our model suggests that in the presence of such a negative wealth shock, an investor with higher wealth will also invest significantly less than what is predicted by a model that ignores such a negative wealth shock and can thus also help explain the equity premium puzzle.

In addition, with this threat of negative wealth shock, current consumption will be low as the investor must save almost all of his current wealth for future consumption. This is because the investor needs almost all of his current wealth to absorb the negative wealth shock and to maintain the subsistence level of consumption if such a shock occurs. Our model can thus help explain the LCHS puzzle widely documented for developing countries such as China, where large negative wealth shocks are especially likely and insurance markets are underdeveloped. On the other hand, the high consumption and low saving in countries like the U.S. may be due to the much greater availability of various insurance programs.<sup>4</sup> Our explanation for the low saving rate in the U.S. thus compliments that of Shiller (2004) who attributes it to the wealth effect of rising housing prices.

The second contribution of this paper is to propose insurance development as a solution to both the limited participation puzzle and the LCHS puzzle. The role of insurance does not seem to have received much attention in the asset pricing literature, but our model suggests that insurance coverage has a profound impact on an

---

<sup>4</sup>The saving rate in the U.S. is less than 3%, which arguably drops below zero recently. See, e.g., *U.S. Economic Accounts*, US Department of Commerce, Feb., 2006.

investor's portfolio decisions. In particular, we show that if there is an insurance market for hedging the wealth shock, an investor may participate much more in the stock market, consume much more, and save much less. Intuitively, when the probability of the negative wealth shock is small, buying insurance is typically inexpensive. Since insurance provides an effective hedge against this shock, the investor can afford to increase current consumption, to invest more, and to save less. Our numerical analysis suggests that in some cases, the investor may even consume almost all of his current wealth and save virtually nothing if his normal future wealth is high. Hence, the availability of insurance can dramatically change an investor's consumption, saving, and investment decisions and play an important role in explaining household investment behavior and asset pricing in general.

To test the key implications of our model, we conduct an extensive empirical analysis and find substantial support for them. First, we find that stock market participation rates across countries are positively correlated with the presence of a large, private insurance market. This correlation holds strongly even after we control for other country-level characteristics shown to be important in the existing literature, including measures of investor protection, level of trust, legal origin, and level of financial and economic development. Second, we find that a greater development of insurance markets over time within a country is negatively related to changes in the saving rates of households within that country, particularly in developing countries where insurance markets are arguably more important. This supports the argument that access to less costly insurance should reduce saving rates.

We also find evidence that the presence of government safety nets, such as unemployment insurance, disability insurance, and publicly funded social security programs, are also positively related to participation levels and negatively related to

overall saving rates. Again using country-level variation, we show that there is a significantly positive correlation between the extent to which individuals are covered by a government-funded social security program and their willingness to hold risky stocks. Moreover, we find that an increase in the share of public expenditures spent on social security within country over time is negatively related to changes in the private saving rate of households. Again, the results are stronger in emerging markets, and they are robust to controlling for a number of country-level characteristics shown to be important in the existing literature on participation rates.

Our empirical evidence, however, is not limited to just country-level differences in the availability of private and public insurance. We also find evidence that differences in the size of public safety nets across U.S. states is also related to stock market participation levels. In particular, we find that differences in the generosity of unemployment insurance programs across U.S. states is positively related to stock market participation levels in those states. This relation between participation rates and unemployment insurance generosity holds even if we account for individual household characteristics such as age, income, wealth, race, and marriage. The results also hold even after controlling for differences in the level of education and economic development across U.S. states. Moreover, we find evidence that the positive relation between unemployment insurance generosity and participation levels is particularly strong in states where a larger fraction of workers are at risk of losing their job. Consistent with our model, this evidence suggests that social insurance programs may directly affect individuals' portfolio decisions even in developed countries.

Finally, we find evidence at the U.S. household level that whether a household holds risky stocks is correlated with the extent to which the household is insured against an adverse health shock. U.S. households that are insured against large,

adverse health shocks – as captured by having an employer-sponsored health policy, life insurance policy, or long-term care policy – are more likely to hold risky stocks after controlling for various household characteristics including age, wealth, education, and income.<sup>5</sup>

As the title of our paper acknowledges, our model is simple and straightforward. But it makes important economic points that are supported by the data.<sup>6</sup> Theoretically, the model is closely related to the literature on precautionary saving against background risk.<sup>7</sup> However, as far as we know, our model is the first to link background risk to limited participation and the first to recognize a potential large, negative wealth shock as an important background risk for portfolio choice and asset pricing in addition to consumption and saving. Our model shows that no matter how small this background risk is (in the sense that the probability of such a negative wealth shock can be arbitrarily small), it can prevent an investor from investing *any* amount of cash into risky assets. In addition, we are the first to theoretically predict and empirically test that better insurance is an effective solution to both the limited participation puzzle and LCHS puzzle.

The rest of the paper is organized as follows. We describe the model in Section I, and introduce an insurance market in Section II. We then present a graphical illustration of a case with constant relative risk aversion preference (CRRA) in Section III. In Section IV, we provide an extensive empirical analysis. The conclusions are offered in the Section V, and all proofs are provided in the Appendix.

---

<sup>5</sup>Predictions of our model are also supported by other related empirical studies (e.g., Gruber and Yelowitz (1999), Chou, Liu, and Hammitt (2003), Goldman and Maestas (2005), and Qiu (2006)).

<sup>6</sup>The seemingly obvious explanations, though ignored in the literature, are strongly supported by our anecdote evidence from conversations with various households across countries.

<sup>7</sup>For example, Kimball (1993) demonstrates that with the standard risk aversion, in the presence of the zero-mean background risk, an investor will invest less in the risky asset and save more. Koo (1991) and Guiso, Jappelli and Terlizzese (1996) show that as the background risk of income increases, an investor decreases risky asset investment.



# I. The Model

To best demonstrate the underlying ideas of our theory, we consider a simple, two-period model. An investor derives utility from intertemporal consumption  $(c_0, c_1)$ , which represents respectively consumption today and consumption next period. The investor has an initial wealth of  $W_0$ . His wealth endowment next period will be  $\tilde{W}_1$ , where, with a possibly small probability  $\epsilon > 0$ ,  $\tilde{W}_1 = -D$ , which represents a negative wealth shock, and, with probability  $1 - \epsilon$ ,  $\tilde{W}_1 = W_1 \geq 0$ , which represents normal future wealth and may be interpreted as the present value of future labor income.

At the beginning of the period, the investor can consume, save, or invest in a risky asset (stock). The initial stock price  $S_0$  is normalized to 1, and the next period stock price is  $\tilde{S}_1$ , where  $\tilde{S}_1 = u > 1$  with probability  $p > 0$ , and  $\tilde{S}_1 = d < 1$  with probability  $1 - p$ . For simplicity, we assume that the stock price process is independent of the investor's income process and that the interest rate is zero.<sup>8</sup> Then, the investor's problem is to choose consumption  $c_0$ , saving  $\alpha$ , and stock investment  $\theta$  to solve

$$\max_{c_0, \alpha, \theta} U(c_0) + \delta E[U(c_1)], \quad (1)$$

subject to the budget constraints

$$\alpha = W_0 - c_0 - \theta, \quad (2)$$

$$c_1 = \alpha + \theta \tilde{S}_1 + \tilde{W}_1, \quad (3)$$

---

<sup>8</sup>A minor modification of the proof applies to the case where these two processes are correlated. Moreover, a nonzero interest rate would not qualitatively change our main results.

where

$$U(c) = \begin{cases} u(c) & \text{if } c \geq \underline{c}, \\ -\infty & \text{otherwise,} \end{cases} \quad (4)$$

and  $u(c)$  is strictly increasing and strictly concave for  $c \geq \underline{c}$ ,<sup>9</sup>  $\delta$  is the subjective time discount rate, and  $\underline{c}$  is the subsistence level of consumption.

In the above standard set-up, we make the following nonstandard assumption:

**Assumption A** The magnitude of the negative wealth shock

$$D = W_0 - 2\underline{c} > 0. \quad (5)$$

This is the key assumption of this paper.<sup>10</sup> Under this assumption, with a positive, but arbitrarily small probability,  $\epsilon$ , the investor will need all his initial wealth to maintain the subsistence level of consumption in both periods.

There are several reasons why a shock of this magnitude may occur. To illustrate this, let us first focus on the case of the U.S. investors and health insurance. According to year 2000 census, the median net worth in the U.S. is \$55,000, and \$13,473 if excluding home equity.<sup>11</sup> This level of wealth is clearly not enough to cover large and unanticipated expenses such as those required for a sudden long-term disability or diagnosis of a terminal condition. If the investor has health insurance, the expense may be less severe, but certainly not eliminated. Moreover, the fact that there are over 45 million Americans who had no health insurance in 2004 certainly makes

---

<sup>9</sup>Following the usual convention, we assume that, if  $u(\underline{c}) = -\infty$ , the investor still chooses to prevent consumption from falling below  $\underline{c}$ , even though he is indifferent at  $\underline{c}$ . This is purely for expositional simplicity as a slight modification of the preference would suffice to avoid this indifference.

<sup>10</sup>Assuming  $D$  takes exactly one value is for simplicity. The main results still hold even when there are many possible wealth shocks as long as one of them is of the magnitude of  $W_0 - 2\underline{c}$ .

<sup>11</sup>Source: Table B and Figure 7 of *Net Worth and Asset Ownership of Households: 1998 and 2000*, an publication issued by the U.S. Census Bureau in 2003.

the problem an important issue as they represent about one quarter of the U.S. population.<sup>12</sup>

Another potential negative wealth shock could include death and an investor's desire to leave a bequest to his family if he deceases next period. The probability for such an event is clearly positive, and the desired bequest level often exceeds what the investor has. In practice, this high level of bequest is often achieved through life insurance, which likely has even lower participation rates than health insurance. Finally, another example of a negative shock is the loss of a job, which can be devastating to the working class. In the event of unemployment, the unemployed needs a large sum of wealth to maintain a minimum standard of living for the uncertain duration of unemployment, and the required wealth can often far exceed his current wealth. For example, Gruber (2002) provides evidence that, using their current wealth, "almost one-third of workers can't even replace 10% of their income loss" due to unemployment. In short, the assumption of a large negative wealth shock, with possibly tiny but nonzero probability, seems realistic for typical households.<sup>13</sup>

On the optimal portfolio choice, we have

**Proposition 1** *Under Assumption A, the investor does not participate in the stock market, i.e.,  $\theta^* = 0$ . In addition, the investor only consumes the minimum and saves the rest, i.e.,  $c_0^* = \underline{c}$  and  $\alpha^* = W_0 - \underline{c}$ .*

Proof. See Appendix.

Proposition 1 says that, in the presence of the wealth shock, the investor will *not*

---

<sup>12</sup>See, e.g., *Kaiser Commission On Medicaid And The Uninsured*, a 2006 publication of the Kaiser Family Foundation.

<sup>13</sup>Even for investors in the upper percentiles of the wealth distribution, the existence of such a negative wealth shock, though likely not as bad as in Assumption A, can still significantly reduce their stock investment.

participate in the stock market at all. This result depends neither on the probability of the negative wealth shock state (as long as it is positive), nor the magnitude of the stock risk premium. Intuitively, longing or shorting in the stock always involves risk. Since any loss in the stock investment would incur an infinite utility loss if the bad wealth shock occurs, the investor optimally chooses not to participate in the stock market today. This result holds for a general class of preferences, wealth profiles, and stock market characteristics. In contrast to the existing studies such as Dow and Werlang (1992), Ang, Bekaert, and Liu (2005), Epstein and Schneider (2005), Cao, Wang, and Zhang (2005), Vissing-Jorgensen (2002) and Linnainmaa (2005), we do not need any behavioral assumptions, market frictions such as transaction costs or short-sale constraints, or any labor income correlation with the stock market to justify the stock market nonparticipation.

Proposition 1 also shows that the presence of a large negative wealth shock, no matter how small the likelihood is, can cause extremely low current consumption and extremely high saving. In particular, the investor will only consume the minimum amount of the subsistence level today and save the rest of his wealth to hedge against the possible negative wealth shock in the future.

It is worth noting that the nonparticipation and an extremely high saving rate arise no matter how high the investor's wealth is in other states. This implies that as long as the wealth shock in one state of the world is bad enough, even the wealthy people will *not* participate in the stock market and will save almost all of their wealth for the future. This prediction is consistent with the empirical finding that even wealthy people have a low participation rate in the stock market (Heaton and Lucas (1997)). Moreover, the level of financial development and the ability to borrow against future earnings also does not matter. Since  $\tilde{W}_1$  can be interpreted as the present value of

all future income, the ability to borrow against future earnings will not eliminate the need for insurance when the potential negative wealth shock is sufficiently large.

## II. The Model with Insurance Coverage

A natural and important question is then how a developing country like China can increase stock market participation, increase current consumption, and decrease saving in order to achieve sustained economic growth that does not rely entirely on foreign demand and investment. In this section, we offer a simple solution: develop an insurance industry.

To illustrate this, we now suppose that the investor can purchase insurance against the negative wealth shock, and that the insurance premium per dollar coverage is equal to  $\lambda$ . Let  $I$  be the dollar amount the investor chooses to insure. Since most insurance programs are compensatory in the sense that insurance claim payment usually does not exceed the full coverage of an damage, we assume that the investor cannot overinsure, i.e.,

$$I \leq D. \tag{6}$$

Now, the investor solves:

$$\max_{c_0, \alpha, \theta, I} U(c_0) + \delta E[U(c_1)],$$

subject to the budget constraints

$$\alpha = w - c_0 - \theta - \lambda I, \tag{7}$$

$$c_1 = \alpha + \theta \tilde{S}_1 + \tilde{W}_1 + I 1_{\{\tilde{W}_1 = -D\}}, \tag{8}$$

and (6).

In contrast to the earlier case without an insurance market, the investor now can hedge against the negative wealth shock using insurance. For simplicity, we assume in what follows that the insurance premium is fair, i.e.,  $\lambda = \epsilon$ .<sup>14</sup> Then, regarding the investor's optimal level of insurance, we have the following proposition:

**Proposition 2** *Suppose  $\lambda = \epsilon$ . Then there exists a  $\underline{\epsilon} > 0$  such that,  $\forall \epsilon < \underline{\epsilon}$ , full insurance is optimal, i.e.,  $I^* = D$ .*

Proof. See Appendix.

The intuition behind this proposition is the following: if the probability of the negative wealth shock is small and the per dollar coverage insurance premium is not too unfair, then the cost of full insurance is small relative to the benefit of smoothing consumption across time by consuming more today and investing more in risky stocks. Given this, the investor will pay the small cost of acquiring insurance – irrespective of his wealth level and risk aversion. To see why, it is important to note that an investor only has two ways to ensure that his next period consumption  $c_1$  will be above the subsistence level  $\underline{c}$ . The first is through saving and the second is through insurance. When the insurance is relatively inexpensive (e.g.,  $\epsilon$  and  $\lambda$  are small), the investor can buy full insurance and save a small amount to ensure the subsistent level consumption  $\underline{c}$ . Saving with low insurance is an inefficient way of hedging, especially when the negative wealth shock occurs with a small probability and normal future wealth is high (i.e.,  $W_1 \gg \underline{c}$ ). This is because saving reduces current consumption for sure and most likely transfers the saving to states where marginal utility consumption is low (i.e., wealth is high). In contrast, insurance transfers current consumption only

---

<sup>14</sup>The results will not alter qualitatively as long as the premium rate is not too unfair.

to the states where marginal utility of consumption is high. The tradeoff between saving and insurance in general will be examined in the next section. The implication for policy makers is that there can be significant social welfare gains from improving insurance products in the economy, because insurance provides a much more efficient hedge against unlikely but disastrous events than precautionary savings.

On stock market participation, we have

**Proposition 3** *If the insurance is available and if the stock has nonzero risk premium, we have  $\theta^* \neq 0$ .*

Proof. See Appendix.

This proposition suggests that with insurance, as long as the risk premium is nonzero, an investor will optimally participate in the stock market, no matter how poor he is. This result suggests that developing an insurance market can potentially help raise the stock market participation and lower the risk premium. In practice, insurance coverage and costs vary across products and countries. The implication of Proposition 3 is that participation rate in the stock market is positively correlated with the participation rate in the insurance markets.

With insurance, we expect that the investor will increase his current consumption since he no longer has to save a lot to protect himself against the negative wealth shock. Indeed, the following proposition confirms this intuition.

**Proposition 4** *Given any  $c_0 \in [\underline{c}, W_0 - \underline{c})$ , there exist  $\bar{W}_1$  and  $\underline{\epsilon}$  such that,  $\forall W_1 > \bar{W}_1$  and  $\epsilon < \underline{\epsilon}$ , the optimal time 0 consumption  $c_0^*$  is strictly greater than  $c_0$ .*

Proof. See Appendix.

This proposition says that if the investor's future wealth is high enough and the probability of a negative wealth shock is low enough, then the investor will consume almost all of his initial wealth. So the saving rate would dramatically drop and consumption would significantly rise in the presence of insurance.

This has implications for many developing countries that often exhibit high saving rates and low consumption. Combined, high savings and low consumption increase their dependence on foreign demand for economic growth. To mitigate this dependence, many developing countries adopt various policies attempting to stimulate consumption and lower the domestic saving rate. For example, the Chinese government in recent years lowered its interest rates substantially to dissuade people from saving. Our model suggests that without insurance, however, an investor will save almost all of his wealth for the protection against the possible negative wealth shock in the future no matter how low the interest rates are. This suggests an important role for the development of private insurance markets to help reduce domestic savings. Moreover, the development of social safety nets, such as unemployment insurance, may also promote more consumption and stock market participation.

Overall, our model suggests that the interactions among insurance, consumption, saving, and portfolio choice can be a new line of promising research.

### **III. Numerical Analysis**

To obtain further insights, we now solve numerically an example where an investor has a CRRA preference and graphically illustrate the implications of our model. The



CRRA utility function is:

$$U(c) = \begin{cases} \frac{c^{1-\gamma}}{1-\gamma} & \text{if } c > 0, \\ -\infty & \text{otherwise,} \end{cases}$$

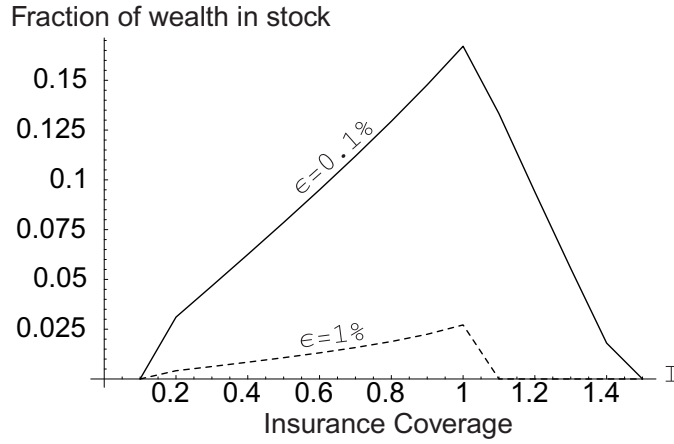
In our analysis below, we use the following default parameter specification:  $\gamma = 2$ ,  $p = 0.999$ ,  $\epsilon = 0.1\%$ ,  $u = 2$ ,  $d = 0$ ,  $W_0 = 1$ ,  $W_1 = 2$ ,  $D = W_0$ , and  $\lambda = \epsilon$ . A brief discussion of some of the default parameter values is in order. We set  $\epsilon$  to be low so that the negative wealth shock is a small probability event. We set  $p$  to be high to emphasize the fact that even a small downside risk in the stock market may deter participation, in the absence of insurance. We set the normal future wealth  $W_1$  to be 2 to illustrate that high normal wealth does not change our main results. We pick  $u = 2$  to show that high risk premium does not change our main results either (recall that the interest rate is set to be 0 for simplicity).

It is interesting that, as shown by Figure 1, with low enough insurance coverage, the investor will invest almost nothing in the stock market.<sup>15</sup> After the coverage increases to a certain threshold, the participation starts to rise sharply. However, if the investor can insure more than the full coverage, then stock investment starts to decline. This is because with the overinsurance, the marginal utility of consumption in the bad wealth shock state decreases and the investor starts to decrease his stock investment to increase his current consumption.

Figures 2 and 3 show that, as insurance coverage increases, the consumption rate increases and the saving rate decreases. When the investor is fully insured, he consumes almost all of his initial wealth and saves nothing. In addition, Figure 3 shows that saving rate is largely determined by the insurance coverage. When the

---

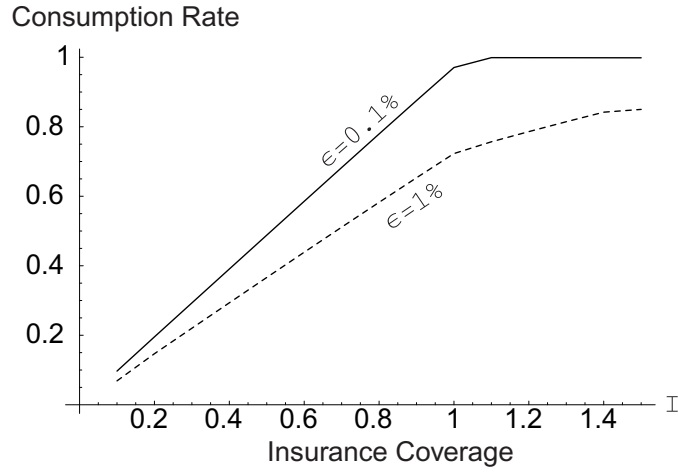
<sup>15</sup>In this analysis, we allow the investor to overinsure to examine the effect of overinsurance.



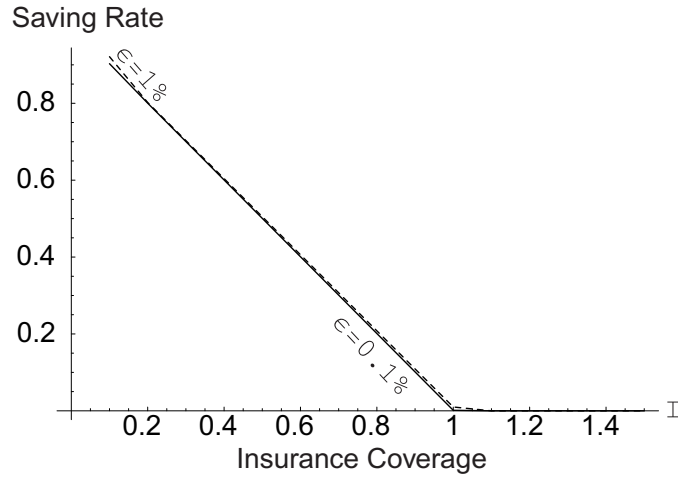
**Figure 1: The fraction of wealth invested in the stock against available insurance coverage for parameters:  $p = 0.999$ ,  $W_1 = 2$ ,  $u = 2$ ,  $d = 0$ ,  $W_0 = 1$ ,  $D = W_0$ , and  $\lambda = \epsilon$ .**

investor is underinsured, he saves enough to make up the difference. These findings suggest that insurance may be critical and effective for increasing consumption and decreasing saving. These three figures also show that a higher probability of the negative wealth shock leads to a lower stock investment, a lower consumption rate, and a higher saving rate, as expected.

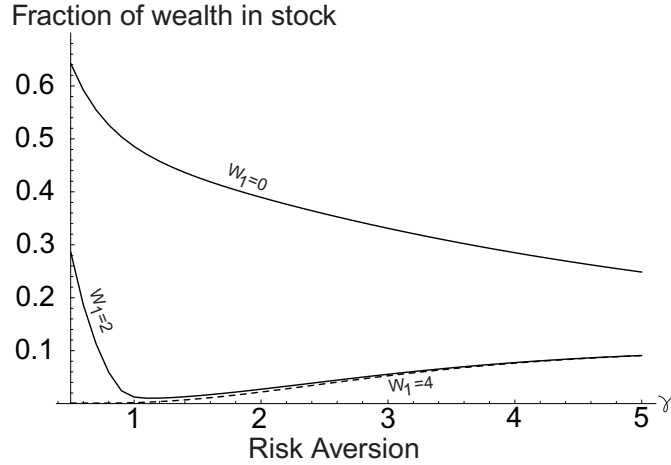
In the standard portfolio choice models, as risk aversion increases, the fraction of wealth invested in stock decreases (e.g., Merton (1971), Cochrane (2001), Liu and Loewenstein (2002), Liu (2004)). Interestingly, as Figure 4 shows that while this is true for those who have low normal future wealth (i.e.,  $W_1$  is small), it is in general incorrect for those who have a high normal future wealth. In particular, for those who have very high normal future wealth ( $W_1 = 4$ ), the opposite is true. Intuitively, the investor faces two types of risks: stock investment losses and negative wealth shocks. Risk aversion coefficient thus has two opposite effects on the stock investment. On the one hand, the investor has a tendency to invest more in the



**Figure 2:** The consumption rate against available insurance coverage for parameters:  $p = 0.999$ ,  $W_1 = 2$ ,  $u = 2$ ,  $d = 0$ ,  $W_0 = 1$ ,  $D = W_0$ , and  $\lambda = \epsilon$ .



**Figure 3:** The saving rate against insurance coverage available for parameters:  $p = 0.999$ ,  $W_1 = 2$ ,  $u = 2$ ,  $d = 0$ ,  $W_0 = 1$ ,  $D = W_0$ , and  $\lambda = \epsilon$ .



**Figure 4: The fraction of wealth invested in the stock against risk aversion for parameters:  $p = 0.999$ ,  $\epsilon = 0.1\%$ ,  $u = 2$ ,  $d = 0$ ,  $W_0 = 1$ ,  $D = W_0$ , and  $\lambda = \epsilon$ .**

stock as risk aversion decreases. However, this would imply a decrease in the current consumption (recall that saving rate is largely determined by insurance coverage). On the other hand, as the risk aversion decreases, the investor is less concerned about the negative wealth shock, and thus would like to consume more today. This tends to decrease the stock investment today. The net effect depends on the relative marginal utility of consumption today and tomorrow and the magnitude of the risk aversion. When the normal future wealth is high, the marginal utility of consumption tomorrow is relatively small, and therefore, as risk aversion decreases, the investor decreases his investment to increase consumption, as shown in Figure 5.

Figure 6 shows that, as the risk aversion coefficient increases, the investor saves more. Intuitively, as risk aversion increases, the investor becomes more concerned about both stock investment losses and a negative wealth shock, and therefore, consumes less today and saves more for the future.

Figure 7 shows how the stock investment changes with normal future wealth  $W_1$ .

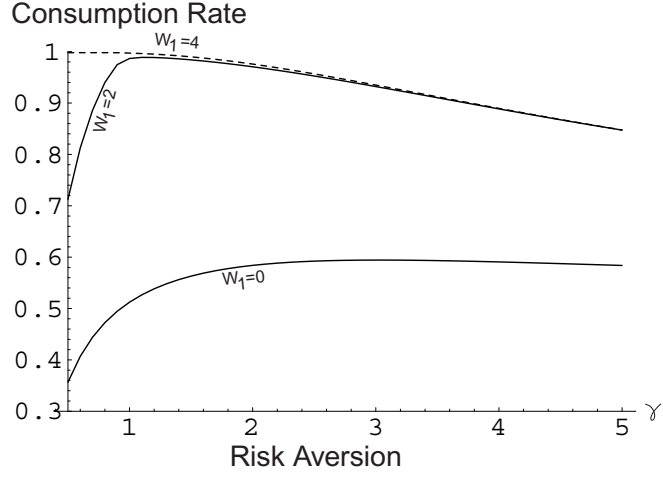


Figure 5: The fraction of wealth consumed against risk aversion for parameters:  $p = 0.999$ ,  $\epsilon = 0.1\%$ ,  $u = 2$ ,  $d = 0$ ,  $W_0 = 1$ ,  $D = W_0$ , and  $\lambda = \epsilon$ .

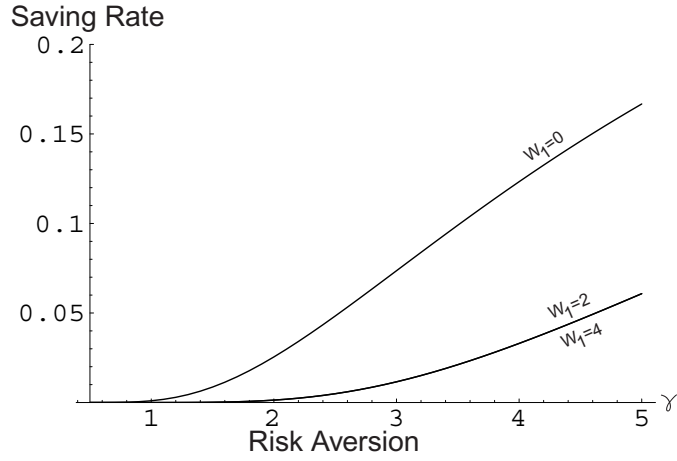
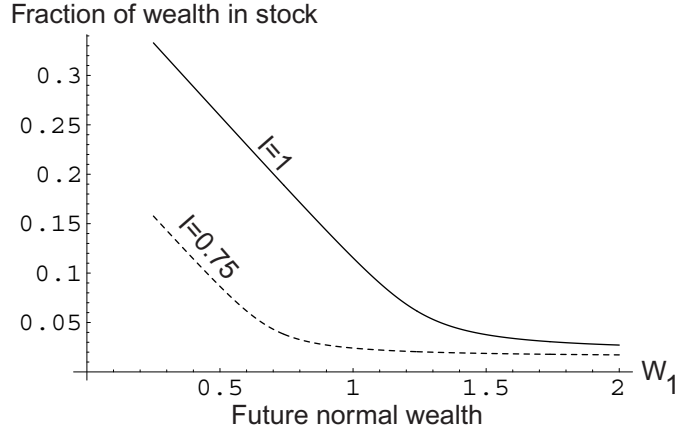


Figure 6: The saving rate as a fraction of current wealth against risk aversion for parameters:  $p = 0.999$ ,  $\epsilon = 0.1\%$ ,  $u = 2$ ,  $d = 0$ ,  $W_0 = 1$ ,  $D = W_0$ , and  $\lambda = \epsilon$ .

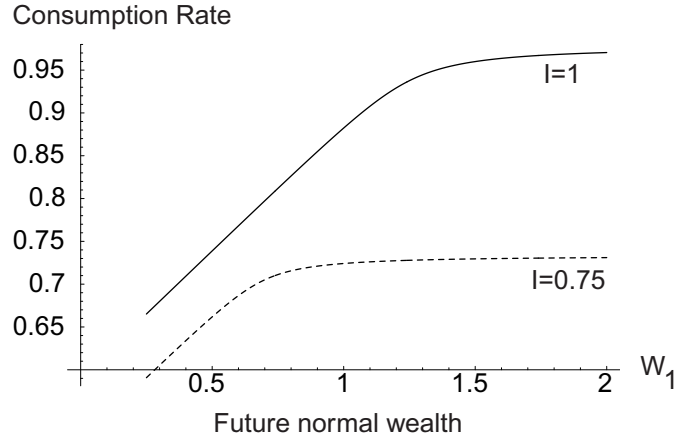


**Figure 7: The fraction of wealth invested in the stock against normal future wealth for parameters:  $\gamma = 2$ ,  $p = 0.999$ ,  $\epsilon = 0.1\%$ ,  $u = 2$ ,  $d = 0$ ,  $W_0 = 1$ ,  $D = W_0$ , and  $\lambda = \epsilon$ .**

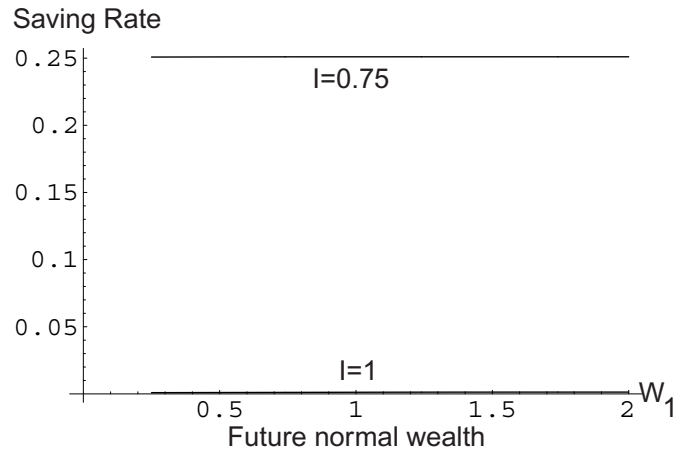
It shows that as the investor's normal future wealth increases, he invests *less* in stock today. This drop in the stock investment is due to the decrease of the marginal utility of future consumption, which makes the current consumption more valuable, and thus the investor invests less in order to consume more today, as shown in Figure 8. Figure 9 shows that the saving rate stays almost constant. As we show before in Figure 3, the saving rate is largely determined by insurance coverage. As before, lower coverage lowers stock investment, consumption, and increases the saving rate.

## IV. Empirical Analysis

Our model yields a number of testable hypotheses regarding stock market participation rates, saving rates, and insurance coverage. In this section, we test these hypotheses using both cross-country and within-country comparisons. First, we test whether differences in the size of private insurance markets across countries and over



**Figure 8:** The consumption rate against normal future wealth for parameters:  $\gamma = 2$ ,  $p = 0.999$ ,  $\epsilon = 0.1\%$ ,  $u = 2$ ,  $d = 0$ ,  $W_0 = 1$ ,  $D = W_0$ , and  $\lambda = \epsilon$ .



**Figure 9:** The saving rate as a fraction of current wealth against normal future wealth for parameters:  $p = 0.999$ ,  $\epsilon = 0.1\%$ ,  $u = 2$ ,  $d = 0$ ,  $W_0 = 1$ ,  $D = W_0$ , and  $\lambda = \epsilon$ .

time are correlated to saving rates and investors' willingness to hold risky stocks. Second, we examine whether differences in the extent to which individuals' consumption level in retirement is insured via a government-funded social security program are related to their willingness to hold risky stocks and their overall saving rates. Third, we use U.S. state-level variation in unemployment insurance generosity to test whether unemployment insurance programs are related to observed differences in stock market participation rates across U.S. states. Finally, we test whether U.S. individuals' coverage via an employee-sponsored health, life, or long-term care insurance policy is correlated to their portfolio choices.

## A. Participation, Saving Rates, and Private Insurance

In our first empirical test, we analyze the correlation between stock market participation levels and the development of private insurance markets across countries. A primary finding of our model is that in the absence of access to low-cost insurance against large, negative wealth shocks, individuals will be less willing to hold risky stocks. Therefore, we should expect to find that in countries with less developed private insurance markets that, all else equal, stock market participation rates should be lower. To test this hypothesis, we run the following cross-country regression:

$$\text{participation}_c = \beta_0 + \beta_1 \text{insurance}_c + \gamma X_c + \varepsilon_c, \quad (9)$$

where *participation* is the share of individuals in country  $c$  that participate in the domestic stock market via direct stock holdings. We obtain our measure of *participation* from Giannetti and Koskinen (2007), which constructed country-level participation



rates for 26 countries based on surveys conducted between 1997–2000.<sup>16</sup> The variable *insurance* measures the degree of private insurance penetration in country  $c$ . This is measured using the ratio of life and non-life insurance premiums to GDP in 1995 as reported in the financial structure database produced by the World Bank and described in Beck, Demirguc-Kunt, and Levine (1999). A larger *insurance* value would indicate a relatively more developed private insurance market in that country.<sup>17</sup> Finally,  $X_c$  includes a variety of country-level controls discussed below in more detail. The estimates from this regression are reported in Table I.

Consistent with our model’s implications, we find a strong positive correlation between stock market participation rates and insurance penetration. The univariate regression results reported in Column (1) of Table I show a strong and statistically significant relation suggesting an important role for private insurance markets in stock market participation levels. The magnitude of the correlation between insurance penetration and participation rates is also economically significant. An increase in a country’s degree of insurance penetration by one standard deviation is associated with a seven percentage point increase in the country’s participation rate.

In Figure 10, we provide a scatter plot of the data to demonstrate that the positive correlation between participation rates and insurance penetration is quite robust and not driven by outliers. Moreover, there is no evidence that the findings are driven by a particular type of insurance. Though not reported here, we find that the strong positive correlation between participation rates and insurance penetration is statistically significant for both life and non-life insurance. Therefore, in subsequent analysis, we

---

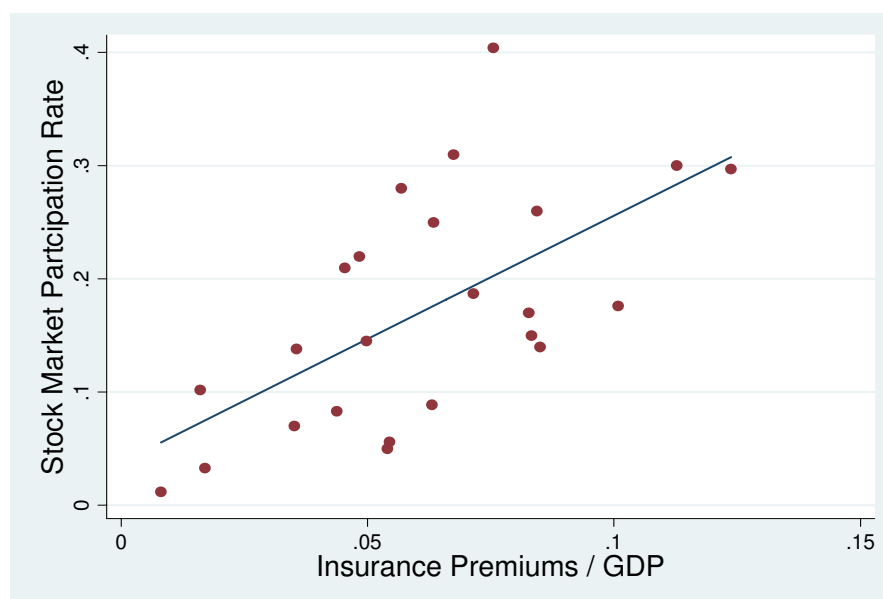
<sup>16</sup>See Giannetti and Koskinen (2007) for more details about exactly how the participation rates were calculated and the various dates at which the surveys were conducted. This data was also used by Guiso, Sapienza, and Zingales (2007).

<sup>17</sup>All results are robust to measuring insurance penetration in other years or by instead using an average of insurance penetration in previous years.

**Table I: Stock Market Participation and Insurance Penetration**

This table presents the estimates from the cross-country regression of stock market participation rates onto *insurance penetration*. The dependent variable, *stock market participation rate*, is constructed using country-level surveys conducted between 1997-2000 and reported in Giannetti and Koskinen (2007). *Insurance penetration* is measured as the ratio of life and non-life insurance premiums to GDP as described in Beck, Demirguc-Kunt, and Levine (1999). Other controls include *financial development*, *shareholder rights*, *trust*, and *common law*. *Financial development* is the ratio of total stock market capitalization to GDP in 1995. *Shareholder rights* is measured using the anti-director rights index from La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998). *Trust* is the fraction of individuals in country that reply that 'most people can be trusted' as reported in the World Values Survey, 1995-1999. *Common Law* is an indicator equal to 1 if the legal origin of the country is English, as given by La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1999). Robust standard errors are reported in parentheses. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)
<b>Insurance Penetration</b>	2.18*** (0.36)	2.21*** (0.38)	1.91*** (0.42)	1.77*** (0.33)	2.09*** (0.37)	1.92*** (0.54)
<b>Financial Development</b>		0.006 (0.023)				-0.045 (0.034)
<b>Shareholder Rights</b>			0.027*** (0.009)			0.012 (0.015)
<b>Trust</b>				0.33*** (0.08)		0.29*** (0.10)
<b>Common Law</b>					0.060* (0.034)	0.063 (0.056)
Observations	24	24	24	23	24	22
R-Squared	0.39	0.40	0.53	0.57	0.47	0.71



**Figure 10: Stock Market Participation Rates and Insurance**

This figure displays the univariate scatter plot of stock market participation rates across countries and the ratio of insurance premiums to GDP in 1995. Participation rates are constructed using country-level surveys conducted between 1997-2000 as reported in Giannetti and Koskinen (2007). The ratio of insurance premiums to GDP is obtained from the financial structure database produced by the World Bank and described in Beck, Demirguc-Kunt, and Levine (1999). The line represents the fitted estimates obtained from the univariate regression.

will continue to use the combination of life and non-life insurance premiums over GDP to better capture the overall development of a country's private insurance market.<sup>18</sup>

One weakness of the cross-country comparison, however, is that the correlation between insurance penetration and stock market participation levels may be driven by omitted factors and not necessarily capture a causal relationship. For example, countries with greater economic or financial development may have both higher par-

---

<sup>18</sup>A priori it is unclear which measure of insurance might better capture an individual's ability to insure against large, adverse wealth shocks. By providing insurance against the death, life insurance will play an important role in insuring households against the death of the primary income earner in the household. On the other hand, non-life insurance products such as health, automobile, and home insurance, could provide equally valuable protections against adverse income shocks.

ticipation rates and greater insurance penetration. Moreover, a number of recent papers have demonstrated the potential importance of shareholder rights, legal origin, and trust for stock market participation rates, and if these factors are also related to the development of insurance markets, there will be an omitted variable bias. To address this concern, a variety of controls are added to the base specification, and these results are reported in columns (2)-(6) of Table I.

Further supporting the potential role of insurance markets, the strong positive correlation between stock market participation rates and insurance penetration continues to hold even after controlling for a country’s level of financial development. This is shown in Column (2), where we control for financial development using the total stock market capitalization normalized by GDP. This measure is provided by the financial structure database described earlier. The strong positive correlation between participation rates and insurance penetration remains statistically significant, and surprisingly, there is no evidence that financial development is related to stock market participation rates. In an unreported test, we also tried controlling for financial development using the stock market turnover ratio and the value of shares traded normalized by GDP. Again, insurance penetration remains a strong, statistically significant predictor of participation rates, and there is little evidence that financial development is related to participation rates.

Moreover, the strong positive correlation between stock market participation rates and insurance penetration continues to hold even after controlling for a number of other country-level factors that have been demonstrated to be important factors in stock market participation levels. In Column (3), of Table I, we control for the level of investor protection using *shareholder rights*, which is measured using the anti-director rights index constructed by La Porta, Lopez-de-Silanes, Shleifer, and Vishny

(1998). Similar to Giannetti and Koskinen (2007), we find that *shareholder rights* is positively related to participation levels, but insurance penetration still remains a strong, positive predictor of participation levels as well. In Column (4), we control for the fraction of individuals in a country that reply that ‘most people can be trusted’ in the World Values Survey, 1995-1999. Guiso, Sapienza, and Zingales (2007) argue that individuals’ trust of others is positively related to their willingness to hold stocks, and our estimates confirm their findings. However, insurance penetration still remains a strong predictor of country-level participation rates. Similarly, the inclusion of controls for legal origin [Column (5)], as captured by an indicator for common law origin, also does not alter the findings. Finally, the inclusion of all controls at once [Column (6)] does not affect the findings. Insurance penetration remains a strong, positive predictor of stock market participation levels whereas only *trust* remains a significant predictor of stock market participation rates while *shareholder rights* and *legal origin* are no longer statistically significant.<sup>19</sup>

While the strong correlation of stock market participation rates with private insurance penetration rates supports our argument that insurance may play a crucial role in explaining participation rates, there is still a possibility that the findings could be driven by other country-level determinants not controlled for in these regressions. One potential way to address this concern would be to use variation in the development of insurance markets and stock market participation levels over time along with country-level fixed effects, but unfortunately, the limited availability of stock market participation levels across time makes this type of analysis infeasible.

However, our model also suggests another important implication pertaining to

---

<sup>19</sup>In unreported regressions, we also tried controlling for economic development, using the log of GDP per capita in 1995. Again, *insurance penetration* remains a strong positive predictor of participation rates, while economic development was not significantly related to participation rates.

saving rates that does more easily yield itself to such a test. Specifically, our model indicates that less-developed countries may better achieve their goal of decreasing their private saving rate and increasing consumption by developing their private insurance industry. Since there exists savings data and insurance penetration data for a number of countries over time, it is possible to conduct a more rigorous test of this prediction that eliminates time-invariant determinants via the inclusion of country-level fixed effects. To test this second hypothesis, we run the following country-level, fixed effects specification:

$$\text{saving rate}_{c,t} = \beta_0 + \beta_1 \text{insurance}_{c,t} + \alpha_c + \delta_t + \varepsilon_{c,t}, \quad (10)$$

where *saving rate* is the private saving rate of country  $c$  in year  $t$  and *insurance* is the ratio of private insurance premiums to GDP. For our measure of savings, we rely on the World Savings Database, which measures a country's private saving rate as the difference between gross national saving and public sector saving normalized by gross national disposable income.<sup>20</sup> This data goes back as early as 1960 for some countries and ends in 1995. For our measure of *insurance*, we again use the World Bank's Financial Structure database described earlier, which measures total life and non-life insurance premiums over GDP beginning in 1987. After combining the two datasets on saving rates and insurance premiums, we are left with a panel of 49 countries that report both variables, and these observations range between the years of 1987–1995.

Since this regression includes country-level fixed effects, the parameter of interest,  $\beta_1$ , will only be estimated using within-country variation in the saving rate over time. Therefore, the coefficient will capture how an increase in insurance penetration at the

---

<sup>20</sup>Public sector savings is defined as the savings by the central, state, local, and regional governments plus state-owned enterprises and other non-financial public enterprises. See the World Savings Database help file for Module 3A, Revision 3.00 on how this measure is constructed.

country-level is correlated to changes in the private saving rate within that country. The inclusion of country fixed effects will exclude the possibility that the findings are driven by time invariant differences in institutions, legal origin, etc. Moreover, to control for the possibility of a global trend in savings and insurance penetration during our sample time period, we also include year dummies,  $\delta_t$ . The estimates, with standard errors clustered at the country level, are reported in Table II.

Overall, the estimates strongly support our hypothesis that greater access to insurance should reduce the saving rate of individuals. Using the entire sample of countries, we find that an increase in insurance penetration is strongly and negatively related to the overall saving rate, as reported in Column (1) of Table II. The finding holds even after controlling for GDP per capita and overall financial development, as done in Columns (2) and (3).<sup>21</sup> While GDP per capita is not strongly correlated with saving rates, there is a strong negative correlation between financial development and saving rates. This is consistent with financial development providing individuals greater ability to transfer resources across time so as to smooth consumption and reduce their need for precautionary savings.

Our model also suggest that the negative relation between insurance availability and saving rates should be particularly acute when individuals are more likely to experience income shocks that put them below a 'subsistence' level. Therefore, we might expect to find the negative relation between insurance penetration and saving rates to be particularly strong in less-developed countries where such shocks are likely more common. The evidence appears to support this hypothesis. When we split the sample into less- and more-developed countries, we find that the negative correlation

---

<sup>21</sup>In Table II, we again control for financial development using the ratio of stock market capitalization to GDP. However, all of the results are also robust to using a variety of other controls for financial development including the ratio of financial deposits to GDP, the value of shares traded over GDP, and the stock market's turnover rate.

**Table II: Saving Rates and Insurance Penetration**

This table presents the estimates from the country-level, fixed effects regression of *private saving rates* onto *insurance penetration* and year dummies. The dependent variable, *private savings rate*, is constructed using the ratio of private saving to gross national disposable income reported by the World Savings Database, where private savings represents the difference between gross national savings and public sector savings. *Insurance penetration* is the ratio of life and non-life insurance premiums to GDP as reported by the financial structure database produced by the World Bank. Other controls include Log(GDP per capita) and *Financial Development*. GDP per capita is calculated using the IMF-IFS database, and *Financial Development* is the ratio of stock market capitalization to GDP reported in the financial structure database. In Column (4), the sample is restricted to countries classified as "Low Income" and "Lower Middle Income" by the financial structure database, and Column (5) restricts the sample to all other countries. Standard errors are clustered at the country level and reported in parentheses. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level.

	<i>Dependent Variable = Private Saving Rate</i>				
	All Countries			Low-Income	High-Income
	(1)	(2)	(3)	(4)	(5)
Insurance Penetration	-0.299*** (0.043)	-0.254*** (0.049)	-0.286*** (0.054)	-0.321*** (0.081)	-0.128 (0.491)
Log(GDP per capita)		-0.037 (0.032)	-0.011 (0.026)	0.026 (0.051)	-0.029 (0.029)
Financial Development			-0.027** (0.011)	0.041 (0.049)	-0.025** (0.011)
Countries	49	49	44	11	33
Observations	333	333	245	65	180
R-Squared	0.69	0.69	0.81	0.80	0.83



between insurance penetration and saving rates is predominately driven by developing countries. This is seen in Columns (4) and (5) where we divide the sample between “Low Income” and “High Income” countries.<sup>22</sup> While the correlation between saving rates and insurance penetration is negative in both samples, it is only statistically significant among the less-developed countries.

## B. Participation, Saving Rates, and Public Insurance

Our model indicates that government safety nets, such as unemployment insurance, disability insurance, and publicly funded social security programs, should also have a positive impact on participation levels. By eliminating the possibility of suffering from a large, negative shock to income, these programs may induce individuals to increase their holdings of risky stocks. Moreover, the public insurance should also reduce individuals’ saving rate for the same reason.

To test this hypothesis, we repeat the above cross-country analysis using a measure of the social safety net present in the country. In particular, we use the degree to which citizens in the country are covered by a government-funded social security program. By providing a base amount of income for individuals in retirement, a social security program implicitly insures individuals against large adverse shocks to their pre-retirement income flows and their ability to save towards retirement. Such a program also implicitly insures individuals against an adverse shock to their personal retirement savings. Therefore, we should expect that in countries with larger social security programs, all else equal, individuals should be more likely to hold risky stocks.

We acquire information about a country’s social security program through the

---

<sup>22</sup>Countries are classified as ‘Low Income’ if the financial structure database lists their income group as either ‘Lower Income’ or ‘Lower Middle Income’, and as ‘High Income’ otherwise.

World Bank’s IEC database, which reports the fraction of a country’s working age population covered by a social security program. The dataset covers 86 countries over the years 1975-1994, though the coverage for most countries is limited to just two or three observations between the years 1987-1993. For the 14 countries that have both stock market participation and social security coverage data available, we calculate a country’s social security coverage rate using the most recent data available. We then repeat the above analysis by replacing the measure of private insurance penetration with the measure of social security coverage. These results are reported in Table III.

The estimates suggest a very strong positive correlation between social security coverage and stock market participation rates in a country. In the univariate regression reported in column (1), we find that an increase in a country’s social security coverage by one percentage point is associated with a stock market participation rate that is 0.28 percentage points larger. Again, these results are robust to controlling for a number of other factors: *financial development*, *shareholder rights*, *trust*, and *legal origin*. In fact, only *shareholder rights* and *trust* remain significant predictors of participation rates after controlling for social security coverage. Moreover, when we include all the controls, as done in column (6), we see that only social security coverage remains a strong positive predictor of stock market participation rates in a country.

Overall, the results suggest a potentially large role for social insurance programs in promoting stock market participation rates as predicted by our model. However, it is important to keep in mind that because of data limitations, our analysis is restricted to just 14 countries. Additionally, there is still potential for an omitted variable bias in that social security coverage might also be correlated to other country-level characteristics that are directly related to participation rates.

**Table III: Stock Market Participation and Social Security Coverage**

This table presents the estimates from the cross-country regression of stock market participation rates onto social security coverage. The dependent variable, *stock market participation rate*, is constructed using country-level surveys conducted between 1997-2000 and reported in Giannetti and Koskinen (2007). *Social Security Coverage* is the fraction of working age population covered by a social security program as most recently reported by the World Bank (IEC) Database. Other controls include financial development, shareholder rights, trust, and *common law*. *Financial development* is the ratio of total stock market capitalization to GDP in 1995. *Shareholder rights* is the anti-director rights index from La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998). *Trust* is the fraction of individuals in country that reply that 'most people can be trusted' as reported in the World Values Survey, 1995-1999. *Common Law* is an indicator equal to 1 if the legal origin of the country is English, as given by La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1999). Robust standard errors are reported in parentheses. \*\*\*, \*\*, and \* indicate statistical significance at the 1, 5, and 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)
<b>Social Security Coverage</b>	0.28*** (0.05)	0.27*** (0.05)	0.30*** (0.04)	0.21*** (0.04)	0.34*** (0.07)	0.26*** (0.05)
<b>Financial Development</b>		0.004 (0.057)				0.020 (0.037)
<b>Shareholder Rights</b>			0.036** (0.016)			0.022 (0.048)
<b>Trust</b>				0.263* (0.128)		0.279 (0.169)
<b>Common Law</b>					0.065 (0.041)	0.026 (0.115)
Observations	14	14	14	13	14	13
R-Squared	0.57	0.57	0.73	0.62	0.65	0.79

Similar to before, we can resolve some of these concerns by moving to a panel regression with country and year fixed effects and testing whether changes in social insurance programs are negatively correlated with changes in saving rates. However, since data on the percent of citizens covered by a social security program is not available for most countries over time, we instead rely on changes in a country's social security expenditures as a total fraction of public expenditures for this analysis. The data on social security expenditures is also obtained from the World Bank's IEC database and is available for 68 countries for the years 1970-1993. When combined with our data on private saving rates across countries, we are left with 58 countries that have both savings and social security expenditure data for the years 1970-1993. Again, we run a country-level regression with both country and year fixed effects. The estimates are reported in Table IV.

While the evidence is weaker than that of private insurance, there is still a negative correlation between country's private saving rates and the degree to which public expenditures are used to fund a social security program as seen in Column (1). When we use a smaller sample of countries that have data available for both GDP per capita and financial development, as seen in Column (3), we again find a very strong negative relation between social security expenditures and private savings rates. The magnitude of the coefficient indicates that a one standard deviation increase in the fraction of public expenditures used for social security is associated with a decrease in the country's private saving rate of thirteen percentage points. Additionally, there is again evidence that the negative correlation is stronger in low-income countries, as shown in Columns (4) and (5).

**Table IV: Saving Rates and Social Security Expenditures**

This table presents the estimates from the country-level, fixed effects regression with year dummies of *private saving rates* onto *social security expenditures*. The dependent variable, *private saving rate*, is constructed using the ratio of private savings to gross national disposable income reported by the World Savings Database, where private savings represents the difference between gross national savings and public sector savings. *Social Security Expenditures* is the fraction of public expenditures spent on social security as reported by the World Bank (WEI) Database. Other controls include Log(GDP per capita) and *Financial Development*. GDP per capita is obtained from the IMF-IFS database, and *Financial Development* is the ratio of stock market capitalization to GDP reported in the financial structure database. In Column (4), the sample is restricted to countries classified as "Low Income" and "Lower Middle Income" by the financial structure database, and Column (5) restricts the sample to all other countries. Standard errors are clustered at the country level and reported in parentheses. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level.

	<i>Dependent Variable = Private Saving Rate</i>				
	All Countries			Low-Income	High-Income
	(1)	(2)	(3)	(4)	(5)
$\chi^2$					
Social Security Expenses	-0.112* (0.063)	-0.184 (0.111)	-0.884*** (0.080)	-0.945*** (0.110)	-0.780*** (0.071)
Log(GDP per capita)		-0.009 (0.030)	0.037 (0.027)	0.063* (0.029)	0.012 (0.029)
Financial Development			0.080 (0.063)	-0.095 (0.067)	0.148* (0.070)
Countries	58	58	25	8	17
Observations	812	767	199	86	113
R-Squared	0.46	0.52	0.74	0.65	0.83

## C. Participation and Unemployment Insurance

Overall, the country-level analysis indicates a strong positive correlation between both the size of a country's private insurance industry and public insurance programs, as captured by social security coverage. However, as noted above, there is the possibility that the availability of insurance may differ across countries in a systematic way that biases our estimates. While it is encouraging that the estimates remain strongly significant even after controlling for numerous country-level factors or after using only within-country variation over time, it would be helpful to demonstrate the importance of insurance also holds on a more uniform set of economies.

To this effect, differences in unemployment insurance premiums across U.S. states provide a potentially interesting test of our model that suffers less from these concerns. As noted by Gruber (1994) and Chetty (2007), the degree to which unemployed individuals' wages are replaced varies significantly across U.S. states. Given this, our model would suggest that, all else equal, in those states with greater unemployment insurance generosity, fewer individuals will be subject to income shocks that drop them below their subsistence level, and hence, average stock market participation levels should be higher. Additionally, while there are certainly differences in household characteristics and local governments across U.S. states, it seems reasonable to expect that these differences will be less than those of our country-level analysis. Moreover, the greater availability of data at both the household and state level within the U.S. will better allow us to control for these differences.

To test the hypothesis that greater unemployment insurance generosity should increase stock market participation levels, we run the following regression:

$$\text{participation}_{s,1992} = \beta_0 + \beta_1 \text{UIG}_{s,1992} + \varepsilon_s, \quad (11)$$

where *participation* is the fraction of households in state  $s$  that owned stocks in 1992, as determined by the Health and Retirement Study (HRS) in 1992 and reported by Hong, Kubik, and Stein (2004).<sup>23</sup> *UIG* is our measure of the ‘unemployment insurance generosity’ for each state. This is measured using the log value of average weekly unemployment benefits paid to individuals in state  $s$  in 1992, as reported by the U.S. Department of Labor.<sup>24</sup> A higher *UIG* indicates that a state’s unemployment insurance program provides relatively higher wages to individuals that are unemployed. The estimates from this regression are reported in Column (1) of Table V. In support of our model, we find a strong positive correlation between average stock market participation levels and unemployment insurance generosity across U.S. states.

This finding is important for two reasons. First, it again demonstrates that social insurance programs may play an important role in determining stock market participation levels. Second, it shows that the strong positive correlation between participation levels and insurance coverage observed in the country-level data also exists within the U.S. This within country evidence mitigates the potential concern of omitted factors, such as legal origin and financial development.

However, there could still be an endogeneity problem if differences in U.S. household characteristics across states is correlated with unemployment insurance generosity. To address this, we rerun the above regression using the *abnormal participation rate* constructed by Hong, Kubik, and Stein (2004). This state-level measure captures the residuals from a household-level regression of a stock market participation indicator onto household characteristics such as age, income, wealth, years of educa-

---

<sup>23</sup>As noted by Hong, Kubik, and Stein (2004), the HRS survey measure of whether households hold stocks does not include holdings in mutual or retirement funds, and therefore, likely understates the true participation rate.

<sup>24</sup>These average weekly benefits were calculated by Chetty (2007) and downloaded from the author’s website. Our later regression results are also similar when we use unemployment insurance generosity as measured in other years or if we use direct weekly benefits rather than logged values.

**Table V: Stock Market Participation and Unemployment Insurance in the U.S.**

This table presents the estimates from a state-level regression of stock market participation rates onto unemployment insurance generosity. In column (1), the dependent variable, *stock market participation*, is the fraction of households in a state that report owning stocks in the 1992 Health and Retirement Study. These rates were obtained directly from Hong, Kubik, and Stein (2004). In columns (2)-(4), the dependent variable, *abnormal stock market participation*, is the state-level residual from a household-level regression of a stock market participation indicator onto household characteristics such as age, income, wealth, race, etc. as reported in Hong, et al (2004). The right-hand side variable, *UI Generosity*, is the the logged value of average weekly unemployment benefits received in a state in 1992 as reported by the U.S. Department of Labor and calculated by Chetty (2007). Other state-level controls, obtained from the 1990 U.S. Census, include *log(average household income)* and percent of persons with some college education. Robust standard errors are reported in parentheses. \*\*\*, \*\*, and \* indicate statistical significance at the 1, 5, and 10% level.

<i>Dependent Variable =</i>	<b>Stock Market Participation</b>	<b>Abnormal Stock Market Participation</b>		
	(1)	(2)	(3)	(4)
UI Generosity	0.174** (0.073)	0.083* (0.047)	0.096* (0.049)	0.094* (0.050)
% with College Education			-0.104 (0.150)	-0.101 (0.153)
Log(Average Household Income)				0.002* (0.001)
Observations	35	35	35	35
R-Squared	0.16	0.12	0.13	0.13



tion, race, risk tolerance, and an urban versus rural indicator.<sup>25</sup> In other words, this variable captures the amount of each state’s average participation rate that *cannot* be explained by characteristics of the household that might plausibly affect a their portfolio choices. By using this as our dependent variable instead, we are better able to exclude the possibility that omitted factors at the household level may drive the correlation between unemployment insurance generosity and stock market participation rates across U.S. states.

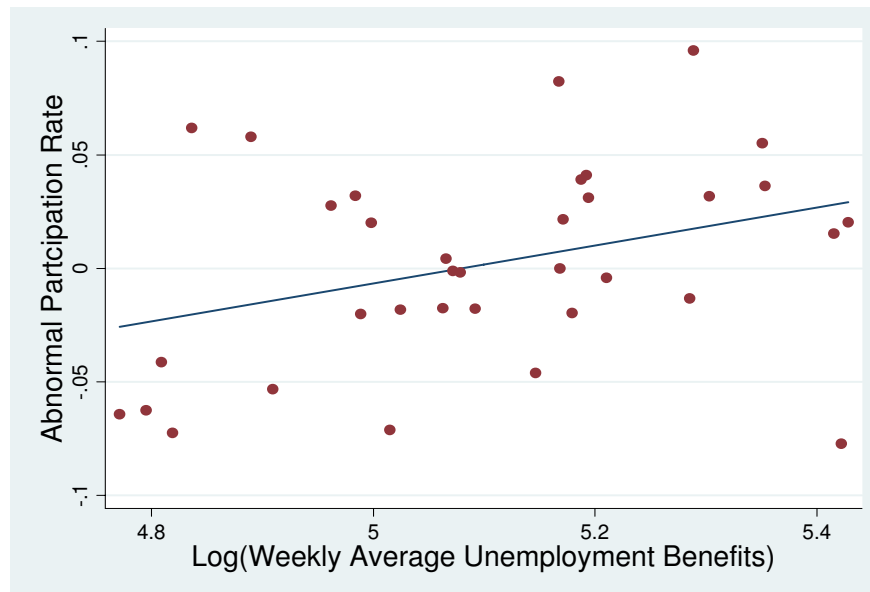
The estimates from this test, as reported in Column (2) of Table V, indicate the positive correlation between state-level participation rates and unemployment insurance levels is not driven entirely by differences in household characteristics across states. While using the residuals from the household regression weakens the estimate, we still find a positive relation between *UIG* and stock market participation levels that is significant at the 10 percent level. Furthermore, this positive correlation is robust to outliers, as seen in the scatter plot provided in Figure 11.

While the significant correlation between state-level unemployment generosity and participation rates, even after controlling for households characteristics, is highly suggestive of a role for public safety nets, there is still a potential concern that state-level unemployment generosity may be correlated with a state’s overall level of economic development or education levels, which may in turn be directly related to participation rates. If this is true, we could be wrongly attributing the impact of overall economic development or education to unemployment generosity.

However, the positive correlation between state-level unemployment generosity and participation rates does not appear driven by the differing levels of development or education across U.S. states. In Column (2), we add a control for the percent

---

<sup>25</sup>See Hong, Kubik, and Stein (2004) for more details on how this measure was constructed.



**Figure 10: Stock Market Participation Rates and Insurance**

This figure displays the univariate scatter plot of stock market participation rates across countries and the ratio of insurance premiums to GDP in 1995. Participation rates are constructed using country-level surveys conducted between 1997-2000 as reported in Giannetti and Koskinen (2007). The ratio of insurance premiums to GDP is obtained from the financial structure database produced by the World Bank and described in Beck, Demircuc-Kunt, and Levine (1999). The line represents the fitted estimates obtained from the univariate regression.

of persons within the state with some college education, and in Column (3), we add a control for the  $\log(\text{average household income})$  of the state. Both controls are calculated using the 1990 U.S. Census. Even after adding these controls for a states' overall education and income levels, we still find a significant positive association between participation levels and unemployment insurance generosity.

Similar to our country-level analysis, we should also expect to find that the importance of insurance for stock market participation should be higher when individuals face greater exposure to large, adverse shocks to their income. In this case, the impact of unemployment insurance should be particularly large in states where a greater fraction of workers are at risk of losing their job. This is in fact what we observe in the data. This is shown in Table VI where we repeat our analysis, but now include a control for the *risk* of a states' population and the interaction of this term with the unemployment generosity of that state. Our measure of *risk* is the fraction of a states' employees in 1992 that are located in 2-digit industries that have seen drops in overall employees exceeding five percent in the last five years as calculated using the 1987-1992 annual data reported by the U.S. Census Bureau in its County Business Patterns database. To make the interpretation of our coefficients easier to interpret, we have demeaned both variables, *risk* and *UIG*.

As shown in Column (1) of Table VI, the positive correlation between the generosity of a state's unemployment insurance program and stock market participation levels is particularly strong in states where a larger fraction of workers are employed in industries exhibiting significant drops in employees in the past 5 years. These results are also robust to including controls for percent of the states' population with at least some college education and the average household income of the state, as seen in Columns (2) and (3). Moreover, it is important to reemphasize that the depen-

**Table VI: Participation, Unemployment Insurance, and Risk**

This table presents the estimates from a state-level regression of stock market participation rates onto unemployment insurance generosity and a measure of how many workers are employed in industries with negative job growth over the past five years. The dependent variable, *abnormal stock market participation*, is the state-level residual from a household-level regression of a stock market participation indicator onto household characteristics such as age, income, wealth, and race, as reported in Hong, Kubik, and Stein (2004). The right-hand side variable, *UI Generosity*, is the the demeaned logged value of average weekly unemployment benefits received in a state in 1992 as reported by the U.S. Department of Labor and calculated by Chetty (2007). Risk Exposure is the demeaned fraction of a states' employees in 1992 that are located in 2-digit industries that have seen drops in overall employees exceeding five percent in the last five years as calculated using the 1987-1992 annual data reported by the U.S. Census Bureau in its County Business Patterns database. Other state-level controls, obtained from the 1990 U.S. Census, include log(average household income) and the percent of persons with some college education. Robust standard errors are reported in parentheses. \*\*\*, \*\*, and \* indicate statistical significance at the 1, 5, and 10% level.

<b><i>Dependent Variable = Abnormal Stock Market Participation</i></b>			
	(1)	(2)	(3)
<b>UI Generosity</b>	0.089 (0.053)	0.102* (0.052)	0.098* (0.055)
<b>Risk Exposure</b>	0.005 (0.169)	-0.060 (0.179)	-0.074 (0.186)
<b>UI Generosity * Risk Exposure</b>	1.090* (0.618)	1.199* (0.658)	1.236* (0.673)
<b>% with College Education</b>		-0.176 (0.176)	-0.178 (0.179)
<b>Log(Average Household Income)</b>			0.003* (0.002)
Observations	35	35	35
R-Squared	0.17	0.19	0.20

dent variable, *abnormal stock market participation*, is the state-level residual from a household-level regression of a stock market participation indicator onto household characteristics. Therefore, the positive impact of unemployment generosity reported in Column (3) is above and beyond what can be explained by household characteristics and state-level measures of education and wealth.

## D. Participation and Health Insurance

In addition to potential unemployment, individuals may also suffer a large, negative wealth shock following an adverse health shock. Given this, our model also indicates that individuals should be more likely to participate in the stock market when they are insured against such health shocks. This will be more likely true when individuals are covered under an employer-sponsored health insurance program. Households may also purchase life or long-term care insurance policies to mitigate such shocks. To that effect, we should also expect to find households covered by such insurance policies to be more likely to hold risky stocks.

To test this hypothesis, we run the following household regression:

$$\text{participation}_h = \beta_0 + \beta_1 \text{insurance}_h + \gamma X_h + \varepsilon_s, \quad (12)$$

where *participation* is an indicator that equals one if the household reports owning stocks in the Health and Retirement Study (HRS) of 1992. *Insurance* includes a number of indicators for whether the household reports being covered by an employer-sponsored health insurance program, life insurance policy, or long-term care policy. Finally,  $X_h$  captures a variety of other household characteristics that may affect stock market participation levels such as age, wealth, and income. In particular, we in-

clude the variables *Age*, which is the age of the oldest member in the household, and *Education*, which is the largest number of years of education obtained by a household member. We also include logged values of the households' reported wealth (including property) and income and indicators *Race* and *Marriage* that equal one if the household reports any non-white members or marriage. The estimates from this regression are reported in Table VII.

As predicted by the model, we find a strong positive correlation between stock market participation and insurance against adverse health shocks. All three types of insurance – employee-sponsored health insurance, life insurance, and long-term care insurance – exhibit a strong, positive relation to stock market participation for U.S. households even after controlling for household income, wealth, and education. Moreover, the magnitudes are economically significant. As reported in Column (4), households covered under an employee-sponsored health insurance program are four percentage points more likely to own risky stocks. This finding is consistent with the recent empirical findings of Qiu (2006) that households with health insurance are more likely to own stocks and tend to invest a larger proportion of their financial assets in stocks than uninsured households do, and of Goldman and Maestas (2005), who find that better health insurance is associated with greater investments in risky assets.

Again, however, our results should be interpreted with caution. While the positive correlation between participation rates and employee sponsored health insurance is suggestive, a potential endogeneity concern remains. For example, it is possible that households with an employee-sponsored health insurance policy are different in way that we are not controlling for that makes them more likely to hold risky stocks. Moreover, there could also be a concern of reverse causality in that households that

**Table VII: Health, Life, and Long-Term Care Insurance**

This table presents the estimates from a U.S. household-level regression of stock market participation rates onto measures of insurance coverage. The dependent variable, *stock market participation*, is an indicator that equals one if the household reports owning stocks in the 1992 Health and Retirement Study. *Employee Health Insurance*, *Life Insurance*, and *Long-Term Care Insurance* are indicators equal to one if the household reports having a such an insurance policy. *Age* is the age of the oldest member in the household. *Education* is the largest number of years of education obtained by a household member. *Race* is an indicator equal to one if any household member is non-white. *Marriage* is an indicator equal to one if the respondent for the household reports being married. *Wealth* is the household's total reported wealth including property. *Income* is the total household income reported. Robust standard errors are reported in parentheses. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level.

<b><i>Dependent Variable = Stock Market Participation Indicator</i></b>				
	(1)	(2)	(3)	(4)
<b>Employee Health Insurance</b>	0.038*** (0.011)			0.036*** (0.012)
<b>Life Insurance</b>		0.056*** (0.011)		0.040*** (0.012)
<b>Long-Term Care Insurance</b>			0.122*** (0.042)	0.113*** (0.043)
<b>Age</b>	0.002** (0.001)	0.002** (0.001)	0.002*** (0.001)	0.002** (0.001)
<b>Education</b>	0.024*** (0.002)	0.024*** (0.002)	0.024*** (0.002)	0.022*** (0.002)
<b>Race</b>	-0.074*** (0.011)	-0.076*** (0.011)	-0.075*** (0.011)	-0.077*** (0.011)
<b>Marriage</b>	-0.029 (0.024)	-0.051** (0.024)	-0.038 (0.023)	-0.047* (0.024)
<b>Log(Wealth)</b>	0.092*** (0.003)	0.09*** (0.003)	0.092*** (0.004)	0.091*** (0.004)
<b>Log(Income)</b>	0.044*** (0.007)	0.047*** (0.007)	0.053*** (0.007)	0.045*** (0.008)
<b>Observations</b>	9484	9427	8930	8816
<b>R-Squared</b>	0.19	0.20	0.20	0.20

hold more risky stocks may choose jobs based on the health insurance program offered by employers. While this this would still suggest an important relation between insurance and the ownership of risky stocks, the underlying story would be different.

## V. Concluding Remarks

We show that the existence of a large, negative wealth shock and the lack of insurance against such a shock can provide a simple and alternative explanation for both the limited stock market participation puzzle and the consumption-saving puzzle. We show that no matter how unlikely the negative wealth shock is, in the absence of insurance, it is rational for investors to not participate in the stock market at all, to consume a minimum amount, and to save almost all of their wealth. However, once insurance is available at a reasonable cost, we find that investors will in general participate more in the stock market, consume more, and save less. Our model suggests that developing a better insurance industry or government funded social safety nets can be a solution to the limited participation, low consumption, and high saving issues in countries like China.

In our extensive empirical analysis, we find that the implications of our model are substantially supported by the data in a diverse set of tests. At the country level, we find that the development of private insurance markets is positively related to stock market participation levels, and that increases in the size of the private insurance industry are negatively correlated with savings rates within countries over time. Moreover, the degree to which individuals' retirement consumption is insured via a government-funded social security program is also positively related to their willingness to hold risky stocks and negatively related to their overall savings rates.



These findings are particularly strong in low-income countries where the possibility of adverse income shocks is likely more acute. At the same time, however, there is also evidence that differences in the generosity of government's unemployment insurance across U.S. states are correlated with individuals' stock market participation rates. This holds even after controlling for both household characteristics and state-level differences in income and education levels. The findings are also stronger in states where workers are at a greater risk of losing their jobs. Finally, the use of health, life, and long-term care insurance is also positively related to U.S. household participation rates. While each of these tests admittedly has their weaknesses, the combination of evidence suggests a potentially important role for insurance in terms of explaining both the limited stock market participation and the low-consumption-high-savings puzzles.

Overall, there is little research devoted to the important impact of insurance on consumption, saving, stock market participation, and asset pricing. Further theoretical and empirical work are necessary for understanding how insurance affect investors' life-cycle consumption, saving, and investment decisions.

## Appendix

In this appendix, we provide all the proofs.

PROOF OF PROPOSITION 1. The investor's problem can be written as

$$\begin{aligned}
\max_{c_0, \theta} \quad & U(c_0) + \delta[p(1 - \epsilon)U(W_0 - c_0 - \theta + \theta u + W_1) \\
& + (1 - p)(1 - \epsilon)U(W_0 - c_0 - \theta + \theta d + W_1) \\
& + p\epsilon U(W_0 - c_0 - \theta + \theta u - D) \\
& + (1 - p)\epsilon U(W_0 - c_0 - \theta + \theta d - D)].
\end{aligned} \tag{13}$$

Suppose  $\theta > 0$ , then we have

$$\begin{aligned}
W_0 - c_0 - \theta + \theta d - D & \leq W_0 - c_0 - \theta + \theta d - (W_0 - 2\underline{c}) \\
& \leq \underline{c} - \theta + \theta d \\
& < \underline{c}.
\end{aligned}$$

So the fourth term in (13) is  $-\infty$  and other terms less than  $+\infty$ . Therefore, we must have  $\alpha^* \leq 0$ . Similar argument on the third term leads to the conclusion that  $\alpha^* \geq 0$ . Thus we must have  $\theta^* = 0$ . Given that  $\alpha^* = 0$ , and  $U(c) = -\infty$  for any  $c < \underline{c}$ , we must have  $c_0^* = \underline{c}$ .  $\square$

PROOF OF PROPOSITION 2. Taking the first derivative of the objective function with respect to  $I$ , we have

$$\delta[-p(1 - \epsilon)\epsilon U'(W_0 - c_0 - \epsilon I - \theta + \theta u + W_1)] \tag{14}$$

$$-(1-p)(1-\epsilon)\epsilon U'(W_0 - c_0 - \epsilon I - \theta + \theta d + W_1) \quad (15)$$

$$+ p\epsilon(1-\epsilon)U'(W_0 - c_0 - \epsilon I - \theta + \theta u + I - D) \quad (16)$$

$$+(1-p)(1-\epsilon)\epsilon U'(W_0 - c_0 - \epsilon I - \theta + \theta d + I - D)], \quad (17)$$

which is always greater than 0 because the third (fourth) term is always greater than the first (second) term, due to the strict concavity of the utility function and  $I \leq D$ . In addition,  $I = D$  is feasible for small enough  $\epsilon$  because Assumption A guarantees that at  $\epsilon = 0$  “buying” full insurance is feasible. Therefore, we must have  $I^* = D$ .  $\square$

PROOF OF PROPOSITION 3. Taking the first derivative of the objective function in (13) with respect to  $\theta$  and evaluating it at  $\epsilon = 0$ , we have

$$(pu + (1-p)d - 1)[U'(W_0 - c_0 - \lambda I + W_1) + U'(W_0 - c_0 - \lambda I + I - D)],$$

which is always positive (negative) if  $(pu + (1-p)d - 1) > (<)0$  for any optimal choice of  $c_0 = c_0^*$  and  $I = I^*$ , since the utility function is strictly increasing. This implies that  $\theta^* \neq 0$  as long as the risk premium  $(pu + (1-p)d - 1)$  is not zero (recall that we set interest rate to zero for notational simplicity).  $\square$

PROOF OF PROPOSITION 4. As  $W_1$  approaches  $\infty$  and  $\epsilon$  approaches 0, the first derivative of the objective function in (13) with respect to  $c_0$  approaches  $U'(c_0) > 0$ . This implies that  $c_0^*$  must approach  $W_0 - \underline{c}$  and hence greater than any  $c_0 < W_0 - \underline{c}$ .  $\square$

## References

- Ang, Andrew, Geert Bekaert, and Jun Liu, 2005, “Why stocks may disappoint?” *Journal of Financial Economics* 76, 471–508.
- Aziz, Jahangir, Eswar Prasad, and Steven Dunaway, 2006, China and India: Learning from each other, Washington: International Monetary Fund.
- Basak, Suleyman, and Domenico Cuoco, 1998, An equilibrium model with restricted stock market participation, *Review of Financial Studies* 11, 309–341.
- Beck, Thorsten, Asli Demirguc-Kunt, and Ross Levine, 2000, A new database on the structure and development of the financial sector, *World Bank Economic Review* 14, 597–605.
- Campbell, John Y., 2006, Household finance, *Journal of Finance* 61, 1553–1604.
- Cao, Henry, Tan Wang, and Harold H. Zhang, 2005, Model uncertainty, limited market participation, and asset prices, *Review of Financial Studies* 18, 1219–1251.
- Cao, Henry, David Hirshleifer, and Harold H. Zhang, 2005, Diversification and capital gains taxes with multiple risky assets, Working Paper, Cheung Kong Graduate School of Business.
- Cao, Shi Larry, and Franco Modigliani, 2004, The Chinese saving puzzle and the life-cycle hypothesis, *Journal of Economic Literature* 42, 145–170.
- Chamon, Marcos, and Eswar Prasad, 2006, The Determinants of household saving in China, Working Paper, International Monetary Fund.

- Chetty, Raj, 2007, Moral hazard vs. liquidity in unemployment insurance, UC-Berkeley, working paper.
- Chou, Shin-Yi, Jin-Tan Liu, James K. Hammitt, 2003, National health insurance and precautionary saving: evidence from Taiwan, *Journal of Public Economics* 87, 1873-1894.
- Cochrane, John H., 2001, Asset Pricing, Princeton University Press, NJ.
- Cochrane, John H., 2005, Financial markets and the real economy, *Foundations and Trends in Finance* 1, 1–103.
- Dow, James, and S. Werlang, 1992, Uncertainty aversion, risk aversion and the optimal choice of portfolio, *Econometrica* 60, 197–204.
- Epstein, Larry, and M. Schneider, 2005, Learning under ambiguity, Working Paper, University of Rochester.
- Giannetti, Mariassunta and Yrjo Koskinen, 2007, Investor protection, equity returns, and financial globalization, working paper.
- Goldman, Dana, and Nicole Maestas, 2005, Medical expenditure risk and household portfolio choice, NBER working paper, 11818.
- Gruber, Jonathan, 1994, The consumption smoothing benefits of unemployment insurance, *American Economic Review* 87, 192-203.
- Gruber, Jonathan, 2002, The wealth of the unemployed, *Industrial and Labor Relations Review* 55, 79–94.
- Gruber, Jonathan, and Aaron Yelowitz, 1999, Public health insurance and private savings, *Journal of Political Economy* 107, 1249–1274.

- Guiso, Luigi, Michael Haliassos, and Tullio Jappelli, 2003, Household stockholding in Europe: Where do we stand and where do we go? *Economic Policy* 18, 117–164.
- Guiso, Luigi, Tullio Jappelli and Daniele Terlizzese, 1996, Income risk, borrowing constraints and portfolio choice, *American Economic Review* 86, 158–72.
- Guiso, Luigi, Paola Sapienza, and Luigi Zingales, 2007, Trusting the stock market, *Journal of Finance*, forthcoming.
- Haliassos, Michael, and Carol C. Bertaut, 1995, Why do so few hold stocks?, *Economic Journal* 105, 1110–1129.
- Heaton, John, and Debra Lucas, 1997, Market frictions, savings behavior and portfolio choice, *Macroeconomic Dynamics* 1, 76–101.
- Heaton, John, and Debra Lucas, 2000, Portfolio choice and asset prices: The importance of entrepreneurial risk, *Journal of Finance* 55, 1163–1198.
- Hong, Harrison, Jeffrey D. Kubik, and Jeremy Stein, 2004, Social interaction and stock-market participation, *Journal of Finance* 59, 137–163.
- Huang, Jennifer, and Jiang Wang, 2007, Market liquidity, asset prices, and welfare, Working Paper, MIT.
- Kimball, Miles S., 1993, Standard risk aversion, *Econometrica* 60, 589–611.
- Koo, Hyeng Keun, 1991, Consumption and portfolio choice with uninsured income risk, Mimeo, Princeton University.
- La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert W. Vishny, 1998, Law and finance, *Journal of Political Economy* 106, 1113–1155.

- Linnainmaa, Juhani, 2005, Learning and stock market participation, Working Paper, University of Chicago GSB.
- Liu, Hong, 2004, Optimal consumption and investment with transaction costs and multiple risky assets, *Journal of Finance* 59, 289–338.
- Liu, Hong, and Mark Loewenstein, 2002, Optimal portfolio selection with transaction costs and finite horizons, *Review of Financial Studies* 15, 805–835.
- Merton, Robert C., 1971, Optimum consumption and portfolio rules in a continuous-time model, *Journal of Economic Theory* 3, 373–413.
- Mankiw, N. Gregory, and Stephen P. Zeldes, 1991, The consumption of stockholders and nonstockholders, *Journal of Financial Economics* 29, 97–112.
- Qiu, Jiaping, 2006, Precautionary saving and health insurance: A portfolio choice perspective, Working Paper, Wilfrid Laurier University.
- Shiller, Robert J., 2004, Household reaction to changes in housing wealth, Working Paper, Yale University.
- Vissing-Jorgensen, Annette, 2002, Towards an explanation of household portfolio choice heterogeneity: Nonfinancial income and participation cost structures, Working Paper, NBER.