Employer Stock Risk, Employee Income Risks, and Portfolio Choice: New Evidence from Taiwan[1]

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February 2011

Abstract

Using comprehensive data on investor portfolio holdings and employer information from Taiwan, we provide novel evidence on how labor risk influences household portfolio choices. For individuals employed at listed companies in Taiwan, we find that both employer-level and individual-level income risks affect portfolio choices. Employees at companies with greater stock return volatilities are less likely to invest in equities. Consistently, such investors invest a smaller fraction of their financial assets in the stock market and employer stocks. Such results hold when we focus on the firm-specific risks in employer stock returns. Further, for individuals at the same company, those with higher income risks are less likely to invest in the equity market as a whole and invest a smaller fraction of financial wealth in equities. Our findings confirm theory predictions that labor income risk is important to household portfolio choices. The current study contributes to a better understanding of the puzzle of limited equity market participation and the equity premium puzzle.

Keywords

Portfolio choices; Stock holdings; Employer Stock Risk, Employee Income Risks

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1. Introduction

Household portfolio choice is a very important topic in economics. How households allocate their capital across different asset classes and how households choose to invest over different time has considerable influence on not only the welfare of each household, but also the asset pricing formation process at the macroeconomic level and real economic growth (Campbell (2006)).

One phenomenon that has been puzzling scholars is households' limited participation in the stock market. Studies report that about one-half of U.S. households do not invest in the stock market, and other developed markets witness a similar level of stock market participation (Hong et al. (2004)).The number is even lower for emerging markets where financial markets are less developed (Guiso and Jappelli (2002))

Given that households forego considerable benefits when they do not invest in stock markets (Vissing-Jrogensen (2002a, 2002b)), policymakers have been watching this topic closely as limited stock market participation seems to preclude some households from sharing societal economic growth. In addition, recent debate on social security investment hinges upon a better understanding of households' asset allocation choices and the desired policies that would induce households to make better retirement investments (Lee et al. (2008)).

Meanwhile, better understanding of limited stock market participation is important to academic research literature. Extant studies point out that the limited stock market participation puzzle is probably related to some other equally important puzzles in the literature, such as the equity premium puzzle and the excessive volatility puzzle (Barberis et al. (2001)). Cao and Zhang (2005) and Cocco (2004) argue that understanding why households avoid stock market participation is critical to understanding the equity premium puzzle.

Various theoretical studies have pointed out that labor income risks are responsible for the limited stock market participation puzzle. For example, Viceira (2002) and Cocco (2004) show that a positive correlation between labor income and stock returns reduces investors' holding of risky assets. Heaton and Lucas (2000a) argue that if households cannot hedge their labor income risks, they will rationally choose to hedge such risks by holding less or completely avoiding risky assets. Further, Vissing-Jorgensen (2002b) and Guiso and Jappelli (2002) contend that different components of investors' labor income, such as labor income at the employer level and the less diversifiable risks at each individual level, all matter to stock market participation.

Despite the large body of extant theoretical studies predicting the relation between investor labor income and portfolio choices, empirical investigation of this topic has been limited, largely due to the lack of available data. One strand of research relies on survey data based on a subsample of the national population. Heaton and Lucas (2000b) use Survey of Consumer Finance (SCF) and individual tax return data and find a weakly negative yet insignificant relationship between the share of risky assets and the standard deviation of wage income. Interestingly, they also find that the share of stockholdings is negatively and significantly related to the variability of the growth rate of proprietary income. In addition, the correlation between income and stock market movement also is found to have a weakly negative impact on the fraction invested in the equity market.

Following studies using survey data from the United States (Vissing-Jorgensen(2002b), Qi and Wu (2006)) are divided about the relationship between stock market participation and various proxies for labor income risks. With a sample of Italian households, Guiso et al. (1996) find a negative relationship between the fraction of risky assets to total wealth and the variation of household income. Arrondel et al. (2005), however, do not find a significant relationship between the two in France.

To overcome the limitations of the survey data summarized in Campbell (2006)'s presidential address to the American Finance Association (selection bias, data accuracy, lack of detailed and longitudinal data), several other studies obtain household level income and portfolio choice information and generate interesting findings. Massa and Simonov (2006) use LINDA data from Sweden and find that income risks seem to encourage, instead of deter, investment in stock markets, contrary to theory predictions. With more comprehensive and detailed information on portfolio holdings and investor characteristics, Calvet, Campbell, and Sodini (2007) argue that financial sophistication matters considerably to investors' participation in the stock market.

The current study takes advantage of a novel data source from Taiwan to revisit this important topic. For all Taiwanese households, we obtain detailed information on portfolio holding and wealth and income information from 1998 through 2001 from the Data Center at the Ministry of Finance of Taiwan. One unique feature of the data is that it contains each individual's employer information. Using this information and focusing on employees at listed companies, we can study how diversifiable (employer-level) and non-diversifiable (employee-level) labor income risks influence portfolio choices in the same study.

First, we estimate the riskiness of a company by estimating the total and idiosyncratic risks of its stock returns. The risks of employer stock returns reflect the riskiness of the employer's business and the probability of the employer going into distress and hurting employee security. In addition, with the introduction of the employee stock ownership plan in Taiwan in the late 1990s, the variability of stock returns would affect the variability of employee income. If individuals indeed adjust their portfolio choices in response to such employer-level components of their income risks, theory predicts that employees at employers with higher stock returns reduce their investment in risky assets.

In addition, we look into whether labor income risk at an individual level contributes incrementally to household portfolio choices. Following previous studies (Carroll and Samwick(1997), Vissing-Jorgensen (2002b), Massa and Simonov (2006)), we construct a conditional standard deviation of labor and non-financial income that reflects not only employer risks, but also different levels of sensitivity to employer performance. Because we estimate the idiosyncratic component of income risk at the employee level and control for employer level (salary distribution and compensation breakdown) and the employee level (i.e. age, gender, marital status) variations, we can more accurately estimate the employee-level income risks than in previous studies. Following the prediction in Heaton and Lucas (2000a) and Vissing-Jorgensen (2002b), individuals with greater idiosyncratic income risks also should reduce their risky investments.

We find support for both predictions. First, we show that the riskiness of employer stock has considerable influence on portfolio decisions. Employees at companies with more volatile

historical stock returns are less likely to invest in equities as an asset class and invest a smaller fraction of their financial wealth in equities. Both effects are economically meaningful: one standard deviation increase in employer stock total risk results in about a 0.7 percent lower likelihood of stock market participation and more than a 3 percent decrease in the fraction of total financial wealth invested in equities. We find results of the same direction and greater magnitude when we examine the intensity of investment in the employer stock, another proxy for investment in risky assets. A one standard deviation increase in employer risk leads to over a 14 percent decrease in the fraction of financial wealth invested in employer's stock. Such findings confirm that the firm-level component of household labor income is important to understanding household portfolio decisions, such as stock market participation and asset allocation in risky assets.

In addition to the labor risk at the firm level, we also investigate how individual-level labor income risk affects portfolio choices. Following prior studies (Carroll and Samwick (1997), Vissing-Jrogensen (2002b)), we generate a conditional standard deviation of labor income, which explicitly controls for factors that influence labor income, such as demographic and other variables, as a reflection of the income risk that each household faces. Consistent with theory argument, Taiwanese investors are less exposed to risky assets (equities or employer stocks) if they have a higher level of labor income variation. Such a relationship also is economically meaningful: a one standard deviation increase in individual income risk reduces the probability of investing in the stock market by 1.9 percent, and for those who choose to invest, reduces the fraction of risky assets by more than 8.9 percent. In sum, our findings confirm that individual-level labor income risk, in addition to firm-level income risk, has marginal explanatory power for household portfolio choices.

These main findings are robust under a host of robustness tests. We experiment with different models to estimate employer-level risks, various measures of labor income, and alternative definitions of employees' wealth. Our results remain the same among a subsample of people who changed jobs: those facing greater (less) income risk after career change invest less (more) in risky assets. Finally, our results are robust within sub samples of years and in a smaller random sample.

Our contributions to the literature lie in the following two areas. First, we provide new evidence on the relationship between income risks and portfolio choices with international data. Given the differences in fundamental economy, financial market infra-structure, and investor demographics, extant studies (Calvet et al. (2007), Heaton and Lucas (2002s), among others) call for more international evidence on the relationship between income risks and portfolio choice. Our new results from an emerging Asian economy complement extant findings focusing exclusively on developed markets in the West.

Further, our findings contrast with other international studies (Arrondel et al. (2005), Massa and Simonov (2006)) that find a positive relationship between investment in risky assets and income risks and provide strong support for theory prediction (Cocco (2004), Heaton and Lucas (2000a)). Several factors potentially are responsible. First, with precise employer information, we consider employer- and employee-level income risks in the same framework. In addition, our employer-level information enables us to estimate individual income risks more accurately.

Further, unlike investors in Sweden who invest extensively through mutual funds (Calvet et al. (2007)), Taiwanese investors mostly invest directly in stocks and rely far less on mutual funds during our sample period. Finally, we focus on employees at listed companies, who earn about 25 percent more than the rest of the population (683,142 against 537,872 NT$). This may explain why our results differ from those in prior Swedish studies that look at the entire population.

Finally, we can disentangle the diversifiable (employer-level) and non-diversifiable idiosyncratic (employee-level) components of income risks and study their separate effect on portfolio choice. Heaton and Lucas (2002a) find that entrepreneur risks that are difficult to hedge reduce households' investment in risky assets (i.e. other common stocks). Angerer and Lam (2009) show that the permanent component of income risks influences portfolio choices, but not the transitory component. With these two exceptions, most extant studies cannot distinguish the two components of income risks and therefore cannot perform accurate identification and testing of theory prediction on non-diversifiable income risks. We bridge such a gap in the literature by examining and providing a more precise test and reliable support for theory prediction that non-diversifiable income risks should negatively affect households' investment in the equity market.

The rest of the paper proceeds as follows. Section 2 outlines the data; Section 3 describes methodology adopted in the empirical analyses; and Section 4 presents our empirical results before we conclude in Section 5.

2. Market Background and Data Description

The Taiwan stock market commands a total market capitalization of about NT $10 trillion (about US $313 billion) in our sample period of the late 1990s and early 2000s. It ranked as the 12th largest equity market in the world in that period and is much bigger than the Swedish and Finnish markets in the previous studies. The listed stock market includes both stocks listed at the Taiwan Stock Exchange (TSE) and over-the-counter (OTC) stocks, with TSE dominating the total market capitalization.

The Taiwan stock market is highly volatile. During the decade between 1993 and 2003, the average annual volatility is 32.3 percent, 72 percent greater than the volatility in the U.S. market during the same period. On the other hand, the average annual return is 10.5 percent, similar to that of U.S. market index. Such high volatility is due partly to the variable fundamental economy during the past decade, but also to the fact that retail investors dominate the market and investor sentiment shifts rather swiftly (Barber et al. (2009)). Such high volatility makes it particularly important to study investors' attitudes toward risky assets and employer stocks because such decisions will make a bigger difference to investor welfare in Taiwan than to investors in countries with relatively stable market.

We use a unique dataset from Taiwan from between 1998 and 2001 in the current study. The data are collected and compiled by the Financial Data Center (FDC), Ministry of Finance in Taiwan. Because processing the data is time consuming and because the data is sensitive, this is the most comprehensive period of available data. The data center collects detailed household information for tax filing after the end of each calendar year. The data is similar to the

information that the Internal Revenue Service (IRS) collects in the United States for household tax filing and covers the entire population of Taiwan. (Please refer to Appendix A for details regarding the source and quality of the FDC data.)

2.1. Sample construction

During our sample period from 1998 through 2001, about 13 million people in Taiwan filed taxes during each sample year. For each filer, we have the following four types of files: (1) the wealth file records the taxable value of house, land and farm at the individual level from 1997 through 2002; (2) the income file records different types of income including wage and salary, interest, dividends, self-employment income, rentals and royalties, pensions, and other income that household members receive, and income taxes levied on the individuals from 1997 through 2002; (3) the stock holdings file records the number of shares invested in companies at the time of filing (the deadline is Dec. 31 of each year) from 1998 through 2001; (4) the household member file records the characteristics (age, gender, and relation, etc.) of each household member from 1997 through 2002. In order to have complete information within respective sample years, we focus on the 1998-2001 period throughout the rest of the paper.

We construct our sample data by starting with the entire population data on individual income tax files (including income data, household registration data, assessment data and deduction data) and personal property data files (including national house data, land data, and farmland data) from 1997 through 2002, and firms' shareholder records from 1998 through 2001 supplied by the FDC in Taiwan. All data are filed individually and can be linked by the individual identification number to a panel data covering the entire population of all data files. Through the household identification number, we also can compile the data at the family level.

The number of listed companies in Taiwan increases from 604 in 1998 to 913 in 2001, and there are a total of 1,984 firm-year observations. The number of employees at listed companies also increases from 526,306 to 654,470 in the same period. Among the total 2,400,192 individual/year observations, we exclude observations from companies if there are fewer than 75 weekly return observations in the prior three-year period and observations from companies for which employees' wage and salary data are missing, stockholders are missing or where there are less than 50 employees. We exclude individuals with total financial wealth less than NT $10,000, employees with fewer than three annual observations on the listed or public companies' income files, and employees for whom the conditional standard deviations of labor income are in the top or bottom one percent of observations. After such filtering, our final sample ends up with 1,312,641 individual observations.

One question that arises with using a part of the population to make inferences about household behavior at the household level is the sample's representativeness. To alleviate potential concerns with generalizing the results to the market level, we conduct a large number of profile comparisons between people employed at listed companies and those employed at non-listed companies. Employees at non-listed companies make about 28 percent less in annual income than those at listed companies and display much lower stock market participation, and the fraction of financial assets invested in equities also tend to be smaller. We feel that our

findings would probably grow stronger for non-listed company employees because they have lower income and are more concerned with their job security and labor income risks. Consistent with our conjecture, the National Policy Foundation of Taiwan reports that peoples in the low-income category who are older than 45 face greater difficulty in job searching and job changing.[2] Therefore, we feel that our analysis produces a conservative estimate of the phenomenon among all employees.

2.2. Information on employees' wealth and portfolio holdings

The data classify individual financial assets (portfolio holdings) into the following categories: listed equity holdings, bond holdings, real estate, and equity holdings in private companies at the time of tax filings. This information essentially provides us both complete holdings invested in different asset classes (detailed below), individual personal portfolios (asset allocation), and precise information on the amount an investor invests in each individual stock (stock picking), including his or her employer stocks. As in many other East Asian economies, households in Taiwan have relatively high savings rates and lower levels of indebtedness than the populations in the West. According to the Bureau of Statistics of Taiwan[3], the average household level of indebtedness ranges between 12.54 and 14.97 percent.

We next generate the fraction of financial wealth invested in different asset classes at the individual level. Firms legally are required to report their individual shareholder records at the time of tax filing, often close to the end of each calendar year. We compile the listed stock closed price at yearend from the *Taiwan Economic Journal* database (TEJ) and compute the market value of listed stockholdings, measured as the number of shares of stock holding times its stock price. We can crosscheck the accuracy of the information of listed stockholdings in our data by comparing the information of listed stocks at the Taiwan Stock Exchange (TSE) and over-the-counter (OTC) stocks. Overall, the data provide stockholder records on 97.15 percent of the listed firms and 97.04 percent of the market capitalization of listed companies. Relative imputed bond holding is defined as the ratio of imputed bond holdings to financial wealth. Following Heaton and Lucas (2000), we impute bond holdings for each employee in each year by dividing interest income by average annual interest rate on savings deposits.[4]

We obtain employees' real estate information from the personal property data files. We impute the market value of housing and land for each employee each year by using the averaged ratio of market value to tax-assessed value provided by each county each year by Department of Land Administration. However, because the Department of Land Administration does not provide the similar information for farms, we use the tax-assessed value of a farm as a proxy for the market

[2]http://www.npf.org.tw/post/2/6323

[3]http://www.dgbas.gov.tw/lp.asp?ctNode=3104&CtUnit=394&BaseDSD=7

[4]However, non-interest-bearing assets (e.g., checking deposit) are not counted. Fortunately for our study, checking accounts make up less than 2 percent of total national deposits, according to summary statistics from the central bank (ranging from 1.4 to 1.9 percent between 1998 and 2004).

value of the farm. In sum, the imputed value of real estate is the sum of the market value of housing, the market value of land, and the tax-assessed value of farm land.

Some employees at listed companies hold stakes in other businesses due to earlier entrepreneur activities or investment projects. Given that such companies are privately held and not obligated to disclose financial information, we use either net value per share as reported by companies (which should be consistent with any public transaction disclosed to the market) or the par value (tens in NT$) if the former is unavailable. We acknowledge that such records can be obsolete and cause some underestimation of holdings in privately held companies. We perform robustness tests using a subsample of employees who do not invest in non-listed companies. All our major findings remain and, indeed, become slightly stronger.

We illustrate the sample employees' asset allocation decisions in Figure 1 and 2. Figure 1 suggests that savings and stock investments make up the majority of assets for employees with relatively lower financial wealth, with the two asset classes commanding about 90 percent of employees' financial wealth. As financial wealth increases, the fraction of both savings and equity investment decreases, with savings still making up about 20 percent of financial wealth, not uncommon for East Asian economies with much higher savings rates than the Western states. Real estate becomes the dominant asset class for employees with higher financial wealth. Holdings in non-listed companies and employer stocks were proportionally high for less wealthy employees and become insignificant for wealthier employees. Again, this is consistent with the folklore in East Asia that most people are 'house rich'— making most of their fortune from real-estate investments. Figure 2 reveals that the participation rate for almost all asset classes increases with financial wealth percentile.

A limitation of the data is that it does not include employees' holdings in mutual funds (Calvet et al. (2009)). This is less of a problem for Taiwan during our sample period than it would be elsewhere. In contrast with the situation in Sweden, where households invest heavily through mutual funds, in Taiwan during our sample period, mutual funds are underdeveloped and employees' holdings in mutual funds are relatively modest. Additionally, according to summary statistics from the central bank, mutual funds make up between 1.37 and 3.26 percent of household domestic financial assets during our sample years. Therefore, we feel that such lack of information on mutual fund holdings should not have directional impact on our results. Nonetheless, readers should interpret our results with due care.

Another potentially important composition of employees' portfolio is holdings in foreign assets. For example, Calvet et al. (2007) show that Swedish households holds portfolios that are well diversified across global financial markets. However, the Swedish experience may not represent the majority of other countries (French and Poterba (1991)). According the Bureau of Statistics of Taiwan[5], foreign assets make up between 1.49 and 2.19 percent of the average household's total assets. Therefore, foreign assets should not have much impact on our main findings.

(Insert Table 1 about here)

[5]http://www.dgbas.gov.tw/lp.asp?ctNode=3104&CtUnit=394&BaseDSD=7

2.3. Information on employees' incomes

We obtain precise employee income information from the Income File. Most households' incomes consist of a combination of non-financial income, financial income, and other income (i.e. pension income for the retirees).

Non-financial income includes salary, self-employment income, rent income, royalties, and award and lottery income. Panel A of Table 1 suggests that salary income makes up over 97 percent of total non-financial income. According to labor law, if an individual's major salary and wage from a company is above NT$216,000, this person is identified as an employee of the company, and the company will report the employee's salary income to the tax authorities. Otherwise, an individual must file salary income from self-employment. The salary income includes the total value of basic salary, a year-end bonus, employees' cash bonuses, and the fair value of employees' stock bonuses. Although employees rarely were prevented from selling their holdings in company stocks from stock bonuses, prior studies (Lee et al. (2008), Cohen(2007)) show that stock (option) granting influences household portfolio choices. Therefore, we perform robustness tests using a subsample of employees at companies that granted or did not grant stock bonus in the past three years. Our results are robust within respective subsamples of employees.

Financial income includes interest income and dividend income. Capital gain is not subject to taxation in Taiwan and therefore not reported under tax filings obligations. Finally, we have information on the amount of income from other sources, such as pension income for the retirees.

2.4. Information on employees' demographic characteristics

To facilitate our empirical study and control other factors important to portfolio choices, we obtain a host of employees' demographic characteristics, such as each employee's household size, age, and gender, from the household member file. We report the summary statistics in Table 1. More than one half of the sample is male (60.48 percent) and married (72.65 percent). About one quarter (23.81 percent) of the sample have mortgage payments. The average employee's age is 38, and there are four people in an average family. About three quarters (74.85 percent) invest in the listed stock markets in Taiwan. This number is much higher than that for the entire population (29.3 percent), which indeed mirrors closely the stock market participation rate in the United States and other developed markets (Huberman and Jiang (2006)).

2.5. Information on firm-level characteristics

Companies are distributed widely across industries, with technology and financial companies commanding leading market capitalization (29.28 and 11.79 percent, respectively). We trace the operation of each listed company in the three years prior to the sample year and classify a company as distressed if a company was declared 'under financial difficulty' by the Taiwan

Stock Exchange[6] during the sample period. By such criteria, 6.85 percent of the observations were distressed. This should not be particularly surprising given that our sample period includes the 1998 Southeast Asia financial crisis and the 2000-2001 internet bubble burst. We obtain complete firm-level information, such as CAPM beta, average past return and return volatility from the *Taiwan Economic Journal* (TEJ) and summarize it in Table 1.

The current data from Taiwan have several advantages over existing data from other countries. First, as Campbell (2006) point out, national-level tax-filing data have the advantages of being more accurate and free from selection bias than most survey data (Benartzi (2001) and Choi et al. (2005)), which enable us to make reliable inferences at the market level. Second, we have precise information about the employer of each investor. Accurately identifying an investor's employer is critical in properly assessing income risk. According to previous research, income risks come into play at the employer level (Heaton and Lucas (2000)). Therefore, controlling for employer-level information is important to estimating idiosyncratic income risk accurately. (Calvet et al. (2007)). Finally, detailed information on investor characteristics in our data facilitates our investigation of how individual-level labor income risk affects portfolio choices.

3. Methodology: employer-level and employee-level income risks

To investigate how individuals adjust the riskiness of their portfolios in response to labor income risks, we calculate the likelihood of investing in risky assets and ratio of risky assets (equities as an asset class or employer stock) to total employees' financial assets and relate them to the level of income risks that each household faces.

We use the Probit model to estimate participation in the stock market and the Tobit model for the fraction of financial assets invested in risky assets. The Tobit model helps provide more understanding about employees' portfolio compositions, in addition to their participation choices. For the Probit model, the dependent variable is a dummy that equals one if one employee invests in any listed company shares, and zero otherwise. For the Tobit regression, we adopt two proxies for risky assets: the fraction of financial assets invested in equities and the fraction of financial assets invested in employer stock. First, we divide the amount of value invested in common stocks by the total amount of employees' financial assets, which captures the employees' asset allocation choices. This ratio reflects how each employee favors the riskier asset class of equities relative to other asset classes, such as investment through savings, real estate, and equities in private companies.

Separately, we divide the amount of value invested in an individual's employer stocks by the total amount of employees' financial assets. Because employer stock is more volatile and correlates more highly with an individual's labor income, we consider employer stocks as riskier assets than common equities in general. If individuals indeed adjust their portfolios in response to income risks, we expect the effect to be stronger for employer stocks than for the overall stocks. Another motivation for us to examine the fraction of employees' portfolios being invested in company stocks is that it helps us gain understanding about household portfolio

[6] The Taiwan Stock Exchange uses a range of indicators, such as net asset, debt-to-asset ratio, and interest coverage, to decide whether a company is 'under financial difficulty'.

composition. Lee et al. (2008) documents that employer stock makes up 47 percent of the average portfolio for people who work at listed Taiwanese companies. Therefore, understanding the fraction invested in employer stocks provides a close approximation for understanding the household equity portfolio composition. In addition, we also estimate the ratio of employees' financial assets invested in stocks within the same industry as the investor's employer and obtain very similar results. [7]

In addition, we follow Campbell (2006) and Calvet, Campbell, and Sodini (2007) to determine the relative importance of these variables in estimating the marginal effect of interested variables. The marginal effect of a variable is calculated by considering the deviation from a reference employee (which is assigned the average of all continuous characteristics) in the employee's stock market participation and asset allocation decisions. In particular, the marginal effect of a dummy variable reflects the changes in the dependent variables (the probability to invest in the equity market or the fraction of financial assets invested through equities), when the independent variable shifts from zero to one. The marginal effect of a continuous variable is the marginal effect on the dependent variable (as defined above), caused by a one-standard-deviation change in the independent variable. The reported change is the absolute increase in the probability of participation for the Probit and the percentage change in the dependent variable for the Tobit model.

3.1. Employer level risks

We classify income risks into two somewhat distinct categories: at the employer level and at the individual employee level. We intend to use employer risks to capture the riskiness of the employers for each employee investor. The performance of the employer has strong influence on an individual's job security and the expected value of bonus and stock options. It is widely known that some companies (for example, a high-tech start up) are riskier than other employers (for example a large conglomerate). Even if not all employees hold employer stocks (Lee et al. (2008) shows that about three quarters of employees at Taiwanese listed companies invest in employer stocks and the average proportion is 47 percent), most employees should consider the performance of company stock an important determining factor on the healthiness of their employer and their expected income. Therefore, investigating firm-level risks can shed some light on how employees at various companies adjust their portfolios in response to variations in their labor incomes. In particular, we intend to quantify such risks with the risks of each company's listed shares.

First, we follow the literature and calculate firm-level total and idiosyncratic risks of the employers (listed companies) by performing the following CAPM regression.

$$\left(R_{it} - R_f\right) = \alpha_i + \beta_i\left(R_{mt} - R_f\right) + \varepsilon_{it} \qquad (1)$$

In which $R_{it} - R_f$ and $R_{mt} - R_f$ respectively denote the excess returns (%) on firm i and the market portfolio. The total firm risk is defined as the standard deviation of a firm's excess return

[7] Such results are available from the authors upon request.

($\sigma_{R_{it}-R_f}$), and idiosyncratic risks are defined as $\sigma_{\varepsilon_{it}}$. These measures of company stock returns gauge the fluctuations in company operation and business prospects over time. The prospect of company business and changes in company value, in turn, should affect the expected value and risk of individuals' human capital. In addition to the CAPM model, we also experiment with an alternative definition of employer risks by performing a characteristics-based asset pricing model (i.e. the Fama-French three factor model) and obtain very consistent results.

In addition, by tracing the corporate events and cash flow of each listed company back in history, we can identify which companies went through distress during the three-year period before the observation year. Because default and distress have an arguably non-linear influence on firm stock performance and risk profile, we include this as a dummy to provide an additional measure of employer level risks. Finally, we perform the same estimation at the industry-level, instead of firm-level, and our results are consistent in that the industry-level return risks affect household portfolio choices.

3.2. Employee-level labor income risk

Not all employees at the same company are equally exposed to the same level of employer risks. For example, it is common for senior managers to obtain the majority of their income in the form of bonuses and granted options, while rank-and-file employees obtain their income primarily from salaries, which are relatively more stable. To capture such differences in income-risk exposures within the same employer, we follow previous studies (Vissing-Jrogensen (2002a, 2002b), Massa and Simonov (2006)) and create our measure of labor income risks with the following measure of income risks in regression (2):

$$\begin{aligned} Ln(w_{it}) - Ln(w_{it-1}) &= \alpha_1 + \alpha_2(Age_{it}) + \alpha_3(Age_{it}^2) + \alpha_4\big(Dummy(marital\ status_{it})\big) + \alpha_4\big(Dummy(gender_{it})\big) \\ &+ \alpha_5(Dummy(salary\ in\ top\ 10\%)) + \alpha_6(Dummy(salary\ in\ top\ 11-25\%)) \\ &+ \alpha_7(Dummy(salary\ in\ top\ 25-50\%)) + \alpha_5(Dummy(salary\ in\ top\ 51-75\%)) + \varepsilon_{it} \end{aligned} \quad (2)$$

where the dependent variable is the differential change in logarithm of employees' annual salary. Vissing-Jrogensen (2002b) argues that the dependent variable reflects the variability in individual labor income. The independent variables include age, square of age, a marital status dummy, a gender dummy, and dummies for various salary levels. Following the same studies, we use the residual from the above regression as an estimate of the sum of permanent and transitory labor income shock and the predicted values of the above regression as an estimate of the drift term of the permanent income. Then, we calculate the conditional standard deviation of labor income as a proxy for the standard deviation of permanent labor income.

We adopt two innovations in our approach, compared to previous studies. First, given the availability of employment information, we perform the above regression that generates individual conditional income risks at the firm level, instead of at the economy level as in previous studies (Vissing-Jorgensen (2002b), Massa and Simonov (2006)). Applying firm-level estimates to assess an individual's income risk is more accurate than applying national-level

estimates (as in previous studies) as such finer data control for not only firm-level risks but also the relative risk-exposure that an employee faces, related to the rest of the employees at the same company. To overcome potential noises that may arise when estimating Equation (2) at the firm level, we also replicate the analysis at the whole economy level, and our results remain the same.

In addition, our data include information at the individual level, as opposed to household level in previous studies. Consequently, our measure of income risk is not influenced by missing variables such as spouse's employment status and is therefore more accurate than in previous studies. To be consistent with previous studies, we replicate our analysis at the household level and replicate our analysis only for households with precisely one person working at listed companies, and our results remain unchanged.

3.3. Control variables

Finally, we include the following individual characteristics in most of the regression specifications. Non-financial income is the total annual employees' income minus income from financial assets. Financial wealth is the total value of financial assets invested in stocks, bonds, savings accounts, real estate, and private company equities. Relative real estate ratio is the value of household real estate value to total financial wealth. Relative private company equities ratio is the fraction of the value of private company equities to total financial assets. Mortgage payment status is a dummy variable that equals one if a household incurs any mortgage payment within a year. Age is the age of the employed individual. Total exemptions are a proxy for family size, which determines the level of exemption that a household receives. Gender status dummy is set to one if an employee is male. Marriage status is a dummy variable that equals one if the individual is married. High salary income dummies are two dummy variables that equal one if an individual's income belongs to the top 10 percentile or the 11^{th} -25^{th} percentile of all employees at the employer, and zero otherwise. We also include year and industry fixed effect through dummies.

4. Empirical results

4.1. Portfolio decisions and employer risks

Table 2 reports results on how individuals' likelihood of investing in equities shifts in response to the risks facing the companies that they work for. Model A reports a significantly negative coefficient for firm total risks, suggesting that employees working for companies with higher return volatility are less likely to invest in the equities market, controlling for other factors. In terms of economic significance, a one-standard deviation increase in total firm risk decreases the likelihood of investing in equities by about 0.7 percent. This is consistent with the notion that investors should reduce their exposure to the equity market in general if they face income risks that are positively correlated with the equity market.

(Insert Table 2 about here)

We next focus on firm-specific risks. Our results in Model B of Table 2 depict a similar picture. The coefficient is negative and highly significant for the firm-specific risks. Further, the coefficients and significance level of the firm-specific risks suggest that firm-specific risks influence the decision to participate in the stock market similarly to total risks, suggesting that firm-specific risks largely drive the relationship between firm overall risks and stock market participation. In terms of economic significance, a one standard change in firm-specific risk leads to about 0.6 percentage variations in the likelihood to invest in equities.

Further, in model C, we include an additional variable of distress dummy. Because this dummy variable is correlated with firm-specific risks, we replace firm-specific risks with the residual firm-specific risks after controlling for the distress dummy. Model C suggests that employees at companies that recently experienced distress are less likely to invest in the equity market compared to employees at otherwise similar companies. Of course, several possible forces may be responsible for such findings. It could be that some companies or industries go through some negative macro-shock and face increasing challenges going forward. If this is the case, investors are then making a rational decision by staying away from the riskier asset class of equities. On the other hand, it is possible that the companies and industries have already recovered from previous difficulty and investors over-extrapolate the recent salient incidents (Benartzi (2001)). We leave the answer to this question to future studies. Regardless of the explanations, our findings again confirm that the risk profiles of employers, and hence job security and income risks, are important to household portfolio choices.

Several findings on the control variables are worth mentioning. The likelihood to invest in equity market decreases with the amount of financial assets and increases with the square of the financial assets. This is consistent with findings on the Swedish market in Calvet, Campbell, and Sodini (2007). Interestingly, the likelihood increases with non-financial income and decreases with the square of non-financial income. Individuals who have mortgage payment are more likely to invest in the stock market. This is somewhat surprising given that we already control for household wealth and income. One possible explanation is that homeowners are more risk tolerant and therefore more interested in investing in stocks. Another possibility is stock investment is indirectly financed via mortgage debt or re-financing of a home through home equity loans (Heaton and Lucas (2000b), Cocco (2004)). Investments in other categories of financial assets, such as real estate and private-company shares, all reduce the likelihood of investing in public companies.

(Insert Table 3 about here)

So far, our Probit regression results depict a clear picture that various risks at employers have considerable influence on a household's choices of investing in equities. We next perform follow-up Tobit regression in Table 3 to explore whether similar patterns exist between income

risks and the fraction of total financial wealth households decide to allocate to equities, relative to other asset classes. Model A of Table 3 shows that the fraction of equities to total financial wealth is significantly smaller for employees working at companies with higher total risks. A one standard deviation increase in firm total risk reduces the fraction invested in equities by a 3.3 percent change, 13 percent of one standard deviation from the average.

The Tobit regressions produce qualitatively similar results. Firm total risk and firm specific risk decrease the fraction of financial wealth invested in equities. Consistent with the Probit results, firm-specific risks again have similar impact on the asset allocation decision to that from total risks. Both effects are also economically meaningful. Consistent with our expectation, employer distress has a negative impact on how much households decide to invest in equities, confirming that investors project recent negative shocks to companies on future investment decisions.

(Insert Table 4 about here)

Next, we evaluate the relationship between our second measure of risk-taking, the fraction of financial wealth invested in the stock of an individual's employer and income risks. Results in Table 4 show that almost all of our results on equity investment as a whole asset class apply to the new analyses that focus on employer stock in particular. Because the return of employer stocks tends to be highly related to the company's fundamentals (such as market capitalization and book-to-market ratio) and past performance, which influence employees' compensation and job security, we expect that investors probably would hold less of employer stocks if they perceive such risks in their employers.

Prior studies argue that (heavily) investing in employer stocks results in severe under-diversification and considerable welfare losses (Cohen(2008), Lee et al. (2008), Benartzi and Thaler (2001)), and the problem becomes even more serious if employees at riskier companies hold more of their own employer stock (Cohen (2008), Lee et al. (2008)). Fortunately, our results in Table 4 shows that in Taiwan the intensity of investing in employer stock indeed decreases with the total level of employer risks. Consistent with our conjecture, we find that the coefficients on risk measures are significantly greater for the employer stock regression than those in the stock market regression, confirming that investor response is stronger for the riskier assets. Again, our findings confirm that individual investors, knowingly or not, tend to modify their portfolio choices in order to hedge risks, especially non-diversifiable risks, regarding their job security and human capital.

A prior study by Lee et al. (2008) finds that employees at high-tech companies are more likely to own employer stocks. A couple of reasons may be responsible. First, the difference between the two studies may stem from how we define employer risks (total risks vs. firm-specific risks) and the fact that we control for industry fixed-effect in the current regressions. Consistent with the current study, the prior paper finds that the standard deviation of stock returns in the past two years (we use an alternative risk measure in the past three years) reduces employees' investment

in employer stocks, although the standard deviation of returns in the past one year does not significantly influence portfolio choices. In addition, the current paper focuses on the fraction of financial wealth invested in employer stocks, whereas the prior study focuses on the fraction of equity portfolio invested in employer stocks.

4.2. Portfolio decisions and employee-level income risks

Now that we have confirmed that individual investors adjust their portfolios in response to the riskiness of the companies that they work for, an important element of the income risk, we next look closely at whether individual-level labor income risks, which vary across individuals employed at the same company and depends heavily on individual characteristics, has incremental influence on portfolio choices. Ideally, such individual variations of income risks provide additional, and arguably sharper, focus on how income risks influence portfolio choice because it can net out income risks coming from employer-level fixed effect.

It is quite plausible that the risk profile of an employer company has the first-order influence on employee labor income. If an employee possesses a skill that is highly specific to the employer, the employee faces the risk of losing most of his/her human capital if the employer fails. However, it is important to point out that there are employees with more portable skills whose human capital will not suffer much in the event of employer failure if they can find a similar position easily. Therefore, we include the conditional standard deviation of labor income in the above regression while keeping other variables as in Tables 2 through 4. Following Vissing-Jorgensen (2002a), we use conditional standard deviation of labor income in Table 5 as a proxy for labor income risk relating to the decision to participate in the stock market. In addition, we use the ratio of conditional standard deviation of labor income to financial wealth as a proxy relating the portfolio share decision in Table 6 and additional proxies for income risks in the robustness tests section.

(Insert Table 5 about here)

Table 5 and Table 6 report that the coefficient for labor income risk (conditional standard deviation of labor income) is consistently negative for all three models. That is, labor income risk significantly reduces investors' tendency to invest in equities, the fraction of financial wealth invested in equities, and the fraction of financial wealth invested in employer stocks. The economic impact of labor income also is meaningful. A one standard deviation increase in labor income risk reduces the likelihood to invest in equities by 1.9 percent, and the fraction invested in equities and employer stocks by 8.9 and 10.9 percent in Model 1, respectively. Most of the control variables retain the same sign and remain statistically significance.

(Insert Table 6 about here)

One may wonder whether the results in Tables 5 and 6 are another rendition of the employer risks shown in Table 2 through 4. Put differently, does individual level labor income risk have any influence on portfolio choice in addition to the impact from the risks associated with the employers? After all, income risks at the employer- and employee-level may be correlated, and it is important to look at the two forces together. To answer this question, we include both employer firm-level risks (as in Table 3 through 4) and employee individual-level labor risks (as in Table 5 and 6) together in the same regression and report the regression results in Table 7.

(Insert Table 7 about here)

Our regression results in Table 7 show that employer risk and individual labor income risk indeed have distinct influence on portfolio choices, consistent with theoretical predictions in prior studies (Heaton and Lucas (2000a, 2000b)). The coefficients for firm total risks and their respective components and conditional standard deviation of labor income all are in the same direction as in previous regressions. Further, the magnitude of the coefficients also remains largely unchanged, explained by the low correlation between the two types of proxies for income risks. This finding should not be too surprising given how we set up labor income risk measure partly controlling for firm level information.

In robustness tests, we include a new variable, the ratio of stock bonus to total salary, defined as the market value of aggregate employees' stock bonuses to the sum of the value of aggregate salary expense, aggregate employees' cash bonuses, and the market value of aggregate employees' stock bonus over a three-year period before the end of the test year. This is to control explicitly the possibility that the par value of stock bonuses in total salary may be undervalued, especially for new companies in high-tech sectors. We conduct additional robustness tests by including salary level, industry dummy, and the fraction of bonuses to total compensation at each company level in a separate regression that estimates household income and obtains very consistent results.

In sum, our results depict a clear picture that income risk matters to individual portfolio choices. Further, we are among the first studies to examine jointly the impact of different components of the income risk on portfolio choice. We confirm that income risks at employer and employee levels have distinct influence on household portfolio choices. Our findings confirm prior theory that income risk affects portfolio choices and therefore potentially is responsible for the limited equity participation puzzle. Further, it disentangles the influence of different aspects of income risks.

4.3. Robustness tests

We carry out a range of robustness tests and our main results remain unchanged.

Career change and portfolio choices

In addition to the above panel regressions that pool observations on all individuals and years, we take advantage of our rich dataset at the individual level over time. Because income risks shift as a person moves from one company to another, career change provides a natural experiment setup. As an individual moves between companies, income risk changes accordingly. The employer risk profile, which relates to the employees' position at the new company, would shift the income risks at both the employer and individual level. Therefore, if one believes that households adjust their portfolios in response to employer risk, one would expect asset allocation changes around career changes. As someone moves to a riskier (less risky) new employer/position, we expect her to reduce (increase) her risky investments accordingly.

(Insert Table 8 about here)

This is exactly what we found for both stock market participation and the fraction invested in risky assets. Because we require both the current and next employer to be a listed-company, our sample reduces to 949 for the participation regression and to 5,150 for the regression on the fraction invested in the stock market. Because we only focus on households that changed their stock market participation choice (from participation to non-participation or vice versa), the participation regression has an even smaller sample of 949 households. Table 8 shows that the coefficient on employer risk is significantly negative, suggesting that if an investor moves from a less risky company to a riskier company, the investor will reduce investing in equities, and vice versa. Similar to our main findings, the responses are similar between total and firm-specific risks. The results remain the same when we look at employer stocks instead of overall stock market investment as proxy for risky investment.

Alternative measures of income (salary income and non-financial income)

In addition to our main specifications that use salary income to measure income risk, we employ an alternative income measure, non-financial income, to measure income risk. Massa and Simonov (2006) argue that including precise income information can control for the potentially missing information on benefits from retirement plans and the riskiness of employees' overall compensation packages. Although our richer data already enable us to control such variations at firm level, we perform robustness tests with alternative definitions of income.

Following Heaton and Lucas (2000b), we define non-financial income as total income subtracting financial income (interest and dividend income). Generally, non-financial income is greater than salary income for a household because non-financial income encompasses a wider range of income sources, such as royalty income, awards, and lottery income. Our unreported

results show that our main results remain unchanged. Such results are not reported to conserve space and are available from the authors upon request.

In addition, we include a variable of the ratio of stock bonus to total compensation in an alternative specification to control further for variations in employee income composition and for the possibility that some investors invest more in equities because they receive many more stocks through their compensation. In unreported results, we find support for this conjecture. Indeed, the ratio of stock compensation to total compensation positively relates to household equity investment. The higher the stock bonus ratio, the more an individual invests in riskier assets such as equities and employer's own stocks. More important, adding such an additional variable does not change any of our main findings.

Alternative measures of income risks

In addition to the specification in regression (2), we also try alternative ways of estimating labor income risk by estimating regressions (3) and (4) respectively, instead of using regression (2).

$$\begin{aligned} Ln(w_{it}) - Ln(w_{it-1}) &= \alpha_1 + \alpha_2(Age_{it}) + \alpha_3(Age_{it}^2) + \alpha_4\big(Dummy(marital\ status_{it})\big) + \alpha_4\big(Dummy(gender_{it})\big) \\ &+ \alpha_5(Dummy(salary\ in\ top\ 10\%)) + \alpha_6(Dummy(salary\ in\ top\ 11-25\%)) \\ &+ \alpha_7(Dummy(salary\ in\ top\ 25-50\%)) + \alpha_5(Dummy(salary\ in\ top\ 51-75\%)) \\ &+ \beta_1(Ln(stock\ return_{it})) + \beta_2(Ln(stock\ return_{it-1})) + \varepsilon_{it} \end{aligned} \tag{3}$$

$$\begin{aligned} Ln(w_{it}) - Ln(w_{it-1}) &= \alpha_1 + \alpha_2(Age_{it}) + \alpha_3(Age_{it}^2) + \alpha_4\big(Dummy(marital\ status_{it})\big) + \alpha_4\big(Dummy(gender_{it})\big) \\ &+ \alpha_5(Dummy(salary\ in\ top\ 10\%)) + \alpha_6(Dummy(salary\ in\ top\ 11-25\%)) \\ &+ \alpha_7(Dummy(salary\ in\ top\ 25-50\%)) + \alpha_5(Dummy(salary\ in\ top\ 51-75\%)) \\ &+ \gamma_1(Var(stock\ return_{it})) + \gamma_2(Var(stock\ return_{it-1})) + \varepsilon_{it} \end{aligned} \tag{4}$$

The innovations in these two regressions are as follows. Specification (3) includes the logarithm of employer stock return in the current and previous year interactions in specification (2). Specification (4) includes measures of employer stock return volatility with weekly return data. Both alternative ways of estimation generate reports very similar to our main findings.

Alternative definitions of household wealth

Heaton and Lucas (2000b) use different definitions of household wealth for robustness tests. Following their approach, we replace financial wealth with liquid net worth (defined as the sum of stocks and bonds) when calculating the ratio of risky assets to wealth and obtain very consistent results.

In addition, following Heaton and Lucas (2000b) and Massa and Simonov (2006), we use the total dollar value of investments in risky assets (equities or employer stocks), instead of the ratio of risky assets to financial wealth as the dependent variables of our regressions. Again, our results remain unchanged.

Alternative definitions of firm-specific risks

In addition to the CAPM regression, we also perform characteristics-based asset pricing models (i.e. the Fama-French factor models) when separately estimating firm-specific risks and obtain very similar results.

Subsample results.

We split our sample into respective years and obtain consistent results within respective sample years. Further, we divide our sample companies into three categories of industries — technology, financials, and other sectors — to test whether our results are robust within respective sectors. Our unreported results confirm that our main findings remain largely unchanged within respective sectors.

Calvet et al. (2007) argue that households that invest in private companies (non-listed companies in our Taiwan sample) are more likely to have severely under-diversified portfolios, so that their investment in public securities is of lesser importance to them. To control for such differences in motivations between households that invest and those that do not invest in non-listed companies, we re-estimate our regression with a sub-sample of only households that do *not* invest in non-listed companies. All our major findings remain and indeed become slightly stronger.

To address the concern that high statistical significance in our coefficient estimate may be driven by the large size of our sample, we re-estimate the results based on a simple random sample of 100,000 employees, and our main results remain the same.

5. Conclusions

With detailed information on income risks and individual portfolio holding, we investigate how different aspects of income risks affect household portfolio choices. Consistent with theory predictions, income risk heavily influences individuals' portfolio choice. Individuals whose employer stock is riskier are more likely to avoid the risky equity market completely, and those who choose to invest in the equity market invest a smaller fraction of their financial assets in stocks.

When we focus on the idiosyncratic component of employer stock risks, we find that individuals hedge their portfolios against idiosyncratic risks by avoiding or scaling back their investment in the stock market if their employer stocks witness a higher level of idiosyncratic

risks. The above findings suggest that risk preference has influence on both individual career decisions and portfolio choices, consistent with previous theoretical argument.

Our findings provide new international evidence to resolving the debate on the limited equity market participation puzzle and the equity premium puzzle, which are thought by many to be closely related to each other. The paper does not, however, pin down the exact mechanism behind the above seemingly rational behavior. Future research is needed to understand the precise mechanism behind such phenomenon and, in particular, why some retail investors' decisions are rational while others are much more prone to behavioral biases. In addition, our findings should be taken as one piece in a big puzzle and interpreted in the entire global context. More results from other global markets are needed before we gain clear understanding of this phenomenon, which is critical in helping theorists sharpen their focus and take on more realistic assumptions.

Appendix A. Description of the Taiwan Taxation System

In Taiwan, households are subject to individual income tax, land value tax, land value increment tax, house tax, vehicle license tax and other miscellaneous taxes. Households are required by law, under the penalty of perjury and tax evasion, to report the required information. Because the Ministry of Finance relies on such information to enforce tax auditing and collection, the Data Center has taken exhaustive steps to ensure the quality and accuracy of the data. To our knowledge, Taiwan is among the few countries (others including Sweden and Finland) in which such detailed information is available at the national level.

In January of each year, tax withholding companies, including government agencies, organization, financial institutions, business entities, and state-owned utilities, submit their declaration of income tax withholding or exemption to local revenue services. This information is then transferred to the FDC, which use it to identify taxpayer identities. According to the FDC statistics, the FDC processed over 70.82 million cases from the preceding year of individual income data supplied by tax withholding companies in 2001. Most of the income comes in the category of salary and wage at 71.04 percent, followed by interest income at 12.28 percent. Later in January, the FDC processes the data files of personal particulars entered into the household registrations, and the married couple files and household relationships created, spouse, and dependent support providers.

In February, the taxpayers receive a tax return on which all the data supplied by employers and financial institutions already have been submitted to the FDC. The taxpayer checks the figures and corrects errors and adds information or claims for deductions, if necessary. Individuals with income equal to or greater than NT$ 201,000 are required to fax tax return filings. In 2002, the FDC received over 4.98 million individual income tax returns filings. Finally, the FDC will audit tax filings by comparing them with records of withholding tax and taxpayer information to produce lists of abnormalities which are transferred to local revenue services for verification. Processing of individual income tax returns in the FDC has been computerized since 1971. For more than three decades now the FDC has been successful both in planning and programming, and we believe the FDC data are high quality (FDC Annual Report (2003)).

The FDC also compiles key information regarding other types of taxes. For example, it collects national land properties data, land price tax assessment data and house tax assessment data in the form of compact discs from local revenue services for taxation control and auditing purposes. In addition, firms are legally required to provide their individual shareholder records (including the identification numbers of shareholders, name of shareholders, and the number of shares held) at the end of the tax year when the firms declare profit-seeking enterprise income tax.

Appendix B. Definitions of Variables

Variable	Definition
1. Employer risk	
Firm total risk	The standard deviation of weekly excess stock returns (%) over 3-years period by the end of the test year.
Firm specific risk	Estimated by the performing CAPM using past three-year weekly stock return (%) by the end of the test year. The CAPM is performed as below. $$(R_{it} - R_f) = \alpha_i + \beta_i(R_{mt} - R_f) + \varepsilon_{it}$$ where $R_{it} - R_f$ and $R_{mt} - R_f$, respectively, denote the excess returns on firm *i* and on the market portfolio. R_{mt} is the weekly return on the value-weighted Taiwan market index. R_f is estimated by using the series of one-month deposit rates of the First Commercial Bank taken from Financial Statistics Monthly, Taiwan District, R.O.C., and is compiled by the Central Bank of China. For each firm, we calculate firm-specific risk ($\sigma_{\varepsilon_{it}}$); where $\sigma_{\varepsilon_{it}}$ respectively, denote the standard deviation of the excess returns on firm *i* and on ε_{it}.
Financial distress dummy	Dummy variable; the value equals to one if a firm has experienced distress in previous three years by the observation year. We classify a company as distressed if a company was declared as 'under financial difficulty' by the Taiwan Stock Exchange during the sample period.
2. Wealth and income	
Imputed bond holding	Imputed bond holdings B_{it} at end of year *t* for employee *I* are approximated measured as $B_{it} = \frac{I_{it+1}}{r_{t+1}}$ where I_{it+1} is the sum of taxable interest income during the test year $t+1$ for employee *i*, and r_{t+1} is the average annual interest rate on savings deposits during the test year $t+1$
Listed stock holdings	Listed stock holdings is the sum of market value of direct public listed stock holdings at end of year *t* for employee *i*. Public listed stocks are the ones that are traded in the Taiwan stock exchange (TSE) and Over the counter market (OTC). The market value of listed stock holdings is measured as the number of stocks times stock price at the end of the test year.
Non-listed stock holdings	Given that such companies are privately held and do not have to disclose financial information, we use either net value per share as reported by companies (which should be consistent with any public transaction

	disclosed to the market) or the par value (tens in NT$) if the former is unavailable.
Real estate	Real estate=imputed market value of land and house + tax-assessed value of farm We impute the market value of housing and land for each employee each year by using the averaged ratio of market value to tax-assessed value provided each county, each year by Department of Land Administration. However, because the Department of Land Administration does not provide the similar information about farm, we use tax-assessed value of farm as a proxy for the market value of farm.
Liquid wealth	Liquidity wealth=imputed bond holding + listed stockholding
Financial wealth	Financial wealth=liquidity wealth + non-listed stock holding + real estate
Non-financial Income	Non-financial income=employee gross total income - dividend - interest income = wage and salary + proprietary income
3. Demographic variable	
Mortgage interest paid dummy	Dummy variable; the value equals one if employee's family mortgage interest paid is positive
Family size	We use total exemptions on an employee's tax-filing as a proxy for her family size.
Gender status dummy	Dummy variable; the value is set to one if an employee is male (D(male=1)).
Marital status dummy	Dummy variable; the value is set to one if an employee is married (D(married=1)).
Top manager dummy	Dummy variable; the value is set to one if an employee's wage and salary falls into top 10 percentile of the employer payroll (D(sal falls in top 10 percentile=1)).
Middle manager dummy	Dummy variable; the value is set to one if an employee's wage and salary falls in top 11-25 percentile of the employer payroll (D(sal falls in top 11-25 percentile=1)).

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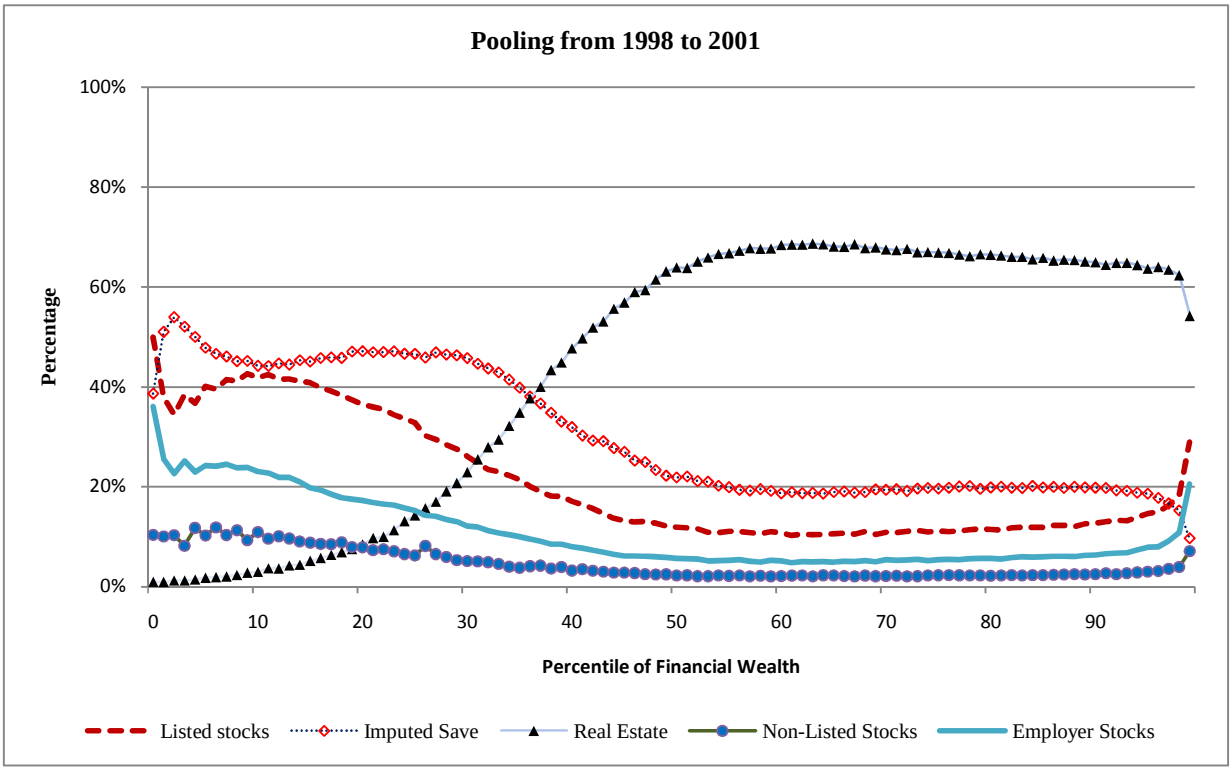
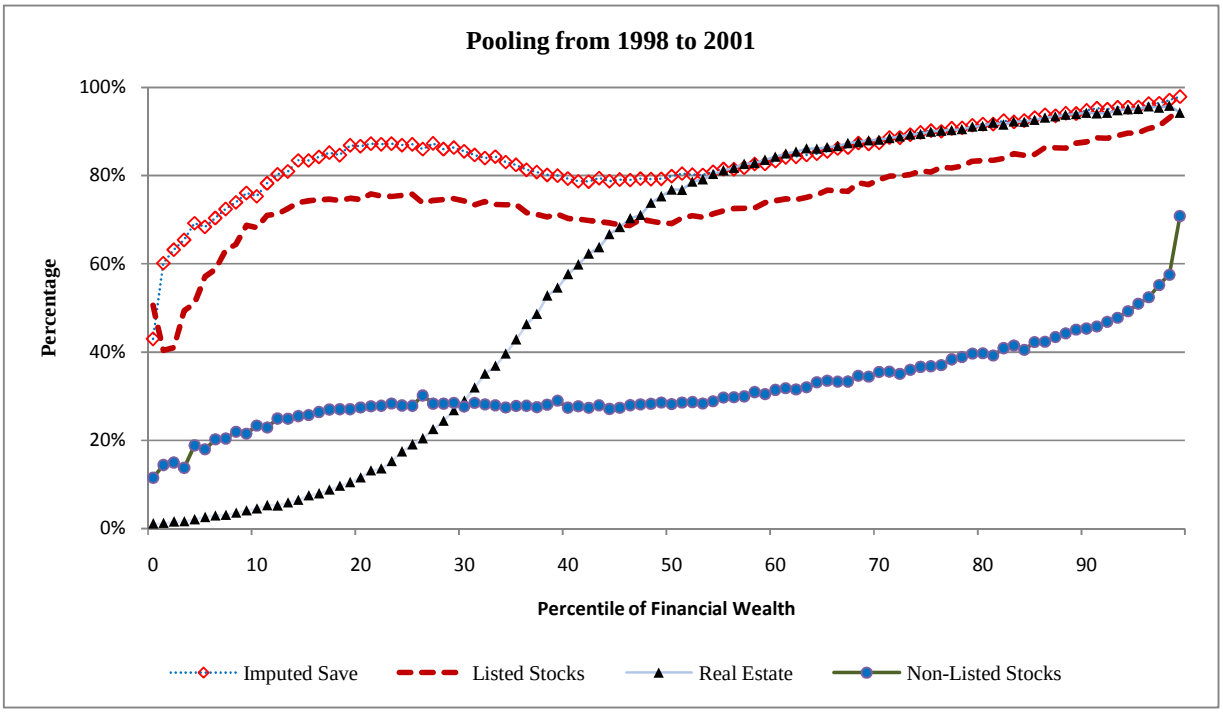
Figure 1:Asset class shares in financial wealth



The figure illustrates the share of each asset class to financial wealth pooled data from 1998 to 2001. We subdivide employees into financial wealth percentiles and compute the average portfolio held by the members of each wealth group.

Figure 2: Participation rates by asset class



The figure illustrates the participation rate of each asset class pooled data from 1998 to 2001. We subdivide employees into financial wealth percentiles and compute the average rate of each wealth group.

Table 1 Summary Statistics

Panel A reports summary statistics of key household characteristics. Labor income is defined as employee annual compensation, which contains a basic salary, overtime pay, year-end bonus, employees' cash bonus and par value of employees' stock bonus. Non-financial income is defined as the total income minus interest income and dividend income. Financial wealth (FW) is defined as the sum of market value holdings in listed companies, bond holdings, real estate, and imputed value of holdings in non-listed companies. Age is the age of the employee. We use total number of exemptions on an employee's tax-filing as a proxy for her family size. The values of labor income, nonfinancial income and financial wealth are defined in ten thousands of new Taiwan dollars (NT$).

Panel B reports summary statistics of alternative measures of firm risks. Firm total risk is measured by the standard deviation of weekly excess stock returns (%) over the three-year period before the end of the test year. Firm total risk is decomposed into systematic risk and firm-specific risk, which are estimated by the performing CAPM using weekly stock return (%) data in the three-year period before the end of the test year. The CAPM is performed as below.

$$\left(R_{it} - R_f\right) = \alpha_i + \beta_i\left(R_{mt} - R_f\right) + \varepsilon_{it}$$

where $R_{it} - R_f$ and $R_{mt} - R_f$, respectively, denote the excess returns on firm *i* and on the market portfolio. R_{mt} is the weekly return on the value-weighted Taiwan market index. R_f is estimated by using the series of one-month deposit rates of the First Commercial Bank taken from Financial Statistics Monthly, Taiwan District, R.O.C., and is compiled by the Central Bank of China. For each firm, we calculate systematic risk ($|\beta_i|\sigma_{R_{mt}-R_f}$) and firm-specific risk ($\sigma_{\varepsilon_{it}}$); where $\sigma_{R_{mt}-R_f}$ and $\sigma_{\varepsilon_{it}}$ respectively, denote the standard deviation of the excess returns on firm *i* and on ε_{it}.

Panel C reports descriptive statistics of conditional of mean and variance of labor income and nonfinancial income. Following the approach of Vissing-Jorgensen (2002) and Massa and Simonov (2006), we fit firm-level OLS regressions for each firm using pooling income data from 1997 to 2002. For each firm, the growth in logarithm of income regressed on age, age squared, marital status dummy, gender dummy, and four salary level dummies. We run regressions using employees' annual labor income and employees' annual nonfinancial income, respectively, as the dependent variable. The values are defined in ten thousands of NT$.

Panel D reports summary statistics of fraction of household financial assets invested in various asset classes across sample employees. The columns headed under "Full sample" include all employees in the sampling data. The columns headed under "Sample of stock market participants" include employees whose stockholding is greater than zero in NT$. The reported fraction is the equal-weighted average of fraction of financial assets invested in stocks computed for each employee. Relative employer stock is the ratio of the value of employer stocks to financial wealth. Relative non-employer stock is defined as the value of listed stocks minus the value of employer stocks. Relative imputed bond holding is calculated as the ratio of the imputed bond holding to financial wealth. Relative real estate is calculated as the ratio of the imputed real estate value to financial wealth. Imputed bond value and imputed real estate value are calculated according to descriptions in Section 2. Non-listed stock is defined as the ratio of the imputed value of holdings in non-listed stocks to financial wealth. The listed stocks include stocks listed on the Taiwan Stock Exchange (TSE) and the Over the Counter (OTC) market.

Panel A. Employees characteristics					
		Standard	25th		75th
Variable	Mean	deviation	percentile	Median	percentile
Wage and salary income (in ten thousands)	76.54	46.91	47.03	63.57	91.47
Non-fianacial income (in ten thousands)	78.87	51.17	48.30	65.20	93.98
Financial wealth (in ten thousands)	610.57	1377.68	98.25	358.82	738.64
Age	38.01	9.23	31.00	37.00	44.00
Family size	4.02	1.95	3.00	4.00	5.00
Panel B. Employer risks					
Firm raw risk(%)	7.32	2.11	5.79	7.14	8.58
Firm specific risk (%)	6.26	1.88	4.96	6.04	7.30
Panel C. Conditional momens of income characteristics of employees (in ten thousands)					
salary income (mean)	78.25	49.23	46.79	64.84	94.25
salary income (standard deviatoin)	12.96	17.37	3.71	6.97	14.47
Non-fianacial income (mean)	79.95	49.74	48.24	66.21	96.03
Non-financial income (standard deviation)	12.43	15.85	3.86	7.06	14.00
Panel D. The descriptive statistics of Portfolio shares relative to financial wealth					
			Full sample		
Relative Employer stock	0.11	0.23	0.00	0.01	0.08
Relative Non-employer stock	0.10	0.20	0.00	0.00	0.09
Relative imputed bond holding	0.30	0.35	0.01	0.13	0.54
Relative real estate	0.44	0.42	0.00	0.47	0.88
Relative non-listed stock holding	0.05	0.15	0.00	0.00	0.01
Number of observations			1,312,641		
			Sample of stock market participants		
Relative Employer stock	0.15	0.25	0.00	0.03	0.15
Relative Non-employer stock	0.14	0.23	0.00	0.03	0.15
Relative imputed bond holding	0.27	0.31	0.02	0.13	0.45
Relative real estate	0.41	0.40	0.00	0.41	0.82
Relative non-listed stock holding	0.04	0.12	0.00	0.00	0.01
Number of observations			982,486		

Table 2. Employer Stock Risk and Stock Market Participation

The table reports maximum likelihood estimation of Probit regressions of investors' tendency to invest in listed stocks. The sample includes 1,312,641 employee-year observations for the period 1998-2001. The dependent variable is equal to 1, if an employee invests in any listed stock and 0 otherwise. In all regressions, we consider income, wealth and demographic variables as control variables. Income variables include logarithm of non-financial income and logarithm of non-financial income squared. Wealth variables include logarithm of financial wealth, logarithm of financial wealth squared, relative real estate, relative non-listed stock, and mortgage interest paid dummy. Firm total risk is measured by the standard deviation of weekly excess stock returns (%) over the three-year period before the end of the test year. Firm-specific risk is estimated by the performing CAPM using weekly stock return (%) data in the three-year period before the end of the test year. Financial distress dummy is set to one if a firm has experienced distress in previous three years before the observation year. Because this dummy variable is correlated with firm-specific risks, we replace firm-specific risks with the residual firm-specific risks after controlling for the distress dummy, denoted by "Firm specific risk (e)".All income and wealth variables are defined in Table 1. Demographic variables consist of age, squared, gender status dummy, marital status dummy and family size. Gender status dummy (D(male=1)) which is set to one if an employee is male. Marital status dummy (D(married=1)) which is set to one if an employee is married. We use total exemptions on an employee's tax-filing as a proxy for her family size. Top manager dummy is set to one if an employee wage and salary falls into top 10 percentile of the employer payroll. Middle manager dummy which is set to one if an employee wage and salary falls in top 11-25 percentile of the employer payroll. All other models are defined in the same way as in Table 1. By considering a reference employee that is assigned the average of all continuous characteristics and zero values for all dummy variables, the marginal effect is computed the impact on the probability of participation of increase a continuous regressor by one standard deviation, or setting a dummy variable equal to one. Coefficient estimates are reported with associated t-statistics and coefficients significant at the 1% level denoted by ***, at the 5% level denoted by **, and at the 10% level denoted by *.

Variable	Model A			Model B			Model C		
	Estimate	p_value	Marginal effect	Estimate	p_value	Marginal effect	Estimate	p_value	Marginal effect
Intercept	-47.023	0.000 ***		-46.981	0.000 ***		-47.105	0.000 ***	
Firm total risk	-0.018	0.000 ***	-0.66%						
Firm specific risk				-0.020	0.000 ***	-0.64%			
Firm specific risk (e)							-0.020	0.000 ***	-0.59%
Financial distress dummy							-0.054	0.000 ***	-0.94%
Ln(non-fianacial income)	6.312	0.000 ***	3.52%	6.310	0.000 ***	3.48%	6.310	0.000 ***	3.46%
Ln(non-fianacial income) squared	-0.210	0.000 ***		-0.211	0.000 ***		-0.211	0.000 ***	
Ln(financial wealth)	-0.118	0.000 ***	5.46%	-0.118	0.000 ***	5.45%	-0.118	0.000 ***	5.42%
Ln(financial wealth) squared	0.015	0.000 ***		0.015	0.000 ***		0.015	0.000 ***	
Relative real eatate	-1.270	0.000 ***	-12.24%	-1.271	0.000 ***	-12.23%	-1.271	0.000 ***	-12.18%
Relative non-listed stock	-1.028	0.000 ***	-2.86%	-1.029	0.000 ***	-2.86%	-1.029	0.000 ***	-2.85%
D(Mortgage interest paid=1)	0.076	0.000 ***	1.23%	0.076	0.000 ***	1.23%	0.076	0.000 ***	1.22%
Age	0.015	0.000 ***	0.55%	0.015	0.000 ***	0.55%	0.015	0.000 ***	0.55%
Age squared	0.000	0.000 ***		0.000	0.000 ***		0.000	0.000 ***	
Family size	-0.004	0.000 ***	-0.13%	-0.004	0.000 ***	-0.14%	-0.004	0.000 ***	-0.14%
D(male=1)	-0.136	0.000 ***	-2.52%	-0.135	0.000 ***	-2.48%	-0.135	0.000 ***	-2.47%
D(married=1)	0.061	0.000 ***	0.99%	0.061	0.000 ***	0.99%	0.061	0.000 ***	0.98%
D(sal falls in top 10 percentile =1)	-0.089	0.000 ***	-1.61%	-0.085	0.000 ***	-1.52%	-0.085	0.000 ***	-1.51%
D(sal falls in top 11-25 percentile =1)	-0.021	0.000 ***	-0.36%	-0.019	0.000 ***	-0.32%	-0.019	0.000 ***	-0.32%
Year fixed effects		Yes			Yes			Yes	
Industry fixed effects		Yes			Yes			Yes	
Number of observations		1,312,641			1,312,641			1,312,641	
Pseudo *R*-squared		0.217			0.217			0.217	

Table 3. Employer Stock Risk and Fraction of Financial Wealth Invested in Equities

The table reports the maximum likelihood estimation of Tobit model on determinants of the fraction of financial wealth invested in listed stock investment. The sample includes 1,312,641 employee-year observations for the period 1998-2001.The dependent variable is the ratio of the fraction of financial wealth invested in listed stocks. All other variables are defined in the same way as in Table 2. Coefficient estimates are reported with associated t-statistics and coefficients significant at the 1% level denoted by ***, at the 5% level denoted by **, and at the 10% level denoted by *.

	Model A			Model B			Model C		
Variable	Estimate	p_value	Marginal effect	Estimate	p_value	Marginal effect	Estimate	p_value	Marginal effect
Intercept	-7.881	0.000 ***		-7.711	0.000 ***		-7.750	0.000 ***	
Firm total risk	-0.005	0.000 ***	-3.34%						
Firm specific risk				-0.008	0.000 ***	-4.76%			
Firm specific risk (e)							-0.008	0.000 ***	-4.25%
Financial distress dummy							-0.026	0.000 ***	-8.50%
Ln(non-fianacial income)	1.316	0.000 ***	19.77%	1.295	0.000 ***	19.34%	1.294	0.000 ***	19.23%
Ln(non-fianacial income) squared	-0.043	0.000 ***		-0.043	0.000 ***		-0.043	0.000 ***	
Ln(financial wealth)	-0.221	0.000 ***	4.29%	-0.221	0.000 ***	4.38%	-0.221	0.000 ***	4.36%
Ln(financial wealth) squared	0.007	0.000 ***		0.007	0.000 ***		0.007	0.000 ***	
Relative real eatate	-0.466	0.000 ***	-52.56%	-0.466	0.000 ***	-52.83%	-0.466	0.000 ***	-52.71%
Relative non-listed stock	-0.529	0.000 ***	-24.06%	-0.529	0.000 ***	-24.20%	-0.529	0.000 ***	-24.13%
D(Mortgage interest paid=1)	0.048	0.000 ***	16.32%	0.048	0.000 ***	16.44%	0.048	0.000 ***	16.37%
Age	0.005	0.000 ***	4.89%	0.005	0.000 ***	4.91%	0.005	0.000 ***	4.91%
Age squared	0.000	0.000 ***		0.000	0.000 ***		0.000	0.000 ***	
Family size	0.004	0.000 ***	2.55%	0.004	0.000 ***	2.52%	0.004	0.000 ***	2.52%
D(male=1)	-0.003	0.000 ***	-1.10%	-0.003	0.000 ***	-0.88%	-0.003	0.000 ***	-0.87%
D(married=1)	0.010	0.000 ***	3.38%	0.010	0.000 ***	3.44%	0.010	0.000 ***	3.42%
D(sal falls in top 10 percentile =1)	-0.028	0.000 ***	-8.91%	-0.025	0.000 ***	-8.08%	-0.025	0.000 ***	-8.01%
D(sal falls in top 11-25 percentile =1)	-0.009	0.000 ***	-2.99%	-0.008	0.000 ***	-2.50%	-0.008	0.000 ***	-2.47%
Year fixed effects		Yes			Yes			Yes	
Industry fixed effects		Yes			Yes			Yes	
Number of observations		1,312,641			1,312,641			1,312,641	
Pseudo *R*-squared		0.416			0.417			0.417	

Table 4. Employer Stock Risk and Fraction of Financial Wealth Invested in Employer Stocks

The table reports the Tobit regression of the fraction of financial wealth invested in employer stocks. The sample includes 1,312,641 employee-year observations for the period 1998-2001.The dependent variable is the ratio of the value of employer stock investment to financial wealth. All other variables are defined in the same way as in Table 3. Coefficient estimates are reported with associated t-statistics and coefficients significant at the 1% level denoted by ***, at the 5% level denoted by **, and at the 10% level denoted by *.

	Model A			Model B			Model C		
Variable	Estimate	p_value	Marginal effect	Estimate	p_value	Marginal effect	Estimate	p_value	Marginal effect
Intercept	-4.954	0.000 ***		-4.719	0.000 ***		-4.766	0.000 ***	
Firm total risk	-0.016	0.000 ***	-14.16%						
Firm specific risk				-0.019	0.000 ***	-15.40%			
Firm specific risk (e)							-0.018	0.000 ***	-12.81%
Financial distress dummy							-0.094	0.000 ***	-36.10%
Ln(non-fianacial income)	0.936	0.000 ***	36.28%	0.907	0.000 ***	35.08%	0.899	0.000 ***	34.10%
Ln(non-fianacial income) squared	-0.028	0.000 ***		-0.028	0.000 ***		-0.027	0.000 ***	
Ln(financial wealth)	-0.306	0.000 ***	12.92%	-0.305	0.000 ***	13.04%	-0.306	0.000 ***	12.88%
Ln(financial wealth) squared	0.010	0.000 ***		0.010	0.000 ***		0.010	0.000 ***	
Relative real eatate	-0.273	0.000 ***	-42.51%	-0.273	0.000 ***	-42.65%	-0.273	0.000 ***	-42.21%
Relative non-listed stock	-0.393	0.000 ***	-23.89%	-0.393	0.000 ***	-23.94%	-0.393	0.000 ***	-23.64%
D(Mortgage interest paid=1)	0.027	0.000 ***	12.24%	0.027	0.000 ***	12.28%	0.027	0.000 ***	12.06%
Age	0.001	0.000 ***	8.30%	0.001	0.000 ***	8.27%	0.002	0.000 ***	8.27%
Age squared	0.000	0.000 ***		0.000	0.001 ***		0.000	0.002 ***	
Family size	-0.001	0.000 ***	-1.26%	-0.002	0.000 ***	-1.37%	-0.002	0.000 ***	-1.32%
D(male=1)	-0.015	0.000 ***	-6.48%	-0.013	0.000 ***	-5.83%	-0.013	0.000 ***	-5.68%
D(married=1)	0.015	0.000 ***	6.93%	0.015	0.000 ***	7.04%	0.015	0.000 ***	6.91%
D(sal falls in top 10 percentile =1)	-0.038	0.000 ***	-15.89%	-0.033	0.000 ***	-14.19%	-0.032	0.000 ***	-13.56%
D(sal falls in top 11-25 percentile =1)	-0.017	0.000 ***	-7.28%	-0.014	0.000 ***	-6.30%	-0.014	0.000 ***	-5.97%
Year fixed effects		Yes							
Industry fixed effects		Yes			Yes			Yes	
Number of observations		1,312,641			1,312,641			1,312,641	
Pseudo *R*-squared		0.359			0.362			0.363	

Table 5. Individual Income Risk and Stock Market Participation

We report regression estimates of stock market participation on conditional standard deviation of labor income, the proxy for labor income risk. The measure is constructed following previous studies (Carroll and Samwick 1997, Vissing-Jorgensen (2002) and Massa and Simonov (2006)). Given the length of the description, please refer to Section 2 and previous studies for details. The conditional standard deviation of labor income (M1)/(M2)/(M3) is measured from the regression (2)/(3)/(4). In model 1, the sample includes 1,312,641 employee-year observations for the period 1998-2001.In the regression (2)/(3), only firm-years with not missing employer stock return/ stock return volatility in the current and previous year are includes and we exclude employees with fewer than three annual observations on the sampling firms. This leaves 918,962/ 918,727 employee-year observations for the period 1998-2001 in model 2/3. All other variables are defined in the same way as in Table 2 through 4. Coefficient estimates in each model are reported with associated t-statistics and coefficients significant at the 1% level denoted by ***, at the 5% level denoted by **, and at the 10% level denoted by *.

	Model 1			Model 2			Model 3		
Variable	Estimate	p_value	Marginal effect	Estimate	p_value	Marginal effect	Estimate	p_value	Marginal effect
Intercept	-37.848	0.000 ***		-34.848	0.000 ***		-34.803	0.000 ***	
Cond. std. of labor income (M1)	-0.006	0.000 ***	-1.89%						
Cond. std. of labor income (M2)				-0.004	0.000 ***	-1.16%			
Cond. std. of labor income (M3)							-0.005	0.000 ***	-1.36%
Ln(non-fianacial income)	4.831	0.000 ***	4.16%	4.157	0.000 ***	4.34%	4.155	0.000 ***	4.43%
Ln(non-fianacial income) squared	-0.152	0.000 ***		-0.121	0.000 ***		-0.120	0.000 ***	
Ln(financial wealth)	-0.105	0.000 ***	5.17%	-0.005	0.699	3.85%	-0.014	0.336	3.93%
Ln(financial wealth) squared	0.015	0.000 ***		0.009	0.000 ***		0.009	0.000 ***	
Relative real eatate	-1.264	0.000 ***	-11.76%	-1.112	0.000 ***	-9.06%	-1.113	0.000 ***	-9.17%
Relative non-listed stock	-1.014	0.000 ***	-2.71%	-0.970	0.000 ***	-2.30%	-0.968	0.000 ***	-2.32%
D(Mortgage interest paid=1)	0.077	0.000 ***	1.18%	0.070	0.000 ***	0.96%	0.072	0.000 ***	0.99%
Age	0.013	0.000 ***	0.51%	0.020	0.000 ***	0.62%	0.019	0.000 ***	0.62%
Age squared	0.000	0.000 ***		0.000	0.000 ***		0.000	0.000 ***	
Family size	-0.004	0.000 ***	-0.14%	0.007	0.000 ***	0.20%	0.007	0.000 ***	0.19%
D(male=1)	-0.143	0.000 ***	-2.55%	-0.271	0.000 ***	-4.69%	-0.271	0.000 ***	-4.75%
D(married=1)	0.054	0.000 ***	0.85%	0.027	0.000 ***	0.38%	0.029	0.000 ***	0.41%
D(sal falls in top 10 percentile =1)	-0.088	0.000 ***	-1.51%	-0.176	0.000 ***	-2.86%	-0.168	0.000 ***	-2.75%
D(sal falls in top 11-25 percentile =1)	-0.022	0.000 ***	-0.36%	-0.030	0.000 ***	-0.44%	-0.028	0.000 ***	-0.42%
Year fixed effects		Yes			Yes			Yes	
Industry fixed effects		Yes			Yes			Yes	
Number of observations		1,312,641			918,962			918,727	
Pseudo *R*-squared		0.219			0.233			0.233	

Table 6. Individual Income Risk and the Share of Portfolio

We report regression estimates of the share of portfolio on conditional standard deviation of labor income, the proxy for labor income risk. The measure is constructed following previous studies (Carroll and Samwick 1997, Vissing-Jorgensen (2002) and Massa and Simonov (2006)). The conditional standard deviation of labor income (M1, M2, M3) is measured from the regression (2), (3) and (4), respectively. In model 1, the sample includes 1,312,641 employee-year observations for the period 1998-2001. In the regression (2)/(3), only firm-years with not missing employer stock return/stock return volatility in the current and previous year are includes and we exclude employees with fewer than three annual observations on the sampling firms. This leaves 918,962/ 918,727 employee-year observations for the period 1998-2001 in model 2/3. Given the length of the description, please refer to Section 2 and previous studies for details. All other variables are defined in the same way as in Tables 2 through 4. Coefficient estimates in each model are reported with associated t-statistics and coefficients significant at the 1% level denoted by ***, at the 5% level denoted by **, and at the 10% level denoted by *.

	Tobit (Listed stock investment/FW)									Tobit (Employer stock investment/FW)								
	Model 1			Model 2			Model 3			Model 1			Model 2			Model 3		
Variable	Estimate	p_value	Marginal effect	Estimate	p_value	Marginal effect	Estimate	p_value	Marginal effect	Estimate	p_value	Marginal effect	Estimate	p_value	Marginal effect	Estimate	p_value	Marginal effect
Intercept	-8.479	0.000 ***		-9.439	0.000 ***		-9.592	0.000 ***		-6.063	0.000 ***		-6.008	0.000 ***		-6.242	0.000 ***	
Cond. std. of labor income (M1) / FW	-0.060	0.000 ***	-8.89%							-0.058	0.000 ***	-10.87%						
Cond. std. of labor income (M2) / FW				-0.062	0.000 ***	-9.08%							-0.052	0.000 ***	-9.61%			
Cond. std. of labor income (M3) / FW							-0.070	0.000 ***	-10.16%							-0.063	0.000 ***	-11.54%
Ln(non-fianacial income)	1.506	0.000 ***	21.12%	1.596	0.000 ***	23.36%	1.631	0.000 ***	23.43%	1.181	0.000 ***	37.86%	1.130	0.000 ***	41.68%	1.183	0.000 ***	41.81%
Ln(non-fianacial income) squared	-0.050	0.000 ***		-0.053	0.000 ***		-0.054	0.000 ***		-0.037	0.000 ***		-0.034	0.000 ***		-0.036	0.000 ***	
Ln(financial wealth)	-0.321	0.000 ***	4.89%	-0.283	0.000 ***	3.09%	-0.295	0.000 ***	3.38%	-0.400	0.000 ***	12.87%	-0.376	0.000 ***	8.24%	-0.392	0.000 ***	8.76%
Ln(financial wealth) squared	0.010	0.000 ***		0.009	0.000 ***		0.009	0.000 ***		0.013	0.000 ***		0.012	0.000 ***		0.013	0.000 ***	
Relative real eatate	-0.461	0.000 ***	-52.20%	-0.465	0.000 ***	-52.19%	-0.465	0.000 ***	-52.24%	-0.267	0.000 ***	-40.51%	-0.253	0.000 ***	-37.91%	-0.253	0.000 ***	-38.02%
Relative non-listed stock	-0.532	0.000 ***	-24.27%	-0.557	0.000 ***	-25.09%	-0.557	0.000 ***	-25.15%	-0.398	0.000 ***	-23.26%	-0.411	0.000 ***	-23.44%	-0.411	0.000 ***	-23.56%
D(Mortgage interest paid=1)	0.048	0.000 ***	16.25%	0.046	0.000 ***	15.42%	0.046	0.000 ***	15.46%	0.026	0.000 ***	11.53%	0.022	0.000 ***	9.54%	0.023	0.000 ***	9.68%
Age	0.005	0.000 ***	4.99%	0.004	0.000 ***	3.91%	0.004	0.000 ***	3.87%	0.001	0.000 ***	8.15%	0.002	0.000 ***	9.23%	0.002	0.000 ***	9.25%
Age squared	0.000	0.000 ***		0.000	0.000 ***		0.000	0.000 ***		0.000	0.000 ***		0.000	0.509		0.000	0.345	
Family size	0.004	0.000 ***	2.68%	0.005	0.000 ***	3.44%	0.005	0.000 ***	3.42%	-0.001	0.000 ***	-0.96%	0.000	0.056 *	0.37%	0.000	0.086 *	0.33%
D(male=1)	-0.004	0.000 ***	-1.30%	-0.013	0.000 ***	-4.09%	-0.013	0.000 ***	-4.24%	-0.016	0.000 ***	-6.52%	-0.038	0.000 ***	-14.85%	-0.038	0.000 ***	-15.02%
D(married=1)	0.009	0.000 ***	2.99%	0.007	0.000 ***	2.34%	0.007	0.000 ***	2.41%	0.014	0.000 ***	6.01%	0.011	0.000 ***	4.80%	0.011	0.000 ***	4.83%
D(sal falls in top 10 percentile =1)	-0.030	0.000 ***	-9.46%	-0.031	0.000 ***	-9.80%	-0.031	0.000 ***	-9.73%	-0.045	0.000 ***	-18.16%	-0.050	0.000 ***	-19.41%	-0.049	0.000 ***	-19.27%
D(sal falls in top 11-25 percentile =1)	-0.010	0.000 ***	-3.32%	-0.007	0.000 ***	-2.25%	-0.007	0.000 ***	-2.24%	-0.021	0.000 ***	-8.81%	-0.020	0.000 ***	-7.97%	-0.020	0.000 ***	-7.96%
Year fixed effects		Yes			Yes			Yes			Yes			Yes			Yes	
Industry fixed effects		Yes			Yes			Yes			Yes			Yes			Yes	
Number of observations		1,312,641			918,962			918,727			1,312,641			918,962			918,727	
Pseudo *R*-squared		0.418			0.431			0.431			0.358			0.373			0.373	

Table7. Employer Stock Risk, Individual Income Risk, and Portfolio Choice

We report regression estimates of portfolio choice on employer risk and conditional standard deviation of labor income, the proxy for labor income risk. The sample includes 1,312,641 employee-year observations for the period 1998-2001. Employer total, systematic, and firm-specific risks are constructed following Calvet, Campbell, and Sodini (2007)and described in Section 2. Conditional standard deviation of labor income is constructed following previous studies (Carroll and Samwick (1997), Vissing-Jorgensen (2002) and Massa and Simonov (2006)). Given the length of the description, please refer to Section 2 and previous studies for details. All other variables are defined in the same way as in Table 2 through 4. Coefficient estimates in each model are reported with associated t-statistics and coefficients significant at the 1% level denoted by ***, at the 5% level denoted by **, and at the 10% level denoted by *.

	Probit (Stock market participation)						Tobit (Listed stock investment/FW)						Tobit (Employer stock investment/FW)					
	Model A			Model B			Model A			Model B			Model A			Model B		
Variable	Estimate	p_value	Marginal effect	Estimate	p_value	Marginal effect	Estimate	p_value	Marginal effect	Estimate	p_value	Marginal effect	Estimate	p_value	Marginal effect	Estimate	p_value	Marginal effect
Intercept	-37.521	0.000 ***		-37.423	0.000 ***		-8.276	0.000 ***		-8.102	0.000 ***		-5.417	0.000 ***		-5.180	0.000 ***	
Firm total risk	-0.015	0.000 ***	-0.53%				-0.005	0.000 ***	-3.20%				-0.016	0.000 ***	-14.18%			
Firm specific risk				-0.017	0.000 ***	-0.56%				-0.008	0.000 ***	-4.75%				-0.019	0.000 ***	-15.57%
Cond. std. of labor income (M1)	-0.006	0.000 ***	-1.94%	-0.006	0.000 ***	-1.95%												
Cond. std. of labor income (M1)/FW							-0.060	0.000 ***	-8.97%	-0.060	0.000 ***	-9.03%	-0.056	0.000 ***	-11.24%	-0.057	0.000 ***	-11.36%
Ln(non-fianacial income)	4.808	0.000 ***	4.29%	4.799	0.000 ***	4.27%	1.482	0.000 ***	20.97%	1.461	0.000 ***	20.54%	1.106	0.000 ***	38.27%	1.078	0.000 ***	37.07%
Ln(non-fianacial income) squared	-0.151	0.000 ***		-0.151	0.000 ***		-0.049	0.000 ***		-0.049	0.000 ***		-0.034	0.000 ***		-0.034	0.000 ***	
Ln(financial wealth)	-0.106	0.000 ***	5.45%	-0.106	0.000 ***	5.46%	-0.320	0.000 ***	5.04%	-0.320	0.000 ***	5.14%	-0.399	0.000 ***	13.96%	-0.399	0.000 ***	14.10%
Ln(financial wealth) squared	0.015	0.000 ***		0.015	0.000 ***		0.010	0.000 ***		0.010	0.000 ***		0.013	0.000 ***		0.013	0.000 ***	
Relative real eatate	-1.265	0.000 ***	-12.19%	-1.266	0.000 ***	-12.21%	-0.461	0.000 ***	-52.82%	-0.461	0.000 ***	-53.10%	-0.268	0.000 ***	-42.49%	-0.268	0.000 ***	-42.65%
Relative non-listed stock	-1.015	0.000 ***	-2.83%	-1.016	0.000 ***	-2.83%	-0.532	0.000 ***	-24.62%	-0.532	0.000 ***	-24.78%	-0.396	0.000 ***	-24.44%	-0.395	0.000 ***	-24.50%
D(Mortgage interest paid=1)	0.077	0.000 ***	1.24%	0.077	0.000 ***	1.24%	0.048	0.000 ***	16.56%	0.048	0.000 ***	16.69%	0.026	0.000 ***	12.30%	0.026	0.000 ***	12.36%
Age	0.013	0.000 ***	0.54%	0.013	0.000 ***	0.54%	0.005	0.000 ***	5.08%	0.005	0.000 ***	5.11%	0.002	0.000 ***	8.59%	0.002	0.000 ***	8.56%
Age squared	0.000	0.000 ***		0.000	0.000 ***		0.000	0.000 ***		0.000	0.000 ***		0.000	0.002 ***		0.000	0.002 ***	
Family size	-0.004	0.000 ***	-0.14%	-0.004	0.000 ***	-0.15%	0.004	0.000 ***	2.70%	0.004	0.000 ***	2.67%	-0.001	0.000 ***	-1.16%	-0.001	0.000 ***	-1.28%
D(male=1)	-0.142	0.000 ***	-2.63%	-0.140	0.000 ***	-2.60%	-0.004	0.000 ***	-1.27%	-0.003	0.000 ***	-1.04%	-0.015	0.000 ***	-6.80%	-0.014	0.000 ***	-6.15%
D(married=1)	0.055	0.000 ***	0.89%	0.055	0.000 ***	0.90%	0.009	0.000 ***	3.08%	0.009	0.000 ***	3.14%	0.014	0.000 ***	6.58%	0.014	0.000 ***	6.69%
D(sal falls in top 10 percentile =1)	-0.077	0.000 ***	-1.37%	-0.072	0.000 ***	-1.28%	-0.027	0.000 ***	-8.73%	-0.024	0.000 ***	-7.87%	-0.037	0.000 ***	-15.73%	-0.032	0.000 ***	-13.98%
D(sal falls in top 11-25 percentile =1)	-0.016	0.000 ***	-0.27%	-0.013	0.002 ***	-0.23%	-0.009	0.000 ***	-2.84%	-0.007	0.000 ***	-2.32%	-0.016	0.000 ***	-7.16%	-0.014	0.000 ***	-6.15%
Year fixed effects		Yes			Yes			Yes			Yes			Yes			Yes	
Industry fixed effects		Yes			Yes			Yes			Yes			Yes			Yes	
Number of observations		1,312,641			1,312,641			1,312,641			1,312,641			1,312,641			1,312,641	
Pseudo *R*-squared		0.220			0.220			0.419			0.420			0.363			0.366	

Table 8. Change of Portfolio Choice and Employment

We report regression estimates of Probit regression of stock market participation, and Tobit regression of the fraction of financial wealth invested in stock markets and employer stocks, respectively. We trace individual employment information to identify change of employment incidents. The sample in Tobit model is the employees who changed job between listed companies during our sample period (5,150 individuals). Because we only focus on households that changed their stock market participation choice (from participation to non-participation or vice versa), the sample in Probit model has even smaller sample of 949 households. In Probit model, the dependent variable is set to 1 (0) if the employee's stock investment is from zero (positive) to positive (zero) when he changes a job. The change in total/systematic/firm-specific risk is respectively calculated as the total/systematic/firm-specific risk in the new employer minus the total/systematic/firm-specific risk in the previous employer. All other control variables are defined in the same way. Coefficient estimates in each model are reported with associated t-statistics and coefficients significant at the 1% level denoted by ***, at the 5% level denoted by **, and at the 10% level denoted by *.

	Probit (Investment in Stocks)				Tobit (Stock Investment/Financial Wealth)				Tobit (Employer Stock/Financial Wealth)			
	Model A		Model B		Model A		Model B		Model A		Model B	
Variable	Estimate	p_value	Estimate	p_value	Estimate	p_value	Estimate	p_value	Estimate	p_value	Estimate	p_value
Intercept	0.218	0.014 **	0.256	0.003 ***	0.004	0.542	0.000	0.943	0.022	0.000 ***	0.014	0.016 **
Firm total risk change	-0.045	0.093 *			-0.008	0.000 ***			-0.018	0.000 ***		
Firm specific risk change			-0.105	0.000 ***			-0.010	0.000 ***			-0.021	0.000 ***
Ln(non-fianacial income) change	0.525	0.001 ***	0.508	0.001 ***	0.033	0.005 ***	0.030	0.010 ***	0.078	0.000 ***	0.072	0.000 ***
Ln(financial wealth) change	0.434	0.000 ***	0.430	0.000 ***	0.035	0.000 ***	0.034	0.000 ***	0.045	0.000 ***	0.045	0.000 ***
Relative real eatate change	-1.853	0.000 ***	-1.837	0.000 ***	-0.517	0.000 ***	-0.517	0.000 ***	-0.308	0.000 ***	-0.308	0.000 ***
Relative non-listed stock investment change	-1.904	0.000 ***	-1.890	0.000 ***	-0.624	0.000 ***	-0.623	0.000 ***	-0.329	0.000 ***	-0.327	0.000 ***
D(from Mortgage interest paid=0 to Mortgage interest paid>0)	0.110	0.452	0.097	0.509	-0.002	0.877	-0.002	0.879	0.013	0.233	0.013	0.230
D(from Mortgage interest paid>0 to Mortgage interest paid=0)	-0.927	0.000 ***	-0.894	0.000 ***	-0.016	0.371	-0.015	0.388	-0.010	0.558	-0.009	0.599
Family size change	0.003	0.942	-0.004	0.932	0.003	0.393	0.003	0.387	-0.002	0.455	-0.002	0.471
D(without a spouse to with a spouse)	-0.017	0.922	0.015	0.932	-0.003	0.784	-0.004	0.757	0.016	0.175	0.015	0.199
D(with a spouse to without a spouse)	-0.048	0.890	0.002	0.996	0.052	0.127	0.055	0.111	-0.012	0.736	-0.007	0.847
D(sal falls in top 10 percentile =1)	0.004	0.985	0.009	0.967	0.010	0.478	0.012	0.404	0.024	0.088 *	0.028	0.050 **
D(sal falls out top 10 percentile =1)	0.183	0.680	0.133	0.765	-0.037	0.183	-0.038	0.169	-0.056	0.046 **	-0.058	0.038 **
D(sal falls in top 11-25 percentile =1)	-0.084	0.549	-0.105	0.455	0.005	0.614	0.005	0.628	0.025	0.009 ***	0.025	0.010 ***
D(sal falls out top 11-25 percentile =1)	0.035	0.866	-0.003	0.988	-0.019	0.200	-0.020	0.176	-0.022	0.133	-0.024	0.101
D(change into high technology industry)	1.292	0.000 ***	1.360	0.000 ***	0.139	0.000 ***	0.133	0.000 ***	0.183	0.000 ***	0.169	0.000 ***
D(change out high technology industry)	-0.389	0.148	-0.417	0.118	-0.022	0.366	-0.017	0.474	-0.092	0.000 ***	-0.081	0.001 ***
D(change into financial industry)	0.704	0.006 ***	0.675	0.007 ***	-0.006	0.752	-0.009	0.636	-0.005	0.777	-0.012	0.528
D(change out financial industry)	-0.313	0.255	-0.292	0.288	-0.001	0.972	0.004	0.833	0.013	0.529	0.024	0.248
Year fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
Number of observations	949		949		5,150		5,150		5,150		5,150	
Pseudo R-squared	0.281		0.291		0.288		0.290		0.198		0.203	