Portfolio Choice and Background Risk: New Evidence from Taiwan[1]

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Portfolio Choice and Income Risks: New Evidence from Taiwan

ABSTRACT

Utilizing comprehensive data on investor portfolio holdings and employer information from Taiwan, we provide novel evidence on how background risk (non-diversifiable employer-specific risks and employee income risks) influences household portfolio choices. Individuals employed at listed-companies with greater return volatilities are less likely to invest in equities in general and in the employer stocks in particular. Consistently, such investors invest a smaller fraction of their financial assets in the stock market and employer stocks. When we decompose firm total risks into systematic and firm-specific risks, we find that firm-specific risk reduces portfolio risk-taking whereas systematic risks have mixed effect on portfolio risk-taking.

At the individual firm level, individuals with higher income risks are less likely to invest in equity the market as a whole and invest a smaller fraction of financial wealth in equities. Detailed information about income and employee characteristics within each individual company enables us to obtain a more accurate estimate on background risks than what has been provided in previous studies.

Our findings confirm theory predictions that background risk is important to household portfolio choices and that individuals adjust their portfolio choices to hedge income risks, in particular idiosyncratic risks. The current study contributes to a better understanding of the puzzle of limited equity market participation and the equity premium puzzle.

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 periods have considerable influence on not only the welfare of each household, but also the asset pricing formation process at the macro-economic 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 similar level of stock market participation (Hong et al. 2004). The number is even lower for emerging markets where financial markets are less developed (please see articles in Guiso, Haliassos, and Jappelli (2002))

Given that households forego considerable benefits when they don't 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.

Numerous theoretical studies have argued that non-diversifiable risks are probably responsible for the limited stock market participation puzzle. For example, 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. In addition to labor income risks, other studies (Heaton and Lucas (2002b), Massa and Simonov (2006)) contend that a wider range of background risks, in addition to labor income risks, are also responsible for the limited participation in equity market.. Such background risks include, but are not limited to: labor income variation, job security, and cost of financing for real estate related areas (Campbell 2006).

Despite the large body of extant theoretical studies, empirical investigation of this topic has been limited, largely due to the lack of data availability. 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 is also found to have a weakly negative impact on the fraction invested in equity market.

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

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 (2005) 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. The data center collects detailed household information for tax filing and collecting purposes after the end of each calendar year. The data are similar to the information that the Internal Revenue Service (IRS) collects in the United States for household tax filing. Because all households are required by law to report their financial wealth and investment portfolio holdings, the data are both comprehensive and accurate.

One prominent feature of the data is accurate information on an investor's employer. Such information enables us to examine two important aspects of background risks, namely employer-specific risks and employee income risks, at the same time. Because the risk profile of an employer has considerable influence on household labor income, detailed information on employer stock risks affords some fresh perspectives on how such 'intangible' employer risks affect portfolio choices. Meanwhile, employer-level information enable us to estimate household income risk more accurately and provide sharper focus on how traditionally defined income risks affect investment in risky assets.

When focusing on only investors who are employees at listed companies, we investigate background risk from two different angles: firm-level risks and individual-level risks. First, we estimate the riskiness of a company by estimating the total, systematic, and idiosyncratic risks of its stock returns. In addition to considering such firm-level risks that affect all employees at the firm, we further look into whether labor income risk at an individual level has incremental contribution to household portfolio choices. Following previous studies (Carroll and Samwich (1997), Vissing-Jorgensen (2002), Massa and Simonov (2006)), we construct a conditional standard deviation of non-financial income that reflects not only employer risks, but also different levels of sensitivity to employer performance. Because we have more detailed information at employer (salary distribution and compensation breakdown) and the employee level (i.e. age, gender, marital status), we can more accurately control such information at the employer, instead of country level, as in previous studies, this unique feature of the data provides us with unprecedented opportunities to study different aspects of background risk in the same study.

We have three primary findings. First, we find 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 likelihood and 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 background risk, which is believed to have a non-linear effect on household labor income, is important int understanding household portfolio decisions, such as stock market participation and asset allocation in risky assets.

Further, we discover an interesting pattern of investors responding differently to the systematic and idiosyncratic components of risks. Whereas firm systematic risks have little impact on stock market participation, employees at companies with a higher level of idiosyncratic risks are less likely to invest in equities. In addition, we find that households at companies with relatively greater systematic risks invest a higher fraction of their financial assets in equities; whereas when we include both in the same specifications, employees at companies with relatively greater firm-specific risks invest a smaller fraction of their financial wealth in equities..Because idiosyncratic risks overweigh systematic risks at the company level, we observe the overall negative relationship between total risk and risky investments. To our knowledge, we are among the first to uncover such differing responses to different aspects of background risks. Given that systematic risks are compensated and can be relatively easily hedged, it is interesting how Taiwanese investors respond differently to diversifiable and non-diversifiable risks through different actions. Our robustness tests generate consistent results when using investments in employer stocks, instead of in the asset class of equities, as the proxy for risky securities.

In addition to the background 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 (2002)), 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 0.7 percent, and for those who choose to invest, reduces the fraction of risky assets by more than 3 percent. In sum, our findings confirm that individual-level labor income risk, in addition to firm level background risk, has marginal explanatory power for household portfolio choices,.

Our above 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 household wealth. Our results remain the same among a sub-sample of people who changed jobs: those facing greater(less) background 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 extant literature lie in the following three areas. First, we confirm that background risk, which include but is not limited to labor income risk, matters to portfolio risks. Such discoveries bridge the gap between theory prediction and empirical literature. Lucas and Heaton (2000ab), show that background risks (unlimited to labor income risks), should influence portfolio decisions, and we provide strong empirical support to such an argument.

In addition, we are among the first to document that investors respond differently to the systematic and firm-specific component of background risk. Separating systematic from firm-specific risks is important to studying household portfolio choice because households can hedge the former with available financial securities or instruments but not the latter one. Calvet, Campbell, and Sodini (2007), for example, reports on idiosyncratic risks of Swedish households when evaluating investor welfare. Although many theories have argued that households are most sensitive to idiosyncratic risks regarding portfolio choice, the availability of investor employment information in this paper provides a unique opportunity to test and confirm the theories.

Finally, the current study provides strong support to the theory that households adjust their portfolio choices to hedge income risks. Such findings contrast to other international studies (Anondel (2006), Massa and Simonov (2006)) that find a positive relationship between investment in risky assets and income risks. Several factors are responsible. First, with precise employer information, we consider employer- and employee-level background 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 andrely 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.

Given the difference in fundamental economy, financial market infra-structure, investor demographics, extant studies (Calvet et al. (2007) and Heaton and Lucas (2002), among others) call for more international evidence on the relationship between background risks and portfolio choice Our new results from an emerging Asian economy complement extant findings focusing exclusively on developed markets in the West.

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

2. Data Description

Campbell (2006) point out that availability of quality data has been one primary challenge facing research on household finance. He argues that the selection bias and the accuracy in self-reporting data make it difficult sometimes to draw definitive answers from survey studies. In addition, survey data usually lack detailed information on household portfolio holdings or longitudinal income information, which are important in studying household portfolio choice.

We utilize a unique dataset from Taiwan 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. 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.

One apparent feature of Taiwan stock market is its high volatility. 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 the retail investors dominate the market and investor sentiment shifts rather swiftly (Barber et al. 2009). Such a high level of 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.

The data center collects detailed household information for tax filing purposes, 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. 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.

An understanding of the tax system and taxation data processing by the FDC in Taiwan will be beneficial in viewing our data. 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. 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.

We construct our sample data by starting with the entire population data on individual income tax files (including income data files, household registration data files, assessment data files and deduction data files) and personal property data files (including national house data files, land data files, and farmland data files) 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.

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 data including wage and salary, interest income, dividend income, self-employment income, rentals and royalties, pension income, 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 December 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.

The current data from Taiwan have several advantages over existing data from other countries. First and foremost, we have precise information about the employer of each investor. Accurately identifying an investor's employer is critical in properly assessing background risk. According to previous research, background risks come into play at the employer level (Heaton and Lucas 2000). If the company that an individual works for struggles or goes into distress, the employee's compensation and job security both may be affected. By combining the tax filing data with detailed firm level information from the TEJ, we can examine background risk at the employer level. For example, we have information on the total, systematic, and idiosyncratic component of the company stock returns. In addition, by tracing business operations in the three years prior to our sample period, we also obtain information on whether a company went through distress, which is critical in understanding a households' risk attitudes.

Controlling for employer-level information is important to accurately estimate income risk. The common practice of estimating income risk is to calculate the conditional standard deviation of labor income or the correlation between labor income and risky asset (stock market) movement. Prior studies acknowledge that such measures without employer information are crude, and employer information will be very instrumental in more accurately estimating this

relationship (Calvet et al. (2006)). Our data enable us to control such factors.

Further, the data provide complete information for the entire Taiwanese population. Investing in employer stocks can vary greatly depending on firm characteristics (such as firm size, plan design and firm past returns as in Benartzi (2001) and Choi et al. (2005)). Therefore, one has to be careful to generalize findings on topics such as social cost of investing in employer stocks to national level, based on studies focusing on a select group of companies. Complete data at the market level, therefore, enable us to accurately assess the social welfare cost without bias.

Finally, detailed information on investor characteristics facilitates our investigation of how individual-level labor income risk affects portfolio choices. For example, employees with certain characteristics, such as older employees and employees holding more senior positions, tend to be more sensitive to the performance of the company, mainly because of company shares awarded through ESOPs. On the other hand, entry-level employees may face greater risks of losing their jobs, during economic distress. The household level information in this dataset is rich enough that we can reliably estimate how sensitive each individual's income is to many aspects of labor income.

2.1. Information on Household Stock Wealth and Portfolio Holdings

The data classify individual wealth (portfolio holdings) into the following categories: financial assets (equities and bonds), real estate, and equity holdings in private companies at the time of tax filings. Such 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.

We next generate the fraction of financial wealth invested in different asset classes at the household level. Households report the value of their equities holdings at the time of tax filing, often close to the end of each calendar year, which we use to calculate the fraction invested in risky assets. 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.[2]

Households have to provide the tax-assessed value of their houses or the houses in which they have beneficiary interests. 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 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 a farm.

Shareholder data files consist of the number of shares of each stock owned by each investor. We exclude employees younger than 20 years old and those with less than NT$10,000 in financial wealth. 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.

Some employees at listed companies hold stake 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 inaccurate in the filing year. However, tax authorities carefully scrutinize filings under this category, and communication with the tax authorities suggests that the authorities devote considerable resources to ensuring that households report, and the authorities use, best-effort estimates or par values. Hence, we are confident that the self-reported numbers are not too different from the true market value at the time

[2] However, non-interest-bearing assets (e.g., checking deposit) are not counted. Fortunately for our study, in order to earn interest, households generally maintain a minimum balance in checking deposit and transfer from their savings account to checking account when paying checks. Besides, annual interest income below a threshold (NT$270,000) are tax exempted in Taiwan. Individuals with interest income more than NT$270,000 are more likely to hold bonds for which interest income is tax exempted. However, the size of the group is rather small (2.25-4.37%) and is unlikely to have a significant effect on our estimates.

We illustrate the aggregate household asset allocation decisions in Figure 1 and 2. Figure 1 suggests that savings and stock investments make up the majority of household assets for relatively lower-income households, with the two asset classes commanding about 90 percent of household financial wealth. As household income increases, the fraction of both savings and equity investment decreases with savings still making up about 20 percent of financial wealth, not common for East Asian economies with much higher savings rates than the Western states. Real estate becomes the dominant asset class for higher income households. Holdings in non-listed companies and employer stocks were proportionally high for lower-income households and become insignificant for higher-income households. Figure 2 reveals that the participation rate for almost all asset classes increases with income percentile.

A limitation of the data is that it does not include household holdings in mutual funds (Calvet et al. (2006)). This is less of a problem for Taiwan during our sample period. In contrast with the situation in Sweden, where households invest heavily through mutual funds, mutual funds are underdeveloped during our sample period, and households' holdings in mutual funds are relatively modest during our sample period (0.8 percent to 1.6 percent of total equity values). 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.

(Insert Table 1 about here)

2.2. Information on Household Labor Income

We obtain precise household income information from the Income File. Most households' incomes consist of non-financial income, financial income, and other income.

Non-financial income includes salary income, self-employment income, rent income, royalty income, 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 the 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 bonus, and the fair value of employees' stock bonus.

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.

2.3. Information on other Household Characteristics

To gauge the impact of background risks, especially labor income risk highly dependent on an individual's employer, we would like to identify the employer of each investor. In order to gain information on employer companies, we focus our attention on the 1,312,641 households which have worked for at least one listed company, where firm-level information is available (outlined in Section 2.4)

To facilitate our empirical study and control other factors important to portfolio choices, we obtain a host of other household characteristics, such as household size, individual age and gender, from the household member file. We report such 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 population are homeowners, while the rest are rent their primary residence. The average individual age is 38, and there are four people in an average family. About three quarters (74.85 percent) invest in listed stock market 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).

2.4. Information on Listed Company

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 less than 75 weekly return observations in the prior 3-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 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.

Companies are widely distributed 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 under financial difficulty 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 bust. 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.

3. Methodology

To investigate how individuals adjust the riskiness of their portfolios in response to background 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 household financial assets and relate them to the level of background 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. 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 household financial assets, which captures the households' asset allocation choice. This ratio reflects how each household 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's stocks by the total amount of household 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 background risks, we expect the effect to be stronger for employer stocks than for the overall stocks.

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 household (which is assigned the average of all continuous characteristics) in the household'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 background risks into two somewhat distinct categories: employer level risks and individual level income risks. We intend to use employer risks to capture the riskiness of the employers for each employee investor. The performance of the employer has important influences on an individual's job security and her 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), and we intend to quantify such risks with the risks of each company's listed shares.

First, we calculate the total, systematic, and idiosyncratic risks of the employers (listed companies) by performing the following CAPM regression.

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

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 ($\sigma_{R_{it}-R_f}$). We further decompose total firm risks into systematic risk (defined as $|\beta_i|\sigma_{R_{mt}-R_f}$) and idiosyncratic risks (defined as $\sigma_{\varepsilon_{it}}$), respectively. Such 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 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.

3.2. Employee-level labor income risk

It is important to note that not all employees at the same company are equally exposed to the same level of employer risks. For example, it is common that senior managers 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 (2002), Massa and Simonov 2006) and create our measure of labor income risks with the following measure of income risks in regression (2):

$$\begin{aligned} Ln(w_{it}) - Ln(w_{it-1}) \\ = \alpha_1 + \alpha_2(Age_{it}) + \alpha_3(Age_{it}^2) + \alpha_4(Dummy(marital\ status_{it})) + \alpha_4(Dummy(gender_{it})) \\ + \alpha_5(Dummy(salary\ in\ top\ 10\%)) + \alpha_6(Dummy(salary\ in\ top\ 11-25\%)) \\ + \alpha_7(Dummy(salary\ in\ top\ 25-50\%)) + \alpha_8(Dummy(salary\ in\ top\ 51-75\%)) + \varepsilon_{it} \end{aligned} \quad (2)$$

where the dependent variable is the differential change in logarithm of employees' annual salary. Vissing-Jrogensen (2002) 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 generate individual conditional income risks at the firm level, instead of at the economy level as in previous studies (Vissing-Jrogensen (2002), 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 employees at the same company.

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.

3.3. Control variables

Finally, we include the following individual characteristics in most of the regression specifications. Non-financial income is the total annual household 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 enjoys. 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 respectively 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 decompose total firm risks into systematic risks and firm-specific risk following regression (1). Our results in Model B of Table 2 reveal that investors' decisions to invest in equities vary considerably for systematic versus firm-specific risks. The coefficient on systematic risk is negative and marginally significant at the 10 percent level. In contrast, the coefficient is negative and highly significant for the firm specific risks. Further, because investors' overall response to firms' total risk is a combination of the two separate responses above, the coefficients and significance level of the firm-specific risks suggest that firm-specific risks have greater influence on the decision to participate in the stock market than those from the systematic risks. Firm-specific risks also have greater economic impact: a one standard change in systematic and firm-specific risk leads to about 0.1 and 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) and 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 background 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.

In contrast to the Probit results, individuals who choose to invest in stock markets indeed favor systematic risk, as reflected by the significantly positive coefficient of systematic risks in Model B or Table 3. Firm-specific risk decreases the fraction of financial wealth invested in equities. Consistent with the Probit results, firm-specific risks again have greater impact on the asset allocation decision than systematic risks do. Both effects are economically meaningful, with firm-specific risks outweighing the systematic risks between the two, yielding the overall negative relationship between firm risks and risky investment in Model A. 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 background 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 likelihood of investing in employer stock indeed decreases with the total level of employer risks. Interestingly, similar to the case on equities as an asset class, the propensity to invest in employer stocks increases with systematic component of total risks, but decreases with the firm-specific component. 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. We feel that 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 have significance influence on portfolio choices.

4.2. Portfolio decisions and investor-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 background risk, we next look closely at whether individual-level labor income risks, which vary across individuals employed at the same company and heavily depends heavily on individual characteristics, has incremental influence on portfolio choices. Ideally, such individual level of variations of income risks provides additional, and arguably sharper focus on how background risks influence portfolio choice because it can net out background 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, at the same time, 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 as a proxy for labor income risk relating to the decision to participate in the stock market in Table 5. 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 additional influence on portfolio choice in addition to the impact from the risks associated with the employers? After all, background risks at the employer- and employee-level may be correlated, and it is important to look at the two forces at the same time. 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 Table7.

In Table 7, 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 3-years 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 under-valued, especially for new companies in high-tech sectors. We conduct further 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.

(Insert Table 7 about here)

Our regressions show that employer risk and individual labor income risk indeed have distinct influence on portfolio choices, consistent with theoretical predictions in prior studies (xxx). The coefficients for firm total risks and their respective components (systematic and firm-specific) and conditional standard deviation of labor income are all 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 background risks. This finding should not be too surprising given how we set up labor income risk measure partly controlling for firm level information.

In sum, our results depict a clear picture that background risk matters to individual portfolio choices. Further, we are among the first studies to examine jointly the impact of different components of the background risk on portfolio choice. We confirm that background risks at employer and employee levels have distinct influence on household portfolio choices. Our findings confirm prior theory that background risk affects portfolio choices and therefore potentially is responsible for the limited equity participation puzzle. Further, it disentangles the influence of different aspects of background 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 background risks shift as a person moves from one company to another, career change provides a natural experiment setup. As an individual moves between companies, background risk changes accordingly. The employer risk profile, which relates to the employees' position at the new

company would shift the background 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 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. 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 her investment in equities, and vice versa. Similar to our main findings, the responses are distinct with respect to systematic and idiosyncratic risk, with the latter being more significant and important. 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. Mass 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.

Taiwanese tax authorities 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 an additional 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).

$$\begin{aligned} &Ln(w_{it}) - Ln(w_{it-1}) \\ &= \alpha_1 + \alpha_2(Age_{it}) + \alpha_3(Age_{it}^2) + \alpha_4(Dummy(marital\ status_{it})) + \alpha_4(Dummy(gender_{it})) \\ &+ \alpha_8(Dummy(salary\ in\ top\ 10\%)) + \alpha_6(Dummy(salary\ in\ top\ 11-25\%)) \\ &+ \alpha_7(Dummy(salary\ in\ top\ 25-50\%)) + \alpha_8(Dummy(salary\ in\ top\ 51-75\%)) \\ &+ \beta_1(Ln(stock\ return_{it})) + \beta_2(Ln(stock\ return_{it-1})) + \varepsilon_{it} \end{aligned} \quad (3)$$

$$\begin{aligned} &Ln(w_{it}) - Ln(w_{it-1}) \\ &= \alpha_1 + \alpha_2(Age_{it}) + \alpha_3(Age_{it}^2) + \alpha_4(Dummy(marital\ status_{it})) + \alpha_4(Dummy(gender_{it})) \\ &+ \alpha_8(Dummy(salary\ in\ top\ 10\%)) + \alpha_6(Dummy(salary\ in\ top\ 11-25\%)) \\ &+ \alpha_7(Dummy(salary\ in\ top\ 25-50\%)) + \alpha_8(Dummy(salary\ in\ top\ 51-75\%)) \\ &+ \gamma_1(Var(stock\ return_{it})) + \gamma_2(Var(stock\ return_{it-1})) + \varepsilon_{it} \end{aligned} \quad (4)$$

The innovations in these two regressions are as follows. Specification (3) includes the logarithm of the returns of employer stock holdings 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 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 systematic and firm-specific risks and obtain very similar results.

Sub-sample results.

We split our sample into respective years and obtain consistent results within respective sample years.

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

When we separately examine idiosyncratic and systematic components of employer stock risks, we find that individuals hedge their portfolios against idiosyncratic risks by avoiding or scaling back their investment in hte stock market if their employer stocks witness a higher level of idiosyncratic risks. At the same time, employees at companies at high systematic risk indeed increase their investment in risky assets. 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 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. Definitions of Variables

Variable	Definition
1. Employer risk	
Firm raw risk	The standard deviation of weekly excess stock returns (%) over 3-years period by the end of the test year
Systematic risk 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 systematic risk ($\lvert\beta_i\rvert\sigma_{R_{mt}-R_f}$) 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}.
Financial distress dummy	Dummy variable; the value equals to one if a firm has experienced distress in previous three years by the observation year.
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 (Dsal 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 (Dsal falls in top 11-25 percentile=1))

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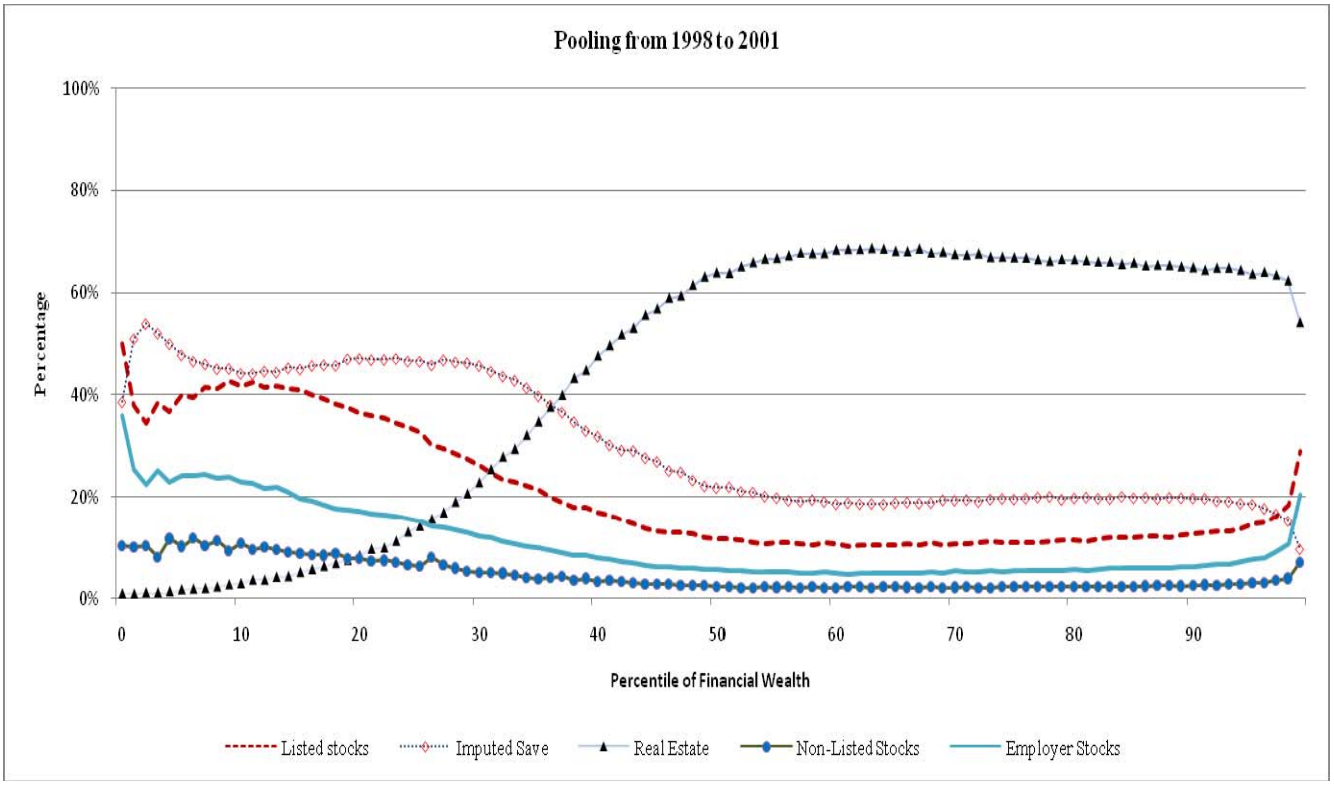
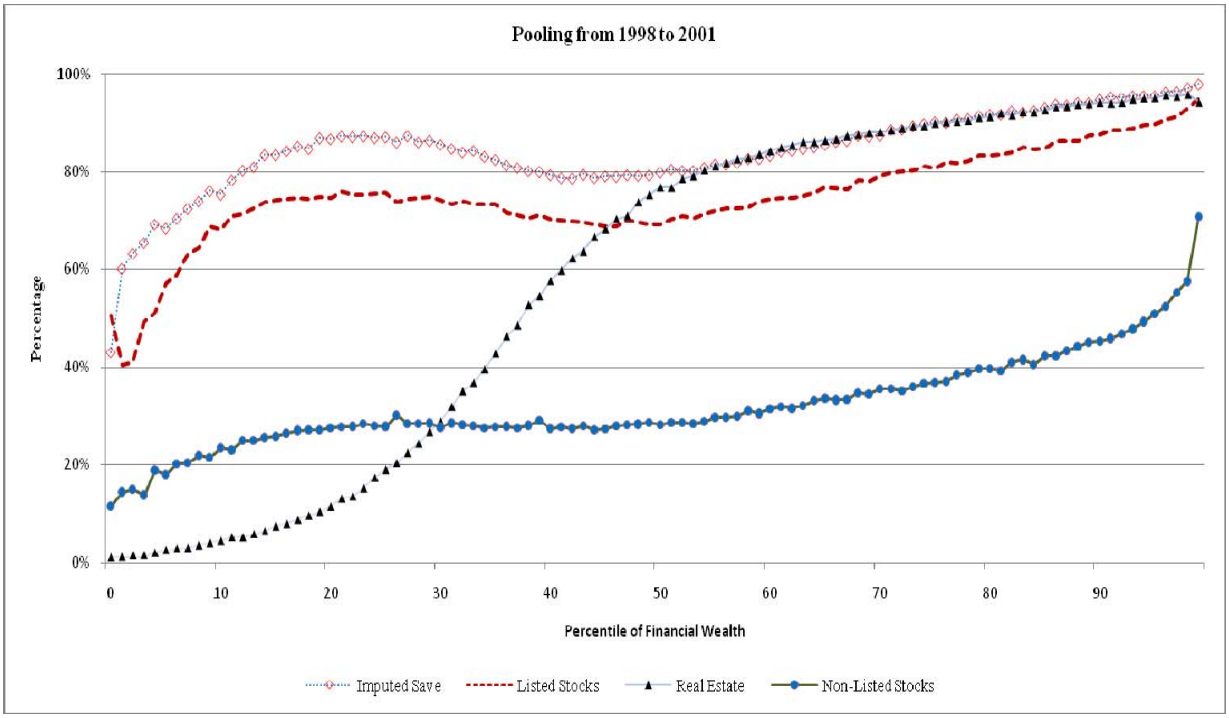
Figure 1: Asset class shares in financial wealth



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-years 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.

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

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 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 an equal-weighted average of shares are 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					
Variable	Mean	Standard deviation	25th percentile	Median	75th 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
Systematic risk(%)	3.53	1.58	2.35	3.32	4.56
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 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. Financial distress dummy is set to one if a firm has experienced distress in previous three years before the observation year. All income and wealth variables are defined in Table 1. Demographic variables consist of age, squared, gender status dummy, martial 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 *.

	Model A			Model B			Model C		
Variable	Estimate	t_value	Marginal effect	Estimate	t_value	Marginal effect	Estimate	t_value	Marginal effect
Intercept	-47.023	-53.70 ***		-46.963	-53.65 ***		-47.084	-53.79 ***	
Firm total risk	-0.018	-18.91 ***	-0.66%						
Systematic risk				-0.003	-1.69 *	-0.07%	-0.003	-1.66 *	-0.07%
Firm specific risk				-0.019	-20.64 ***	-0.63%			
Firm specific risk (e)							-0.020	-18.90 ***	-0.58%
Financial distress dummy							-0.055	-8.10 ***	-0.96%
Ln(non-fianacial income)	6.312	48.26 ***	3.52%	6.307	48.24 ***	3.49%	6.308	48.24 ***	3.48%
Ln(non-fianacial income) squared	-0.210	-43.21 ***		-0.211	-43.23 ***		-0.211	-43.23 ***	
Ln(financial wealth)	-0.118	-9.91 ***	5.46%	-0.118	-9.90 ***	5.46%	-0.118	-9.90 ***	5.43%
Ln(financial wealth) squared	0.015	34.36 ***		0.015	34.38 ***		0.015	34.38 ***	
Relative real eatate	-1.270	-277.50 ***	-12.24%	-1.271	-277.58 ***	-12.25%	-1.271	-277.56 ***	-12.21%
Relative non-listed stock	-1.028	-116.49 ***	-2.86%	-1.028	-116.58 ***	-2.87%	-1.029	-116.57 ***	-2.85%
D(Mortgage interest paid=1)	0.076	22.97 ***	1.23%	0.076	22.97 ***	1.23%	0.076	22.97 ***	1.23%
Age	0.015	19.00 ***	0.55%	0.015	19.03 ***	0.55%	0.015	19.02 ***	0.55%
Age squared	-0.000	-15.07 ***		-0.000	-15.10 ***		-0.000	-15.10 ***	
Family size	-0.004	-4.45 ***	-0.13%	-0.004	-4.55 ***	-0.14%	-0.004	-4.55 ***	-0.14%
D(male=1)	-0.136	-41.93 ***	-2.52%	-0.135	-41.46 ***	-2.49%	-0.135	-41.46 ***	-2.48%
D(married=1)	0.061	14.84 ***	0.99%	0.061	14.89 ***	0.99%	0.061	14.89 ***	0.98%
D(sal falls in top 10 percentile =1)	-0.089	-13.12 ***	-1.61%	-0.086	-12.52 ***	-1.53%	-0.086	-12.52 ***	-1.53%
D(sal falls in top 11-25 percentile =1)	-0.021	-4.92 ***	-0.36%	-0.019	-4.43 ***	-0.33%	-0.019	-4.43 ***	-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		0.2170			0.2171			0.2171	

Table 3. Employer 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 stock market participants sample contains 982,486 employee-year observations and the non stock market participant sample contains 330155 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	t_value	Marginal effect	Estimate	t_value	Marginal effect	Estimate	t_value	Marginal effect
Intercept	-7.881	-51.53 ***	.	-7.683	-50.26 ***	.	-7.730	-50.57 ***	.
Firm total risk	-0.005	-24.21 ***	-3.34%			.			.
Systematic risk			.	0.007	20.32 ***	3.46%	0.007	20.18 ***	3.44%
Firm specific risk			.	-0.008	-41.60 ***	-5.08%			.
Firm specific risk (e)			.			.	-0.008	-38.16 ***	-4.61%
Financial distress dummy			.			.	-0.026	-17.23 ***	-8.35%
Ln(non-fianacial income)	1.316	57.64 ***	19.77%	1.290	56.56 ***	18.86%	1.290	56.53 ***	18.78%
Ln(non-fianacial income) squared	-0.043	-51.51 ***	.	-0.043	-50.67 ***	.	-0.043	-50.64 ***	.
Ln(financial wealth)	-0.221	-94.27 ***	4.29%	-0.220	-94.21 ***	4.36%	-0.220	-94.21 ***	4.34%
Ln(financial wealth) squared	0.007	85.23 ***	.	0.007	85.25 ***	.	0.007	85.25 ***	.
Relative real eatate	-0.466	-509.64 ***	-52.56%	-0.466	-510.41 ***	-52.52%	-0.466	-510.39 ***	-52.41%
Relative non-listed stock	-0.529	-256.11 ***	-24.06%	-0.529	-256.38 ***	-24.02%	-0.529	-256.36 ***	-23.95%
D(Mortgage interest paid=1)	0.048	70.18 ***	16.32%	0.048	70.32 ***	16.29%	0.048	70.32 ***	16.23%
Age	0.005	30.63 ***	4.89%	0.005	30.69 ***	4.85%	0.005	30.71 ***	4.83%
Age squared	-0.000	-22.09 ***	.	-0.000	-22.21 ***	.	-0.000	-22.23 ***	.
Family size	0.004	21.63 ***	2.55%	0.004	21.09 ***	2.48%	0.004	21.10 ***	2.47%
D(male=1)	-0.003	-5.21 ***	-1.10%	-0.002	-2.92 ***	-0.62%	-0.002	-2.90 ***	-0.61%
D(married=1)	0.010	12.17 ***	3.38%	0.010	12.33 ***	3.41%	0.010	12.32 ***	3.40%
D(sal falls in top 10 percentile =1)	-0.028	-22.38 ***	-8.91%	-0.024	-19.01 ***	-7.60%	-0.024	-18.95 ***	-7.56%
D(sal falls in top 11-25 percentile =1)	-0.009	-11.08 ***	-2.99%	-0.007	-8.39 ***	-2.27%	-0.007	-8.34 ***	-2.25%
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		0.4156			0.4170			0.4170	

Table 4. Employer 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 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	t_value	Marginal effect	Estimate	t_value	Marginal effect	Estimate	t_value	Marginal effect
Intercept	-4.954	-32.65 ***	.	-4.698	-31.00 ***	.	-4.753	-31.38 ***	.
Firm total risk	-0.016	-74.98 ***	-14.16%			.			.
Systematic risk			.	0.006	16.81 ***	3.93%	0.005	15.43 ***	3.56%
Firm specific risk			.	-0.020	-93.07 ***	-15.76%			.
Firm specific risk (e)			.			.	-0.018	-80.02 ***	-13.17%
Financial distress dummy			.			.	-0.095	-57.23 ***	-36.02%
Ln(non-fianacial income)	0.936	41.38 ***	36.28%	0.904	40.00 ***	34.43%	0.896	39.65 ***	33.53%
Ln(non-fianacial income) squared	-0.028	-34.17 ***	.	-0.028	-33.08 ***	.	-0.027	-32.81 ***	.
Ln(financial wealth)	-0.306	-132.97 ***	12.92%	-0.305	-133.01 ***	12.95%	-0.305	-133.12 ***	12.80%
Ln(financial wealth) squared	0.010	123.29 ***	.	0.010	123.39 ***	.	0.010	123.52 ***	.
Relative real eatate	-0.273	-295.32 ***	-42.51%	-0.273	-296.22 ***	-42.42%	-0.273	-296.12 ***	-42.00%
Relative non-listed stock	-0.393	-179.31 ***	-23.89%	-0.393	-179.60 ***	-23.79%	-0.393	-179.48 ***	-23.50%
D(Mortgage interest paid=1)	0.027	38.63 ***	12.24%	0.027	38.80 ***	12.21%	0.027	38.66 ***	11.99%
Age	0.001	8.69 ***	8.30%	0.001	8.63 ***	8.18%	0.002	9.19 ***	8.18%
Age squared	0.000	3.58 ***	.	0.000	3.55 ***	.	0.000	3.14 ***	.
Family size	-0.001	-7.90 ***	-1.26%	-0.002	-8.79 ***	-1.39%	-0.002	-8.59 ***	-1.34%
D(male=1)	-0.015	-22.96 ***	-6.48%	-0.013	-19.50 ***	-5.50%	-0.013	-19.31 ***	-5.38%
D(married=1)	0.015	18.11 ***	6.93%	0.015	18.38 ***	6.99%	0.015	18.31 ***	6.86%
D(sal falls in top 10 percentile =1)	-0.038	-30.52 ***	-15.89%	-0.032	-26.14 ***	-13.68%	-0.031	-25.32 ***	-13.12%
D(sal falls in top 11-25 percentile =1)	-0.017	-20.17 ***	-7.28%	-0.014	-16.75 ***	-6.04%	-0.013	-16.12 ***	-5.74%
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		0.3587			0.3628			0.3633	

Table 5. Labor 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). 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	t_value	Marginal effect	Estimate	t_value	Marginal effect	Estimate	t_value	Marginal effect
Intercept	-37.848	-42.00 ***		-34.848	-29.12 ***		-34.803	-29.08 ***	
Cond. std. of labor income (M1)	-0.006	-60.53 ***	-1.89%						
Cond. std. of labor income (M2)				-0.004	-27.30 ***	-1.16%			
Cond. std. of labor income (M3)							-0.005	-31.47 ***	-1.36%
Ln(non-fianacial income)	4.831	35.82 ***	4.16%	4.157	23.13 ***	4.34%	4.155	23.12 ***	4.43%
Ln(non-fianacial income) squared	-0.152	-30.08 ***	.	-0.121	-17.93 ***	.	-0.12	-17.89 ***	.
Ln(financial wealth)	-0.105	-8.84 ***	5.17%	-0.005	-0.39	3.85%	-0.014	-0.96	3.93%
Ln(financial wealth) squared	0.015	33.34 ***	.	0.009	17.82 ***	.	0.009	18.44 ***	.
Relative real eatate	-1.264	-276.29 ***	-11.76%	-1.112	-203.25 ***	-9.06%	-1.113	-203.51 ***	-9.17%
Relative non-listed stock	-1.014	-114.94 ***	-2.71%	-0.970	-92.92 ***	-2.30%	-0.968	-92.90 ***	-2.32%
D(Mortgage interest paid=1)	0.077	23.06 ***	1.18%	0.070	17.22 ***	0.96%	0.072	17.58 ***	0.99%
Age	0.013	16.01 ***	0.51%	0.020	21.47 ***	0.62%	0.019	20.57 ***	0.62%
Age squared	-0.000	-12.18 ***	.	-0.000	-17.13 ***	.	-0.000	-16.32 ***	.
Family size	-0.004	-4.74 ***	-0.14%	0.007	6.41 ***	0.20%	0.007	6.16 ***	0.19%
D(male=1)	-0.143	-44.04 ***	-2.55%	-0.271	-65.13 ***	-4.69%	-0.271	-65.23 ***	-4.75%
D(married=1)	0.054	13.26 ***	0.85%	0.027	5.49 ***	0.38%	0.029	5.75 ***	0.41%
D(sal falls in top 10 percentile =1)	-0.088	-12.87 ***	-1.51%	-0.176	-21.83 ***	-2.86%	-0.168	-20.89 ***	-2.75%
D(sal falls in top 11-25 percentile =1)	-0.022	-5.15 ***	-0.36%	-0.030	-5.91 ***	-0.44%	-0.028	-5.58 ***	-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		0.2194			0.2333			0.2333	

Table 6. Labor 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. 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	t_value	Marginal effect	Estimate	t_value	Marginal effect	Estimate	t_value	Marginal effect	Estimate	t_value	Marginal effect	Estimate	t_value	Marginal effect	Estimate	t_value	Marginal effect
Intercept	-8.479	-55.56 ***		-9.439	-48.34 ***		-9.592	-49.07 ***		-6.063	-39.92 ***		-6.008	-30.66 ***		-6.242	-31.82 ***	
Cond. std. of labor income (M1) / FW	-0.060	-66.30 ***	-8.89%							-0.058	-63.27 ***	-10.87%						
Cond. std. of labor income (M2) / FW				-0.062	-42.27 ***	-9.08%							-0.052	-35.15 ***	-9.61%			
Cond. std. of labor income (M3) / FW							-0.070	-47.13 ***	-10.16%							-0.063	-42.05 ***	-11.54%
Ln(non-fianacial income)	1.506	65.72 ***	21.12%	1.596	54.31 ***	23.36%	1.631	55.44 ***	23.43%	1.181	51.80 ***	37.86%	1.130	38.32 ***	41.68%	1.183	40.06 ***	41.81%
Ln(non-fianacial income) squared	-0.050	-59.16 ***	.	-0.053	-48.54 ***	.	-0.054	-49.65 ***	.	-0.037	-43.89 ***	.	-0.034	-31.51 ***	.	-0.036	-33.23 ***	.
Ln(financial wealth)	-0.321	-115.20 ***	4.89%	-0.283	-82.63 ***	3.09%	-0.295	-85.99 ***	3.38%	-0.400	-145.6 ***	12.87%	-0.376	-109.87 ***	8.24%	-0.392	-114.75 ***	8.76%
Ln(financial wealth) squared	0.010	106.80 ***	.	0.009	75.65 ***	.	0.009	78.83 ***	.	0.013	138.01 ***	.	0.012	102.13 ***	.	0.013	106.70 ***	.
Relative real eatate	-0.461	-503.03 ***	-52.20%	-0.465	-410.14 ***	-52.19%	-0.465	-409.68 ***	-52.24%	-0.267	-288.45 ***	-40.51%	-0.253	-217.77 ***	-37.91%	-0.253	-217.58 ***	-38.02%
Relative non-listed stock	-0.532	-257.88 ***	-24.27%	-0.557	-222.33 ***	-25.09%	-0.557	-222.66 ***	-25.15%	-0.398	-180.85 ***	-23.26%	-0.411	-152.42 ***	-23.44%	-0.411	-152.80 ***	-23.56%
D(Mortgage interest paid=1)	0.048	69.79 ***	16.25%	0.046	53.22 ***	15.42%	0.046	53.21 ***	15.46%	0.026	38.11 ***	11.53%	0.022	25.44 ***	9.54%	0.023	25.69 ***	9.68%
Age	0.005	30.93 ***	4.99%	0.004	20.07 ***	3.91%	0.004	19.60 ***	3.87%	0.001	8.67 ***	8.15%	0.002	10.95 ***	9.23%	0.002	10.65 ***	9.25%
Age squared	-0.000	-22.23 ***	.	-0.000	-14.47 ***	.	-0.000	-14.06 ***	.	0.000	3.94 ***	.	0.000	0.66	.	0.000	0.94	.
Family size	0.004	22.69 ***	2.68%	0.005	23.25 ***	3.44%	0.005	23.02 ***	3.42%	-0.001	-6.28 ***	-0.96%	0.000	1.91 *	0.37%	0.000	1.71 *	0.33%
D(male=1)	-0.004	-6.15 ***	-1.30%	-0.013	-15.08 ***	-4.09%	-0.013	-15.60 ***	-4.24%	-0.016	-24.07 ***	-6.52%	-0.038	-43.76 ***	-14.85%	-0.038	-44.09 ***	-15.02%
D(married=1)	0.009	10.78 ***	2.99%	0.007	6.78 ***	2.34%	0.007	6.98 ***	2.41%	0.014	16.44 ***	6.01%	0.011	10.62 ***	4.80%	0.011	10.62 ***	4.83%
D(sal falls in top 10 percentile =1)	-0.030	-23.87 ***	-9.46%	-0.031	-20.51 ***	-9.80%	-0.031	-20.31 ***	-9.73%	-0.045	-36.82 ***	-18.16%	-0.050	-32.76 ***	-19.41%	-0.049	-32.35 ***	-19.27%
D(sal falls in top 11-25 percentile =1)	-0.010	-12.33 ***	-3.32%	-0.007	-6.89 ***	-2.25%	-0.007	-6.85 ***	-2.24%	-0.021	-25.70 ***	-8.81%	-0.020	-19.16 ***	-7.97%	-0.020	-19.04 ***	-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		0.4183			0.4305			0.4305			0.3587			0.3731			0.3733	

Table7. Employer Risk, Labor 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. 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	t_value	Marginal effect	Estimate	t_value	Marginal effect	Estimate	t_value	Marginal effect	Estimate	t_value	Marginal effect	Estimate	t_value	Marginal effect	Estimate	t_value	Marginal effect
Intercept	-37.521	-41.67 ***		-37.427	-41.59 ***		-8.276	-54.14 ***		-8.075	-52.85 ***		-5.417	-35.68 ***		-5.161	-34.05 ***	
Firm total risk	-0.015	-15.37 ***	-0.53%				-0.005	-22.76 ***	-3.20%				-0.016	-73.78 ***	-14.18%			
Systematic risk			.	0.003	1.82 *	0.08%			.	0.007	22.09 ***	3.84%			.	0.006	18.51 ***	4.41%
Firm specific risk			.	-0.018	-18.61 ***	-0.57%			.	-0.008	-41.00 ***	-5.10%			.	-0.02	-92.77 ***	-15.97%
Cond. std. of labor income (M1)	-0.006	-59.46 ***	-1.94%	-0.006	-59.69 ***	-1.95%			.			.			.			.
Cond. std. of labor income (M1)/FW			.			.	-0.060	-65.79 ***	-8.97%	-0.060	-66.35 ***	-9.02%	-0.056	-61.85 ***	-11.24%	-0.057	-62.87 ***	-11.36%
Ln(non-fianacial income)	4.808	35.68 ***	4.29%	4.799	35.63 ***	4.25%	1.482	64.62 ***	20.97%	1.458	63.58 ***	20.01%	1.106	48.55 ***	38.27%	1.075	47.26 ***	36.34%
Ln(non-fianacial income) squared	-0.151	-30.05 ***	.	-0.151	-30.05 ***	.	-0.049	-58.24 ***	.	-0.049	-57.43 ***	.	-0.034	-41.10 ***	.	-0.034	-40.10 ***	.
Ln(financial wealth)	-0.106	-8.92 ***	5.45%	-0.106	-8.90 ***	5.44%	-0.320	-115.04 ***	5.04%	-0.321	-115.3 ***	5.12%	-0.399	-145.49 ***	13.96%	-0.400	-146.09 ***	14.00%
Ln(financial wealth) squared	0.015	33.46 ***	.	0.015	33.47 ***	.	0.010	106.72 ***	.	0.010	107.02 ***	.	0.013	138.04 ***	.	0.013	138.64 ***	.
Relative real eatate	-1.265	-276.44 ***	-12.19%	-1.266	-276.57 ***	-12.18%	-0.461	-503.31 ***	-52.82%	-0.461	-504.07 ***	-52.77%	-0.268	-289.54 ***	-42.49%	-0.268	-290.39 ***	-42.40%
Relative non-listed stock	-1.015	-115.04 ***	-2.83%	-1.016	-115.15 ***	-2.82%	-0.532	-257.79 ***	-24.62%	-0.532	-258.08 ***	-24.58%	-0.396	-180.57 ***	-24.44%	-0.396	-180.89 ***	-24.34%
D(Mortgage interest paid=1)	0.077	23.01 ***	1.24%	0.077	23.02 ***	1.23%	0.048	69.78 ***	16.56%	0.048	69.93 ***	16.53%	0.026	38.11 ***	12.30%	0.026	38.28 ***	12.27%
Age	0.013	16.53 ***	0.54%	0.013	16.56 ***	0.54%	0.005	31.30 ***	5.08%	0.005	31.36 ***	5.03%	0.002	9.26 ***	8.59%	0.002	9.21 ***	8.47%
Age squared	-0.000	-12.63 ***	.	-0.000	-12.66 ***	.	-0.000	-22.61 ***	.	-0.000	-22.74 ***	.	0.000	3.17 ***	.	0.000	3.13 ***	.
Family size	-0.004	-4.79 ***	-0.14%	-0.004	-4.93 ***	-0.15%	0.004	22.45 ***	2.70%	0.004	21.90 ***	2.62%	-0.001	-7.17 ***	-1.16%	-0.001	-8.07 ***	-1.30%
D(male=1)	-0.142	-43.55 ***	-2.63%	-0.14	-42.94 ***	-2.59%	-0.004	-5.88 ***	-1.27%	-0.002	-3.49 ***	-0.75%	-0.015	-23.69 ***	-6.80%	-0.013	-20.15 ***	-5.78%
D(married=1)	0.055	13.35 ***	0.89%	0.055	13.40 ***	0.89%	0.009	10.91 ***	3.08%	0.009	11.05 ***	3.11%	0.014	16.90 ***	6.58%	0.014	17.15 ***	6.64%
D(sal falls in top 10 percentile =1)	-0.077	-11.24 ***	-1.37%	-0.071	-10.37 ***	-1.26%	-0.027	-21.52 ***	-8.73%	-0.022	-18.01 ***	-7.34%	-0.037	-29.68 ***	-15.73%	-0.031	-25.16 ***	-13.41%
D(sal falls in top 11-25 percentile =1)	-0.016	-3.70 ***	-0.27%	-0.013	-3.00 ***	-0.22%	-0.009	-10.31 ***	-2.84%	-0.006	-7.50 ***	-2.07%	-0.016	-19.48 ***	-7.16%	-0.013	-15.95 ***	-5.86%
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		0.2195			0.2196			0.4187			0.4210			0.3629			0.3671	

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 Probit and Tobit model is the employees who changed job between listed companies during our sample period (5,150 individuals). 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	t_stat	Estimate	t_stat	Estimate	t_stat	Estimate	t_stat	Estimate	t_stat	Estimate	t_stat
Intercept	0.218	2.47 **	0.172	1.90 *	0.004	0.61	0.002	0.32	0.022	3.54 ***	0.016	2.42 **
Firm total risk change	-0.045	-1.68 *	.	.	-0.008	-4.67 ***	.	.	-0.018	-10.13 ***	.	.
Systematic risk change	.	.	0.108	3.02 ***	.	.	-0.002	-0.62	.	.	-0.001	-0.52
Firm specific risk change	.	.	-0.127	-4.22 ***	.	.	-0.009	-5.35 ***	.	.	-0.020	-11.44 ***
Ln(non-fianacial income) change	0.525	3.42 ***	0.485	3.16 ***	0.033	2.82 ***	0.030	2.60 ***	0.078	6.63 ***	0.072	6.18 ***
Ln(financial wealth) change	0.434	8.50 ***	0.425	8.21 ***	0.035	9.06 ***	0.034	9.00 ***	0.045	11.72 ***	0.045	11.66 ***
Relative real eatate change	-1.853	-8.38 ***	-1.854	-8.37 ***	-0.517	-31.82 ***	-0.517	-31.81 ***	-0.308	-18.76 ***	-0.308	-18.81 ***
Relative non-listed stock investment change	-1.904	-5.80 ***	-1.914	-5.76 ***	-0.624	-27.03 ***	-0.622	-26.99 ***	-0.329	-14.22 ***	-0.327	-14.17 ***
D(from Mortgage interest paid=0 to Mortgage interest paid>0)	0.110	0.75	0.090	0.62	-0.002	-0.15	-0.002	-0.15	0.013	1.19	0.013	1.20
D(from Mortgage interest paid>0 to Mortgage interest paid=0)	-0.927	-4.06 ***	-0.855	-3.68 ***	-0.016	-0.89	-0.015	-0.87	-0.010	-0.59	-0.009	-0.53
Family size change	0.003	0.07	-0.008	-0.19	0.003	0.85	0.003	0.85	-0.002	-0.75	-0.002	-0.73
D(without a spouse to with a spouse)	-0.017	-0.10	0.065	0.37	-0.003	-0.27	-0.004	-0.30	0.016	1.36	0.015	1.29
D(with a spouse to without a spouse)	-0.048	-0.14	0.096	0.27	0.052	1.52	0.054	1.57	-0.012	-0.34	-0.007	-0.21
D(sal falls in top 10 percentile =1)	0.004	0.02	0.042	0.20	0.010	0.71	0.011	0.82	0.024	1.71 *	0.027	1.95 *
D(sal falls out top 10 percentile =1)	0.183	0.41	0.125	0.28	-0.037	-1.33	-0.038	-1.38	-0.056	-1.99 **	-0.058	-2.08 **
D(sal falls in top 11-25 percentile =1)	-0.084	-0.60	-0.118	-0.84	0.005	0.50	0.005	0.48	0.025	2.62 ***	0.025	2.58 ***
D(sal falls out top 11-25 percentile =1)	0.035	0.17	-0.012	-0.06	-0.019	-1.28	-0.020	-1.36	-0.022	-1.50	-0.024	-1.65 *
D(change into high technology industry)	1.292	7.42 ***	1.180	6.54 ***	0.139	12.74 ***	0.136	11.85 ***	0.183	16.64 ***	0.172	14.89 ***
D(change out high technology industry)	-0.389	-1.45	-0.289	-1.08	-0.022	-0.90	-0.019	-0.81	-0.092	-3.80 ***	-0.083	-3.43 ***
D(change into financial industry)	0.704	2.77 ***	0.548	2.17 **	-0.006	-0.32	-0.008	-0.40	-0.005	-0.28	-0.011	-0.57
D(change out financial industry)	-0.313	-1.14	-0.173	-0.62	-0.001	-0.03	0.003	0.15	0.013	0.63	0.023	1.10
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		0.298		0.288		0.290		0.198		0.204	