The Costs of Owning Employer's Stocks: Lessons from Taiwan

Yi-Tsung Lee
Department of Accounting
National Chengchi University
Taipei, Taiwan
(886-2) 2939-3091 #81027
actytl@nccu.edu.tw

Yu-Jane Liu
Department of Finance
National Chengchi University
Taipei, Taiwan
(886-2) 2939-3091 #81123
finyjl@nccu.edu.tw

Ning Zhu
Graduate School of Management
University of California, Davis
Davis, CA 95616
(530)752-3871
nzhu@ucdavis.edu [1]

[1] Lee and Liu are from National Chengchi University, Taiwan and Zhu is from University of California, Davis. Part of the work was finished when Liu was a Fulbright Scholar at University of California, Berkeley. The authors acknowledge the support from the Data Center, Ministry of Finance, Taiwan, and comments from Brad Barber, Lauren Cohen, and seminar participants at UC Davis. The authors are responsible for all remaining mistakes.

The costs of owning employer's stocks: Lessons from Taiwan

Using data on all employees at listed companies in Taiwan, where pension plans were rare, we find that bias toward employer stocks is generic to individual investor decision-making, but not limited to retirement plans. 71 percent of sample employees invest in employer stocks and the employer's stock makes up on average 47 percent of employee portfolios. The under-diversification resulting from the bias toward employer stocks is highly costly. Holding current portfolio risk constant, employees forego 4.89 percent per annum in raw returns by investing in employer stocks, which represents 39.74 percent of their average 1998 salary income. Our findings have important implications for social security reform and retirement account management.

Employees hold a large proportion of their retirement plans in employer stocks and incur significant costs by doing so (Benartzi 2001, Cohen 2005, Huberman and Sengmueller 2004). Meulbroek (2003) estimates that employees sacrifice about 42 percent of their retirement account holdings in employer stock due to the higher level of idiosyncratic risks. Anecdotal evidence from the late 1990s suggests that employees of once successful companies such as Enron and WorldCom lost almost all of their investments in employer stocks, both through brokerage accounts and retirement plans, alongside the downfall of the employers (Benartzi et al. 2004, Mitchell and Utkus 2005). The under-diversification in equity portfolio is particularly hazardous because individuals usually do not hold diversified portfolios across different asset classes (i.e. stocks, bonds, and real estate etc.)[2]

Two limitations of extant studies prevent a more generalized understanding about the cost of individuals investing in employer stocks. First, almost all current studies draw their conclusions from individual choices in retirement accounts[3]. Because Bethel et al. (1998), Gordon and Pound (1990), and Rauh (2005) find that corporations are motivated to promote employees' share ownership as ways to defend hostile takeovers and retain corporate control, it seems natural that individuals' bias toward employer stocks in retirement accounts may be induced by their companies. As a matter of fact, Benartzi (2001), Brown et al. (2005) and Choi et al. (2005) show that plan design, employer matching policies, and plan default settings all significantly influence employees' attitude toward employer stocks in retirement plans. What remains unclear is how individuals treat employer stocks in other discretionary accounts, where influences from employers or plan designs play little role. The question is important because it helps predict investor behavior in managing their retirement accounts and private social security account should the social security reform progress further.

[2] For example, Wall Street Journal reports that half of IRA holders with Vanguard Group, a large mutual fund company and IRA custodian, put their entire accounts into stocks. ("Many Savers Failing to Diversify Net Eggs; Only Small Groups Found to be Making Trades, May Suffer 'Choice Overload'", Wall Street Journal (Eastern edition) November 28, 2005, Pg. C.9.

[3] Agnew 2002(a), 2002(b), Agnew et al. 2001, Cogan and Mitchell (2003), Holden et al. (2000), Huberman et al. (2003), Ramaswamy (2002)

One possibility is that individuals frame retirement and other investment accounts separately and the under-diversification in retirement accounts goes away if one considers the rest of individual portfolios.[4] Although Goetzmann and Kumar (2004) and Zhu (2005) find that individuals hold under-diversified portfolios (on average 4 stocks) in their brokerage accounts, it is still possible that stocks in other accounts can diversify away at least part of the idiosyncratic risk of the employer stocks. More importantly, under this assumption, individuals can probably manage to invest in a diversified way when there is no influence from employers and retirement plans (i.e. such as a private social security account). This will, of course, be reassuring to those who worry that individuals make poor decisions managing their private social security accounts and hurt their security after retirement, should the reform move forward.

If instead, individuals exhibit similar bias towards employer stocks in other discretionary investment accounts due to inherent behavioral biases (Khaneman 2003 and Khaneman and Tversky 1986) such as over-extrapolation (Benartzi 2001), inertia (Choi et al. 2002), and loyalty (Cohen 2005), the problem of investing in employer stocks looms even bigger. Apparently individuals take on greater risk if the holdings of retirement and other accounts resemble each other. More importantly, if investors' choices outside their retirement accounts represent how they would manage their retirement without the influence from employers (i.e., a private social security account), it is imperative that policymakers realize the grave consequence of granting individuals too much autonomy. Many individuals will run into the hazard of holding severely concentrated retirement portfolios which could jeopardize their livelihood after retirement. Extensive investor educational programs and legislative changes to ensure diversification in retirement and private social security account therefore seem necessary. For example, legislators could consider putting explicit upper-limit on how much one can invest in employer's stocks in the retirement accounts.

[4] Zhu (2005) reports that mutual fund investments made up 38 percent of total equity investments between 1992 and 2001 in Survey of Consumer Finance and 23 percent for investors from a large discount brokerage firm between 1991 and 1996.

The second limitation of existing studies from the United States is that they generate a wide range of results on the tendency to hold employer stocks. For example, the fraction of retirement plans invested in employer stocks ranges from 16 percent (Holden and VanDerhei 2003) to over 40 percent (Brown et al. 2005, Huberman and Sengmueller 2004) for a similar period of time (See Appendix A for a useful comparison of existing results and how the current study fits in). Although it is completely understandable to have such drastic differences because the bias towards employer stocks varies greatly depending on firm characteristics, employee characteristics and corporate policies (Choi et al. 2005, Cohen 2005), future studies and policymakers alike will have difficulty in drawing reliable conclusions nationwide and determining appropriate policies to curb the adverse impact of such decisions.

The current study attempts to bridge these two gaps by presenting how the universe of employees at Taiwanese listed companies treat employer stocks in a context free from institutional influences. Our data have the advantages of successfully dealing with both above problems. Because institutional background such as retirement plan design, employer matching, bonus shares, or even mutual funds exerted little influence on sample individuals' decisions, we have the unique opportunity to investigate how investors treat employer stocks when it is completely up to their own discretion. The lack of alternative retirement plans during the sample period also puts individuals into a realistic scenario where they have to invest for their retirement. We believe this resembles closely to what individuals would do if they were to manage their private retirement or social security accounts in countries where it is, or will soon be allowed.

In addition, because we observe portfolio choices for the entire universe of corporate employees from Taiwan, we can provide a complete observation of the phenomenon of investing in employers and precisely estimate its social cost at the market level, for the first time. If the bias inflicts only some of the employees (i.e. corporate managers who are relatively well off), the problem of investing in employer stocks may not be as grave. However, if it is the rank and file employees, who desperately need the investment after retirement, that suffer more from the bias, policymakers on social

security reform should be particularly alarmed. Therefore, our comprehensive study of all employees not only enables reliable assessment of the cost such bias puts onto the entire society for future reference, but also provides detailed description about how different groups of employees suffer from the bias.

We find that employees at Taiwanese listed companies hold a strikingly large proportion of their personal portfolios in employers' stocks. For the 442 listed companies, 71 percent of employees participating in Taiwan stock market held their own employer's stocks at the end of 1998. The employer stock makes up an average of 47 percent of the value of the personal portfolios (the median is 41 percent). Although this pattern is particularly strong for senior managers (55 percent), the results are very robust across different levels of employees.

Investor characteristics are important in explaining cross-sectional differences in employees' tendency to invest in employers. Employees who are older and make higher incomes invest more in employers. Different from the anecdotal evidence that managers invest heavily in employer stocks, rank and file employees are more susceptible to the bias on the percentage basis. When controlling for other investor characteristics, we find that senior managers indeed invest about 3 percentage less of their portfolios in employer stocks than other employees do. Employees of companies with high book-to-market ratio, larger market capitalization, in high-tech companies invest more in their employers, whereas those of companies with high exposure to systematic risk (i.e. market beta) invest less. Although higher past one-year volatility leads to greater investment in employers, the relationship reverses for the longer two-year horizon.

Individuals suffer considerably by investing in employers. In contrast with evidence from the United States and Sweden (Ivkovich and Weisbenner 2005, Massa and Simonov 2005), there is little evidence that individuals gain abnormal returns by investing in local and familiar stocks. Instead, under-diversification resulting from the employer bias exposes individual portfolios to excessive idiosyncratic risks. If employees were to replace the 47 percent of their holdings in employer stocks with the market

portfolio, they could obtain a higher return of 4.89 percent per annum, holding constant the current risk. The foregone return represents a striking 39.74 of investors' average annual salary in 1998. With the more conservative estimate for the median employee, the foregone return is still considerable at 11.54 percent of the 1998 income. It seems that investors lose considerably not only from active trading (Barber et al. 2005), but also from holding the wrong portfolios. Over the 27-year horizon before average employee retires, portfolios free from employer bias generates terminal value that is more than three times as large as individuals' observed choices. That is, the bias-free portfolio can sustain retirees three times as long as the observed portfolios, under the same spending pattern.

Because of the lack of alternative sources, Taiwanese investors must plan to use part of their investment portfolios for retirement purposes. Hence, our study provides a unique opportunity to understand how the bias toward employer stocks hurts individual retirement investment where employees are not induced to do so by employers or pension plans. If the Taiwan experience can be generalized, our findings will shed some light on how individuals would treat employer stocks when they are allowed to manage their personal social security account in other countries around the world. Because stocks on average generate higher returns for retirement plans, some European countries (such as United Kingdom, Germany, and Austria, for example), started setting looser requirement for how individuals at small pension plans can invest their plan assets so that plan holders can invest directly in the stock market (Herbertsson and Orszag 1999). At the same time, some Asian countries also consider relaxing the regulations on whether investors can directly hold stocks in their retirement accounts (Asian Development Bank, 1998). If this trend were to spread around the globe, it is imperative to inform policymakers that the potential higher returns could result in higher risks and grave consequences if individuals cannot properly exercise their freedom to invest.

Our findings indicate that some inherent behavioral biases drive investors' strong desire to invest in employers' stocks even without institutional influences. This implies that improvement in plan design alone is insufficient to safeguard the security of future retirees. Legislators should reconsider how much autonomy individuals should have over

their retirement and private social security accounts. In addition to the often-mentioned educational programs aimed at enhancing investor awareness of the bias and its cost, some constraints should be imposed on the minimum fraction of portfolios invested in stock market index funds or other asset classes such as treasury bonds, and the maximum fraction of portfolios invested in employer stocks. Corporate policies should explicitly discourage, instead of encouraging, employees to hold employer stocks, to ensure employees long-term welfare. Even if employees become aware of the costly bias and adjust their behavior with current contributions, their retirement accounts can remain sub-optimal because of inertia.[5] Proactive programs such as Save-More-Tomorrow™ by Benartzi and Thaler (2004) should then be introduced to gradually achieve diversification in retirement accounts.

The rest of the study proceeds as follow: Section 2 describes background in Taiwan stock market and outlines the unique data on individual stock holdings and employment information from Taiwan; Section 3 presents empirical evidence that employees display strong bias toward employer stocks in Taiwan; Section 4 estimates the economic costs caused by the bias before we conclude in Section 5.

2. Background in Taiwan and Employee Stock Holding Data

2.1. Taiwan stock market and listed companies

The total market capitalization of Taiwan stock market is about $NT 10 trillion (about $US 313 billion) in the late 1990s, which ranked as the 12th largest market in the world. The listed stock market includes both stocks listed at the Taiwan Stock Exchange (TSE) and over-the-counter (OTC) stocks. Among 509 listed companies in Taiwan during 1998, we focus on the 442 of which complete firm-level information is available.

One apparent feature about 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,

[5] See Appendix B in Huberman and Sengmueller (2004) and Choi et al. (2002) for a more comprehensive discussion.

the average annual return is 10.5 percent, similar to that of U.S. market index. We plot the TAIEX (a value weighted index of all listed shares) movement during the decade in Figure 1. The high volatility underscores that sample selection has non-negligible impact on analyses on stock returns. Because we only have one year of data in 1998, we intentionally downplay employer bias's impact on individual portfolio returns but focus primarily on the consequent under-diversification.

(Insert Figure 1 about here)

We obtain firm-level information, such as firm size, market value, CAPM beta[6], past return and return volatility from the Taiwan Economic Journal (TEJ) and summarize it in Panel A of Table 1.

(Insert Table 1 about here)

2.2. Investor position and employment information

We obtain tax-filing data from Data Center at the Ministry of Finance of Taiwan that 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. For each household, we have the following four types of files: (1) the Wealth File that records wealth (land, house, cars) for all household members; (2) the Income File that records different types of income data including salary, cash dividends and stock dividends that household members receive, and income tax levied on the household; (3) the Household Member File that records the characteristics (Age, Gender, and Relation, etc.) of each household member; and (4) the Stock Shareholders File that records the dollar amount invested in companies at the time of filing (the deadline is December 31 of each year).

[6] CAPM beta is calculated by running CAPM regression for the period of 1996-1998 for each firm.

The data cover the entire investor universe. There are about 23 million populations in Taiwan as of 1998 and about 15 million filed taxes with taxable income. 6,678,678 individuals report income from salary, which identify them as employees of companies or organizations. 4,045,360 of such employees with income and salary above basic living standard are required to file for tax purposes and report their stock holdings. More than one third of these individuals (1,547,163) invest in the 442 listed companies in Taiwan in our file.[7] These listed companies employ 210,103 people and the current study focuses on 167,116 of those who hold at least one listed company stock as revealed by stock shareholder data.

Two variables of paramount importance to the current study merit further discussion. The foremost feature is the information about an individual's employer. We obtain precise employer information about each individual from the Income File, which records each individual's employer and the salary that the individual earns from the company. Once identifying the investor's employer, we next match the employer information with individual portfolio holding data recorded in the Stock Shareholder File. Combining the employer information and stock holding data, we can calculate the fraction of individual portfolios that are invested in employer stocks, which reflect employees' attitude toward employer stocks.

Several distinct features of the data provide unique research opportunities. First, the data provide complete information for the entire Taiwanese population. Because investing in employer stocks can vary greatly depending on firm characteristics[8], it is unreliable to draw conclusion on the social cost of investing in employer stocks based on evidence from any select group of companies. Complete data at the market level, therefore, enable us to accurately assess the social welfare cost resulting from the bias.

[7] There are 607 listed companies throughout history in the data provided by the data center, Ministry of Finance, Taiwan. 509 companies were extant in 1998. To retain all necessary firm-level characteristics, such as past 1-year and 2-year past returns, some 67 more firms are dropped and our sample consists of 442 listed companies.

[8] such as firm size, pension plan, and past returns in Benartzi (2001), Choi et al. (2005) and Cohen (2005)

Our data are also unique in that employers play little role in investor decisions. Few options were granted for corporate executives or employees before 2002 and employee share ownership plans (ESOPs) (Kruse et al. 2005) are rare even in the 2000s. Despite that executives are occasionally awarded with employer stocks. Supplemental data on executive compensation indicates that this only makes up a very small fraction of the employee ownership.[9] Unlike in United States, there is no lock-up requirement for granted options in Taiwan during the sample period, so executives can sell their awarded share without any constraint, making awarded shares no different from shares obtained through open-market purchase. We also verify the limited role of option-granting with employee's income data. Even for the most senior executives, salary accounts for more than 92 percent of their total income. ($NT 2,093,165/ 2,268,009 in Table 2.) The rest is made up from incomes from rents, investment proceeds, intellectual property, and professional services. Stock options account for less than 1 percent of the total income.

(Insert Table 2 about here)

More importantly, unlike U.S. investors who obtain shares through different channels (brokerage accounts, retirement accounts, matching contributions from employers, option granting, ESOPs, etc.), Taiwanese investors obtain their shares almost exclusively from open-market transactions. Because there is no private pension plan practice in Taiwan, the sample investors make virtually all their investment decisions free from employer influences. This puts the current study in stark contrast with existing studies that focus on retirement plans, where employer matching policy and retirement plan design induce employees to hold company stocks.

Finally, the data allow us to distinguish company managers from rank and file employees. Examining whether managers hold more/less employer stocks than rank and file employees can indicate whether managers are over-confident about employer

9 Additional information on total executive compensation and employee bonus information from the Taiwan Economic Journal (TEJ) reveals that executive compensation and employee bonus account for an

prospect or more sophisticated and hold more diversified portfolios. Studying whether managers can profit from holding employer stocks will provide additional evidence on whether employment-generated-familiarity can generate out-performance and whether managers can profit from their private information about the employers. More importantly, such information helps policymakers understand which employees are most susceptible to the bias toward employers and design specific actions targeted at helping rank and file employees.

2.3. Taiwan pension system in 1998

The social security system in Taiwan deserves some further discussions. There was no universal social security plan in Taiwan during the sample period[10], and retirement benefits and insurance vary considerably among different social strata. Government employees, accounting for about 8 percent of population, are entitled to a lump-sum old-age benefit of up to 34 months of salary by the Government Employee Insurance and an additional 53 months of salary or a monthly pension of 70 percent of pre-retirement basic salary offered by the Retirement Reserve Fund, in which all government employees are required to participate. Employees of companies made up about one third of the population in the 1990s and received up to a lump sum of up to 50 months of salary. The remaining half of the population are not covered by any public retirement insurance (Lin 2002). Companies are under no legal obligations to provide retirement plans to employees and few employers provide any other forms of private pension plans. Hence, factors that influence portfolio choices in U.S. retirement accounts, such as company matching and retirement plan design, do not influence Taiwanese investors' decisions toward their employers.

average 0.28 and 0.51 percent (the medians are both 0) of all outstanding shares for listed companies.

[10] National Health Insurance (NHI) and National Pension Program (NPP) reform took place in the late 1990s but was not put into effect until the turn of the century.

Equity mutual funds were in their infancy during the sample period. At the end of 2000[11], all Taiwanese individual investors held $NT 180 million worth of mutual funds, averaging a meager $NT 120 per investor among all stock market participants (Shu et al. 2002)[12]. The lack of a public retirement system and the immaturity of mutual fund industry imply that Taiwanese investors, especially corporate employees who have no other income sources after retirement, must plan to use part of their investments for retirement purpose (Lin 2002). Consequently, the situation is similar to what investors would do should they have to invest their private social security account, with virtually no influence from the employers or the retirement plans.

This provides an ideal opportunity to observe the 'what-if' scenario that cannot be examined in countries like United States, where retirement investment decisions are heavily influenced by employers. If Taiwanese investors can steer away from their employers' stocks, investing in employers is less worrisome if employees in other countries were to manage their own retirement investment. If, instead, Taiwanese investors are also keen with their employers' stocks even under little influence from the employers, investment in employer stocks seems to be a common pattern for corporate employees. This raises the question whether modifying company contributions or retirement plan designs is enough to prevent individuals from the costly strategy of investing in their own employers and the broader question of how to 'privatize' social security. If individuals tend to hold equity portfolios concentrated in a very small number of stocks in their private social security accounts, they probably should not be allowed to directly invest in stocks in the retirement accounts. Instead, individuals should be encouraged to allocate their accounts among mutual funds on various asset classes to diversify risks.

[11] The earliest mutual fund holding data goes back to 2000 and mutual fund investment is even less common going further back in history.
[12] We use the number of investor in the listed market, 1,547,163, in 1998.

3. Bias toward Employer Stocks

3.1. Tendency to invest in employers' stocks

We first present evidence that Taiwan investors tend to invest an abnormally large proportion of their portfolios in employer stocks. Panel B of Table 2 reports that more than 70 percent of the 167,116 listed company employees (who receive salaries from listed companies in the tax filing file) own shares of their employers[13]. Senior employees are much more likely to own company shares [14]: 83 percent of senior management (whose salaries are above the top 5 percentile within each company) invest in employer stocks, as opposed to 65 percent for employees with salaries below the median salary at respective employers. Comparison between employees who invest and do not invest in employer stocks in Appendix B reveals that employees who invest in employer stocks tend to be male, older, and wealthier.

Another informative measure is the average fraction of portfolios that individuals invest in the employer stocks. We calculate the following fraction for each investor:

$$\text{Percent in Employer} = \frac{Investment - in - Employer}{Total - Investment} \qquad (1)$$

where *Investment-in-Employer* is the dollar value invested in the employer's stocks and *Total-Investment* is the dollar value of all portfolio holdings.

Panel B of Table 2 reveals that listed company employees on average invest 47 percent of their portfolios in their employer's stocks (median=41 percent). Consistent with the above pattern, senior managers invest a higher fraction of their portfolio in

[13] If an investor were to randomly pick stocks, the probability of any investor owning his employers' stocks is N/442 (where N is the number of stocks held in portfolios and 442 is the number of listed companies in Taiwan in 1998). Given that average investors hold 3 stocks in their portfolios, a potential benchmark to compare against is 3/442, or less than 1 percent of listed-company employees are expected to hold employer shares.

[14] This is when ESOPs and executive compensation through stock options was rare in Taiwan in 1998.

employer stocks (55 percent) than rank and file employees (44 percent), despite that senior management hold much bigger portfolios (41 million compared to about 4 million Taiwan Dollar).

It is striking that individuals hold about one half of their portfolios in a single stock of their employers. Such severe under-diversification is apparently detrimental from a return-to-risk perspective. To make things even worse, the single stock that investors bet heavily on is that of the employers, from which they obtain a large fraction of their income. [15] It is therefore expected that such an investment strategy will post considerable costs to the entire society,[16] which we will assess in Section 4.

We next try to investigate whether the tilt toward employer stocks by listed company employees results in particularly severe portfolio under-diversification. We first compare whether portfolios are more concentrated for listed-company employees who invest in employer stocks than those who do not. Additional analyses reveal that 44.52 percent of employer-investing employees invest only in one stocks (almost all of them hold the single stock of their employers) and the largest holding constitute an average of 78.46 percent of entire their portfolio holdings. In contrast, 35.90 percent of the 49,035 employees who do not invest in employers hold only one stocks and the largest holding make up an average of 72.33 percent of their total holdings. Both differences are significant at the 1 percent level and suggest that employees are more likely to hold under-diversified portfolios if they invest in employer stocks.

We further compare listed-company employees with those at non-listed companies. 571,479 non-listed companies employ 3,704,704 people during 1998. 21.67 percent of employees at non-listed companies own their employers' stocks and 21.54

[15] Previous studies have discussed how investing in employer stocks can impose considerable risk to investors' human capital and hinder diversification of all types of investor wealth, including home equity and salary income. (Benartzi et al. 2004, Meulbroek 2003)

[16] We also examine the fraction for employees of all employers, regardless of whether the employers are listed companies. Individuals invest an average of 24 percent of their portfolio in their employers' stocks. The median value is 0. We believe this is a very conservative estimate because the whole sample includes mostly private companies and organizations, where employees cannot purchase employer shares through open market transactions.

percent hold at least one listed companies. That is, the likelihood of investing in employer stocks is similar to that of investing in a random listed company. Both figures are much smaller compared with that 56.20 percent of employees at listed companies (118,081 divided by 210,103 in Panel B of Table 2) invest in their employers' shares. Such summary statistics based on participation depicts a clear picture that employment with a listed company greatly increases someone's likelihood of holding under-diversified equity portfolios. [17]

3.2. Investor characteristics and tendency to invest in employer stocks

Individuals exhibit different levels of behavioral biases (Dhar and Zhu 2005) and some investors are more enthusiastic with employer stocks than others (Choi et al. 2002, Cohen, 2005). We next investigate which individuals favor employer stocks more in a regression setting. First, we perform probit regression to understand which employees are more likely to invest in employers. The dependent variable is a binary dummy variable that equals to 1 if an employee invests in her employer's stocks and 0 if she does not. Because our final sample only includes employees of listed companies who invest in the stock market, all employees fall in one of the two categories.

Investor characteristics include dummy variables for managers, logarithm of investor age, logarithm of investor income, and a gender dummy variable. The dummy variables for managers are constructed as follows. We sort all employees of each listed company by their salaries and consider investors with top 5/10/25 percentile salaries as managers. The top 5 percentile employees are most likely to include senior corporate managers and the top 10 and 25 percentile represent mid-level management. [18] The remaining 75 percent can be considered as the rank and file employees of companies. The senior 5/10/25 dummy variable takes the value of 1 if an investor's salary falls in the 5/10/25 percentile range and 0 otherwise. Investor age and income are observations in

[17] Because price information is not available for non-listed companies, we cannot evaluate the fraction of portfolio value invested in employer stocks for non-listed companies.
[18] We will use 'top 5 salary employees' and 'senior managers' and 'top 10/25 salary employees' and 'mid-level managers' interchangeably in the rest of the paper.

1998 and the gender dummy variable takes value of 1 if an investor is male and 0 if she is female. The gender dummy is meant to control for difference in confidence and other behavioral biases between male and female employees (Barber and Odean 2001). We also control other firm level information that will be discussed in Section 3.3.

(Insert Table 3 about here)

Older employees and employees with higher taxable income are more likely to invest in employers. An investor who is 10 years older is 10 percent more likely to invest in employers and an investor with $NT 10,000 higher income is 168 percent more likely to invest in employer stocks. Managers are less likely to invest in the employers than rank and file employees when controlling for age and income. Senior managers are about 8 percent less likely to invest in the employers. The results may seem surprising because it is opposite to the summary statistics results in Table 2. This is entirely because we control for other investor characteristics in the regression setting. Because senior managers tend to be older and wealthier than other employees and older and wealthier investors are more likely to invest in employers, regression results depict an accurate picture of manager's propensity to invest in employers.[19] Male employees are slightly more likely to invest in employers.

We further perform tobit regression with the dependent variable as the percent of each portfolio invested in the employer stocks. The tobit regression estimates investors' tendency to invest in employer stocks and how much they decide to invest in employers at the same time. As expected, most of the variables come out in the same direction as the probit regression.

[19] This finding is in contrast with findings in U.S. (Malmendier and Tate 2005) that CEO own a mean of 2.3 percent (median=0.12 percent) of employer stocks. Note that executive compensation through stock ownership and vested options is much more population in the United States than Taiwan.

Consistent with Choi et al. (2005) on employees from three U.S. companies, managers invest a smaller fraction of their portfolios in employer stocks, controlling other variables. This finding highlights that rank and file employees are indeed more susceptible to the mistake of investing in employer stocks. We conjecture that this is partly because senior managers have much bigger portfolios that can be diversified through other holdings or because they are more likely to understand the diversification principle or utilize professional services to manage their portfolios. Consistent with the probit results, age and income are positively related to the fraction invested in employers. Despite that male employees are more likely to invest in employers, they invest about 4 percentage less in employers than female employees do, when controlling for their choices.

3.3. Firm Characteristics and Tendency to Invest in Employers

Previous studies find that employees at companies with certain characteristics allocate more towards their employers in the retirement plans. For example, Benartzi (2001) shows that investors favor employer stocks more if company stocks have performed well in the past few years, and Cohen (2005) finds that employees of larger companies invest significantly more in their employers' stocks.

We include firm level characteristics such as company market capitalization, market to book ratio, CAPM market beta, high-tech dummy, and past return and volatilities. Market capitalization is calculated by multiplying the total number of outstanding shares and the share price at December 31, 1998. Beta is calculated by running CAPM regression between January 1, 1996, and December 31, 1998, for each firm. High Technology is a dummy variable that equals to 1 if a company is in computer-related and bio-technology industry and 0 otherwise. Past one- and two-year return and volatility are the company returns between January 1, 1998/1997, and December 31, 1998 and the standard deviation of the monthly returns.

Consistent with U.S. findings, investors hold more employer stock if the employer stocks perform relatively better. Interestingly, individuals' response to employer stock return volatility depends heavily on the time-horizon. They increase employer stock holding for stocks with high 1-year volatility and decrease holding for stocks with high 2-year volatility.[20] Similar to Cohen (2005), employees hold relatively more if employers have high market capitalization or the employer stock enjoys higher valuations, controlling for past returns. High-tech company employees hold about 5 percentage more in employers stocks, consistent with the notion that high-tech company employees favor the employers, even without the common practice of option granting in U.S. high-tech companies in the 1990s.

4. Costs of Investment in Employers' Stocks

One apparent reason why investors may favor employer stocks is that they may possess advantageous information about their employers. Existing studies are divided on whether familiarity generates value-relevant information. Ivkovich and Weisbenner (2005) and Massa and Simonov (2005) claim that investors obtain abnormal return by investing in nearby stocks but Huberman (2001) and Zhu (2004) argue that familiarity is not necessarily driven by information. Seasholes and Zhu (2005) show that Ivkovich and Weisbenner's results disappear when returns are measured with the correct calendar-time portfolio approach based on investor trades.

Because we only have a snapshot of investors' portfolios for one year, attempts to draw conclusion on whether investing in employers generates abnormal returns will be hindered by not only the limited power of the test but also the correlation in contemporaneous stock returns. In particular, we perform cross-sectional regression of the one-, two-, and five-year forward returns of each listed company on the fraction of each company's outstanding shares being held by all employees, senior managers, and

[20] This may be attributed to the high level of return volatility and the reversal of annual returns in the Taiwan stock market.

middle managers, respectively[21]. The coefficients for employee ownership in all specifications are negative yet insignificant, hinting that the more employees invest in their employers, the lower the employer stock returns are. Hence, it does not seem that employees can forecast employer stock returns.

In addition, we divide all sample employees into quartiles by the fraction of their portfolio invested in employer stocks. We next form four portfolios by pooling the portfolio positions by employees belonging to each quartile. Contrary to the claim that familiarity generates higher returns, the 1-year forward portfolio return is indeed significantly lower for portfolios by individuals who invest most in employer stocks than those who invest least. The difference remains negative and becomes insignificant when we evaluate the 2-year and 5-year horizon, indicating that sample selection heavily influences the results over the shorter horizon. Given the respective limitation of above tests, neither of the above results is sufficient to conclude that individuals suffer lower returns by tilting portfolio toward their employers. Notwithstanding, there is hardly any evidence that individuals gain higher return by investing in employers, either.

Hence, we make no claim on whether individuals gain abnormal returns by investing in employers. Instead, we assume that investing in employer stocks does not influence individuals' portfolio return and focus exclusively on how employees suffer from the severe under-diversification resulting from the bias toward employers. We first summarize the one-year forward portfolio return and volatility and ask the question whether the portfolio choice can be improved by replacing the investment in employer stocks with randomly selected portfolios, such as a market index.

[21] For example, one regression is specified as: return(1)=a+ b* (shares owned by all employees) + ε, where return(1) is the one-year forward return for a listed company and "shares owned by all employees" is the total number of the company's shares owned by all of its employees divided by the total number of outstanding shares.

A simple comparison of the return and risk of the observed portfolio versus the bias-free portfolio by replacing company stocks with market index [22] reveals that individuals could increase the returns and reduce the risk of their portfolios at the same time by investing less in employers. The average one-year forward monthly return is 1.64 percent for observed portfolio and 2.34 percent for the bias-free portfolios. The hypothetical bias-free portfolios outperform individuals' real portfolios by 20 basis points per month on the two-year horizon but lags the real portfolios by 9 basis points per month over the five-year horizon. Such findings are consistent with our earlier argument that the return results are sensitive to sample selection and must be interpreted with caution.

In contrast, the hypothetical employer-bias-free portfolios are consistently less risky than the real portfolios. On the one-year horizon, the volatility of both the real and hypothetical portfolios is much higher (12.75 and 10.48 percent, respectively) than the market index volatility of 7.63 percent [23]. It is noteworthy that replacing employer stocks with market index reduces the portfolio risk by 17.8 percent. Over the two- and five-year horizon, portfolios free from employer bias also enjoy much lower level of risks than the observed portfolios (11.47 percent vs. 14.09 percent and 12.59 percent vs. 15.85 percent, representing a 18.6 and 20.6 percent reduction in portfolio risks). Above summary statistics confirm that under-diversification resulting from employer bias consistently hurts individuals' welfare.

(Insert Table 4 about here)

We next assess the economic significance of the losses caused by such under-diversification in Table 4. The essence of our estimation approach is to compare individual portfolios' return-to-risk ratio (i.e. Sharpe ratio) with the hypothetical portfolio if individuals do not invest heavily in employers. We first estimate each investor's

[22] By doing so, we implicitly assume that individuals will randomly pick other stocks if they were not to invest in their employers stocks. In aggregate, that is very similar to investing in the market portfolio by aggregating employees from all listed companies.

monthly portfolio return and volatility in 1999, one year after forming the portfolio at the tax-filing deadline.[24] Because return results are sensitive to the sample period, we construct the hypothetical portfolio for each individual by holding the observed portfolio return constant and replace the observed portfolio volatility with the volatility of the hypothetical portfolio free from employer bias.[25] We next calculate the Sharpe ratio for the observed versus the hypothetical portfolio to evaluate how return-to-risk ratio could be increased if individuals steer away from employer stocks. The improvement is striking. The average Sharpe ratio increases from 0.068 to 0.099, an increase of almost 50 percent, if individuals were not to invest heavily in employer stocks. We next multiply the Sharpe ratio with the observed portfolio standard deviation and calculate how individual portfolio returns would change if individuals were to hold portfolios with current risk but do no tilt portfolios toward employers. The average employee can obtain a higher return 0.63 percentage point per month than the observed portfolio. The average annualized foregone return is 4.89 percent.[26]

There are several ways of putting the foregone return into perspective. We first calculate the ratio of the foregone return in dollar value to individual' salary income in 1998. For each individual, we multiply the foregone return with the 1998 year-end portfolio value and divide it by the 1998 salary income. We windsorize 1% of extreme observations on both tails because of outliers. Foregone return on average represents 39.74 percent of investor's last-year income. Our results are apparently influenced by the fact that Taiwanese employees hold large portfolios relative to their incomes, which is not uncommon in some Asian stock markets. (For example, Feng and Seasholes (2004) reports that the 51,218 sample investors from mainland China hold portfolios on average

[23] The monthly market index volatility is 9.33 percent per annum between January 1993 and December 2003.
[24] We assume all individuals file at December 31, 1998 and ignore possible change in portfolio holdings from tax filing to December 31, 1998.
[25] We obtain very similar results when using 2 years and 5 years as hypothetical holding periods. Given that the turnover is high in the Taiwan stock market and particularly high for individual investors (See Barber et al. 2005(a) 2005(b)), we feel the one-year holding period assumption is more appropriate.
[26] Because returns compound differently for different portfolios, the average annualized foregone return (4.89 percent) does not equal to average foregone return compounded at annual basis (7.83 percent).

worth of RMB Yuan 136,777, or $16,577[27], which is much greater than the per capita income of about $1,000 during their sample period.) Nevertheless, the magnitude of the portfolios exactly reflects that individuals probably plan to use at least part of their stock portfolios to support their retirement given the lack of other retirement plans in Taiwan. To avoid influence from outliers, we also calculate the more conservative ratio of median portfolio value to median salary income in 1998. The ratio equals to 2.36. By multiplying 2.36 with the average foregone return of 4.89 percent, we find that the foregone return still represents a considerable 11.54 percent of investor's 1998 salary income.

(Insert Table 5 about here)

It is evident from the above illustration that bias toward employer stocks cause individuals dearly over the 1-year horizon. It should not be surprising that such a strategy causes even greater losses compounded over longer horizons. Based on summary statistics in Table 2, average employees are 38-year old and have 27 years until retirement. We assume the portfolio value to be $NT 339,906, which is the median portfolio value for all Taiwanese employees. Using average return during the decade around the sample year between 1993 and 2003, employees' portfolios with or without employer bias will grow to $NT 1,476,298 and $NT 5,012,077, respectively. That is, investment without bias toward employers will generate more than three times as much wealth as individuals' real portfolios. Using the median annual income of $NT 429,804 for all investors, the terminal value of the investment strategy with and without employer bias can sustain the median investor for 6.87 and 23.32 years, at 50 percent of the 1998 income. Put differently, individuals' observed strategy generates wealth that can barely support retirees for 10 years. In contrast, the bias-free strategy can keep retirees through their life-expectancy.[28]

[27] The median portfolio size is RMB Yuan 34,422, or $ 4,172, which is still much higher than the per capita income.
[28] Life expectancy is 77.8 in 1998 according to Ministry of Interior, Taiwan

It also helps to put the foregone returns in the context of U.S. market. If U.S. employees were to exhibit similar bias toward their employers (the fraction invested in employers in Taiwan 47 percent is indeed similar to some of the estimates in United States for retirement plan accounts (Brown et al. (2005), Huberman and Sengmueller (2004)), we can estimate how much average U.S. employees would give up. According to Holden and VanDerhei (2003), average account balance for active 401(k) plan participants is $57,668. We assume that an individual invests through market index and obtains the historical average return of 12.3 per annum during the past 50 years. With an additional assumption of investment horizon for 20 years till retirement, the investor will receive $587,903 terminal value at retirement. Instead, if she tilts their portfolios toward employers as the average Taiwanese investor does and gives up 4.89 percent per year, the terminal value will be $241,346, less than one half of the value if individuals were not to bias toward the employers. The above examples both demonstrate that bias toward employer stocks can incur such high cost to employees that retirees' livelihood after retirement will be jeopardized.

Needless to say, the above outcomes have drastically different implications on social stability and government responsibilities. Younger generations would have to bear greater burden if the older ones did not obtain enough from the retirement investments. It is likely that individuals may have other types of investments such as savings and real estate. Notwithstanding, if one were to assume that private retirement accounts make up the majority of retirees' income, as will happen under the regime of private social security account, our findings in Taiwan expose the hazard of giving individuals too much autonomy over their retirement accounts. It seems that employment with a listed company greatly increases someone's chance of investing in employer stocks and holding under-diversified portfolios, and may cause catastrophic consequences.

5. Conclusions

We utilize a comprehensive data from Taiwan to show that employees of listed companies invest about one half of their portfolios in their employers' stocks. The economic cost of doing so is considerable. Investors on average give up 4.89 percent of raw returns per annum by holding their employers' shares, which equal to 39.74 percent of their 1998 salary income. Such allegiance to employer stocks cannot be attributed to executive option compensation, ESOPs, sponsoring policies by employers to own company stocks, plan designs, or private information. Instead, behavioral biases, such as availability and salience heuristics, inertia, over-confidence, and over-extrapolation are all possible reasons behind the phenomenon.

Different from previous findings drawn from retirement accounts in the United States and other countries, our findings suggest that investing in employer stocks is generic to individual investor decision-making, but not limited to their decisions in the context of investing for retirement. The findings emphasize that although improving plan design and company sponsoring policy could alleviate the severe under-diversification in retirement plans to some extent, it is highly plausible that individuals will choose to invest sub-optimally in employer stocks even without the influence from their retirement plans. Our study underscores the potential pitfall that investors will get into after social security is 'privatized' and motivates policy changes that will safe-guard retirees' security through social security reform. The findings are also important for countries considering reforming their social security. Any attempt to 'privatize' social security must be based on very careful consideration of individual behavioral biases and potential mistakes. Unnecessary risky investment can result in loss of security after retirement and impose consequential problems to financial markets and social stability.

Future studies are needed in the following areas. First, further studies are required to understand why individuals have such strong attachment to employer stocks as reported in this study. Only after understanding the behavioral mechanism behind the loyalty phenomenon can scholars and policymakers determine the best way to help

investors avoid the bias. Second, institutional differences in retirement arrangement around the world can provide valuable opportunities to compare and contrast the costs and benefits of competing systems and engender policy proposals that better ensure employees' welfare. Finally, future research should come up with specific mechanisms that can limit employee's enthusiasm for their employers' stocks. It is worth emphasizing that employees hardly have any information advantage on their employers than other investors and investing in other vehicles such as mutual funds should be advocated.

	Number of Plans	Number of companies	Number of participants	Value of Assets	Time Period	Average percent invested in employer stock	Data Source
Benartzi (2001)	154	N/A	2.57 million	$102 billion	1993	23/24*	11-K filings
Brown, Liang and Weisbenner (2005)	N/A	1,377	13.17 million	$1,377 billion	1991-2000	17 to 45.5 **	11-K filings
Choi et al. (2005)	N/A	3	94,191	$8.4 billion	1993-2000	17.7	Hewitt & Associates
Cohen (2005)	N/A	263	N/A	$142 billion	1997-2000	17.3 to 20.6 ***	11-K filings
Holden and Vanderhei (2003)	46,310	N/A	15,509,185	$619 billion	2002	16******	Employee Benefit Research Institute (EBRI) and Investment Company Institute (ICI)
Huberman and Sengmueller (2004)	335	239	N/A	N/A	1994-1998	35-40(1993-1998)	
Mitchell and Utkus (2005)	300,592****	N/A	11 million	1,541 billion*****	1993-1998	15.5-17.4	U.S. Department of Labor
U.S. retirement plans (estimate from Mitchell and Utkus 2003)	700,000	N/A	55 million	over 2 trillion	2001	N/A	Employee Benefit Research Institute (EBRI) and Investment Company Institute (ICI)
Current Study	N/A	442	167,116	$NT 713.98 billion (US$ 22.16 billion)	1998	47	Data Center, Ministry of Finance, Taiwan Exchange rate: 1 US$=32.22 $NT

Appendix A. Comparison and contrast between current study and existing studies on investment in employer stocks in the United States

* depending on equal weighted vs. weighted by plan contributions; ** 17 percent for unrestricted match and 45.5 percent for company stock match;
*** 17.3 percent for conglomerate firms and 20.6 for stand-alone firms; **** 401(k) only, as of 1998; ***** 401(k) only, as of 1998; ****** As of 1998.

	Employees who invest in employer stocks		Employees who do NOT invest in employer stocks		Employees who invest in listed companies	
Age < 18	7	0.01%	1	0.00%	8	0.00%
Age18-25	5,766	4.88%	2,283	4.66%	8,049	4.82%
Age 26-64	110,800	93.83%	46,322	94.47%	157,122	94.02%
Age > =65	1,508	1.28%	429	0.87%	1,937	1.16%
Gender (Male)	69,343	58.72%	26,242	53.52%	95,585	57.20%
Tax < 13%	108,963	92.28%	47,439	96.75%	156,402	93.59%
Tax (13-21%)	7,378	6.25%	1,407	2.87%	8,785	5.26%
Tax (21-30%)	1,103	0.93%	135	0.28%	1,238	0.74%
Tax > =31%	637	0.54%	54	0.11%	691	0.41%
Total	118,081		49,035		167,116	

Appendix B. Characteristics for Investors who Invest and who do not Invest in Employer Stocks

References

Agnew, Julie, 2002, Do Behavioral Biases Vary across Individuals?: Evidence from Individual Level 401(K) Data, *Journal of Behavioral Finance*, forthcoming.

Agnew, Julie, 2002, Inefficient Choices in 401(k) Plans: Evidence from Individual Level Data, working paper, College of William and Mary.

Agnew, Julie, Pietro Balduzzi, and Annika Sunden, 2001, Portfolio Choice, Trading, and Returns in Large 401(k) Plan, *American Economic Review,* 93-1, 193-215.

Asian Development Bank, 1998, Policy Options for Pension Reform in Asia: Challenges in Design and Implementation, Technical Assistance Reports.

Barber, Brad, Yi-Tsung Lee, Yu-Jane Liu, and Terrance Odean, 2005 (a), Who Loses from Trade?: Evidence from Taiwan, working paper, UC Davis.

Barber, Brad, Yi-Tsung Lee, Yu-Jane Liu, and Terrance Odean, 2005(b), Do Individual Day Traders Make Money? Evidence from Taiwan, working paper, UC Davis.

Barber, Brad and Terrance Odean, 2001, Boys will be Boys, Gender, Overconfidence and Common Stock Investment, *Quarterly Journal of Economics*, 261-292.

Barber, Brad, Terrance Odean, and Ning Zhu, 2005, Does Individual Investor Herding Forecast Returns? Working paper, UC Davis.

Benartzi, Shlomo, 2001, Excessive Extrapolation and Allocations of 401(k) Accounts to Company Stocks, *Journal of Finance,* 56, 1747-64.

Benartzi, Shlomo and Richard H. Thaler, 2001, Naive Diversification Strategies in Defined Contributions Savings Plans, *American Economic Review*, 91-1, 79-98.

Benartzi, Shlomo and Richard Thaler, 2004, Save More Tomorrow: Using Behavioral Economics to Increase Employee Savings, *Journal of Political Economy*, 112(1), Part 2, S164-S187.

Benartzi, Shlomo, Richard H. Thaler, Stephen P. Utkus, and Cass R. Sunstein, 2004, Company Stock, Market Rationality, and Legal Reform, working paper, University of Chicago Law School.

Bethel, Jennifer E., Julia Porter Liebeskind, and Tim Opler, 1998, Block Share Purchases and Corporate Performance, *Journal of Finance*, 53(2), 605-634.

Brown, Jeffrey, Nellie Liang, and Scott Weisbenner, 2005, 401(k) Matching Contributions in Company Stock – Costs and Benefits for Firms and Workers, *Journal of Public Economics*, forthcoming.

Choi, James, David Laibson, Brigitte Madrian, and Andrew Metrick, 2002, Defined Contribution Pensions: Plan Rules, Participant Decisions and the Path of Least Resistance, *Tax Policy and the Economy*, 16, MIT Press.

Choi, James, David Laibson, Brigitte Madrian, and Andrew Metrick, 2005, Employees' Investment Decisions About Company Stock, in Olivia S. Mitchell and Stephen P. Utkus (eds), *Pension Design and Decision-Making Under Uncertainty*, Oxford University Press, forthcoming.

Cohen, Lauren, 2005, Loyalty Based Portfolio Choice, working paper, University of Chicago.

Cogan, John, and Olivia Mitchell, 2003, Perspectives from the President's Commission on Social Security Reform, *Journal of Economic Perspective*, 17, 149-172.

Dhar, Ravi and Ning Zhu, 2005, Up Close and Personal, An Individual Level Analysis of the Disposition Effect, *Management Science*, forthcoming.

Fama, Eugene and Kenneth R. French, 1993, Common Risk Factors in the Returns on Stocks and Bonds, *Journal of Financial Economics*, 33, 3-56.

Feng, Lei and Mark Seasholes, 2004, Location Effects and Portfolio Tilting, working paper, University of California, Berkeley.

Goetzmann, William and Alok Kumar, 2004, Why Individual Investors Hold Under-Diversified Portfolios, working paper, Yale University.

Gordon, Lilli A. and John Pound, 1990, ESOPs and Corporate Control, *Journal of Financial Economics*, 27, 525-555.

Herbertsson Thor Tryggvi and Michael J. Orszag, 1999, Issues in European Pension Reforms, Supplementary Pensions, working paper, University of London.

Holden, Sarah and Jack VanDerhei, 2003, 401(k) Plan Asset Allocation, Account Balances and Loan Activity, Investment Company Institute.

Holden, Sarah, Jack VanDerhei, and Carol Quick, 2000, 401(k) Plan Asset Allocation, Account Balances, and Loan Activity in 1998, *Investment Company Institute Perspective,* 6(1).

Huberman, Gur, 2001, Familiarity Breeds Investment, *Review of Financial Studies*, Fall 2001, Vol. 14, No. 3, pp. 659-680.

Huberman, Gur and Wei Jiang, 2005, Offering vs. Choice in 401(k) Plans, Equity Exposure and Number of Funds, *Journal of Finance*, forthcoming.

Huberman, Gur, and Paul Sengmueller, 2004, Performance and Employer Stock in 401(k) plans, *Review of Finance*, 8-3, 403-443.

Huberman, Gur, Sheena Iyengar, and Wei Jiang, 2003, Defined Contribution Pension Plans: Determinants of Participation and Contribution Rates, working paper, Columbia University.

Ivkovich, Zoran and Scott Weisbenner, 2005, Local Does as Local Is: Information Content of the Geography of Individual Investors' Common Stock Investments, *Journal of Finance*, 60-1, 267-306.

Kruse, Douglas, Richard Freeman, Joseph Blasi, Robert Buchele, and Adria Scharf, 2005, Motivating Employer-Owners in ESOP firms: Human Resource Policies and Company Performance, NBER working paper 10177.

Khaneman, Daniel, 2003, Maps of Bounded Rationality: Psychology for Behavioral Economics, *American Economic Review*, 93, 1449-1475.

Kahneman, Daniel and Amos Tversky, 1986, Rational Choice and the Framing of Decisions, *Journal of Business*, 59, 251-278.

Lin, Chen-Wei, 2002, *The Developing Economies*, XL-3 (September), 327-358.

Malmendier, Ulrike and Geoffrey Tate, 2005, CEO Overconfidence and Corporate Investment, *Journal of Finance*, forthcoming.

Massa, Massimo and Andrei Simonov 2005, Hedging, Familiarity, and Portfolio Choice, Review of Financial Studies, forthcoming.

Meulbroek, Lisa, 2003, Company Stock in Pension Plans: How Costly Is It?, working paper 02-058, Harvard Business School.

Mitchell, Olivia S. and Stephen P. Utkus, 2005, Company Stock and Retirement Plan Diversification, working paper, Wharton School, University of Pennsylvania.

Ramaswamy, Krishna, 2002, Company Stock and DC Plan Diversification, working paper, University of Pennsylvania.

Rauh, Joshua, 2005, Own Company Stock in Defined Contribution Pension Plans, A Takeover Defense? *Journal of Financial Economics*, forthcoming.

Seasholes, Mark and Ning Zhu, 2005, Is there Information in the Local Portfolio Choices of Individuals, working paper, University of California, Davis.

Shu, P.-G., Y.-H. Yeh, and T. Yamada, 2002, The Behavior of Taiwan Mutual Fund Investors-Performance and Fund Flows, *Pacific-Basin Finance Journal*, 10(5), 583-600.

Zhu, Ning, 2004, The Local Bias of Individual Investors, working paper, University of California, Davis.

Zhu, Ning, 2005, Cost of Time and Household Choice between Direct and Delegated Investments, working paper, University of California, Davis.

Table 1. Investor Sample and Firm Summary Statistics

Panel A provides summary statistics on key firm characteristics. M/B is firm market value to book value ratio where market value is defined as the total number of outstanding shares times stock prices as of December 31, 1998. CAPM beta is calculated by running CAPM regression of firm returns on market index return for the period between January 1, 1996, and December 31, 1998. Size is the market capitalization of the firm, calculated as the number of outstanding shares times the stock price as of (December 31, 1998). Annualized 1-, 2-, and 5-year raw return is the per annum forward-looking return in percentage, for each stock during the period between January 1, 1999, and December 31st of 2000, 2001, and 2004, respectively. Past 1-, 2-, and 5-year raw return is the per annum return for each stock in percentage during the period between January 1 of 1998, 1997, 1994, and December 31, 1998, respectively. Panel B describes how sample investors are selected. The final sample of 167,116 investors includes all listed company employees who invest in Taiwan stock market.

Panel A. Firm Characteristics

	Mean	Median	Standard deviation
M/B	2.97	1.48	0.17
Beta	1.05	0.78	0.02
Size	107,805	6,827	6,202
Annualized one-year forward return	32.09	-24.48	3.70
Annualized two-year forward return	-15.82	-33.69	1.23
Annualized five-year forward return	-1.57	-7.73	0.68
Annualized one-year past-return	-11.32	-26.49	1.48
Annualized two-year past return	53.39	10.01	4.06
Annualized five-year past return	24.82	10.35	1.67

Panel B. Investor Sample Construction

	Number of Observations	Percent of employees investing in employers
Total Population	23 million	
Individuals with identified income	14,541,662	
Individuals with Income and salaries	6,676,100	
Individuals with Income and salary above basic standard	4,045,360	
Investors in listed markets	1,547,163	
Employees of listed companies	210,103	
Employees of listed companies invest in the listed market	167,116	100.00%
employees of listed companies who own company stocks	118,081	70.66%

Table 1 Summary Statistics

Table 2 Summary Statistics on Taiwan Investors

Panel A provides sample investor characteristics. Age, income (in $NT), and salaries (in $NT) are obtained from the income file and household member file from the Data Center, Ministry of Finance, Taiwan. Number of shares in lots and value of investment (in $NT) for each individual is obtained from the stock shareholders file from the same source. Senior 05/10/25/50 correspond to employees whose salaries fall into the top 5/10/25/50 percentile within respective employers. Standard deviation is reported in parentheses. Panel B describes Taiwan employees' tendency to invest in employer stocks. For each group of investors, fraction of employee/investors that invest in employer stocks is calculated as the number of employees who invest in employer stocks divided by the number of employees who invest in the stock market. Similarly, for each group of investors, fraction of portfolio invested in employer stocks is obtained by first calculating the dollar value of each household's investment in employer stocks divided by total dollar value of the household portfolio, and then calculating the average of such a ratio among all investors from each group.

Panel A. Investor Characteristics

	All Investors	All Employess of Listed Companies	Senior 05	Senior 10	Senior 25	Senior 50
Number of Observation	1,547,163	210,103	14,711	28,552	67,447	125,779
Age	40.82	37.73	46.04	44.16	41.55	39.54
	(11.61)	(10.00)	(9.11)	(8.97)	(9.03)	(9.34)
Income	429,804	812,181	2,268,009	1,793,831	1,310,174	1,025,289
	(542,246)	(820,424)	(2,278,074)	(1,753,092)	(1,248,700)	(981,266)
Salaries	402,624	779,977	2,093,165	1,688,296	1,310,174	1,025,289
	(492,767)	(665,378)	(12,642,405)	(1,277,460)	(949,918)	(770,225)
Number of Shares Invested in	179,110	147,710	1,444,369	807,116	376,801	219,526
	(72,822,122)	(3,751,474)	(12,642,405)	(9,150,151)	(5,991,344)	(4,404,492)
Dollar Value of Investment	4,313,174	4,272,364	41,709,761	23,240,578	10,824,114	6,311,646
	(156,833,289)	(125,115,369)	(436,108,418)	(315,225,725)	(206,129,503)	(151,476,899)

Panel B. Portfolio Summary

Number of Observation	1,547,163	210,103	14,711	28,552	67,447	125,779
Number of Observations where Employees Invest in Stock Market		167,116	12,152	23,417	54,946	101,893
Number of Employee/Investor that invest in Employer Stocks		118,081	10,057	18,863	42,718	76,775
Fraction of Employees/Investor that Invest in Employer Stocks		70.66%	82.76%	80.55%	77.75%	75.35%
Fraction of Portfolio Invested in Employer Stocks	5.89%	47.43%	55.17%	52.99%	50.72%	49.62%

Table 2. Bias toward Employer Stocks

Table 3. Factors that Influence Individuals' Investment in Employer Stocks

Panel A performs probit and Panel B performs tobit regression of individual portfolio's tilt toward employer stocks on investor seniority, characteristics, and employer characteristics. For the probit regression, the dependent variable is a binary variable that equals to 1 if an employee invests in the employer stock and 0 if the employee does not. For the tobit regression, the dependent variable is the fraction of the investor's portfolio being invested in employer stocks, calculated as the total dollar value invested in employer stocks divided by the total dollar value of the investor portfolio. Senior 5/10/25 are dummy variables that equal to 1 if an investor's salary falls in the top 5/10/25 percentile of the employer's payroll and 0 otherwise. Ln (age) and Ln (income) are the logarithm of age and income where data are obtained from the household member file and the income file from the data center, Ministry of Finance, Taiwan. Male is a dummy variable that equals to 1 if an investor is male and 0 if female. Firm-level characteristics are obtained from the TEJ (Taiwan Economic Journal). Ln (M/B) is the logarithm of the market to book value ratio. Ln (Size) is the logarithm of the market capitalization, calculated as the number of outstanding shares times stock price as of December 31, 1998. Beta is calculated by running CAPM regression between January 1 1996, and December 31, 1998, for each firm. High Technology is a dummy variable that equals to 1 if a company is in computer-related and bio-technology industry and 0 otherwise. Past 1- and 2-year returns are the company returns between January 1 1998/1997, and December 31, 1998. Stdev(1-year return) and stdev(2-year return) are the standard deviation of monthly stock returns between January 1 1998/1997, and December 31, 1998. *,**, and *** denote significance at the 10, 5, and 1 percent levels.

	Panel A: Probit									Panel B: Tobit					
	Coefficient	P-value		Coefficient	P-value		Coefficient	P-value		Coefficient	T-stat	Coefficient	T-stat	Coefficient	T-stat
Intercept	-5.148	0.000	***	-5.293	0.000	***	-5.154	0.000	***	-164.709	-22.17***	-171.794	-22.14***	-166.148	-20.93***
Senior 5	-0.084	0.000	***							-3.257	-3.17***				
Senior 10				-0.083	0.000	***						-3.599	-4.36***		
Senior 25							-0.035	0.057	**					-1.843	-2.82***
Ln Age	0.100	0.000	***	0.104	0.000	***	0.100	0.000	***	18.816	17.90***	18.804	18.05***	18.660	17.91***
Ln Income	0.424	0.000	***	0.435	0.000	***	0.425	0.000	***	11.327	20.45***	11.875	20.46***	11.453	19.14***
Male	0.018	0.000	***	0.019	0.000	***	0.022	0.000	***	-3.925	-7.55***	-3.900	-7.52***	-3.730	-7.18***
Ln(M/B)	0.482	0.000	***	0.483	0.000	***	0.483	0.000	***	-21.641	-38.79***	-21.545	-38.56***	-21.557	-38.42
Ln(Size)	-0.049	0.000	***	-0.050	0.000	***	-0.049	0.000	***	1.084	4.23***	1.004	3.89***	1.062	4.10***
Beta	-0.489	0.000	***	-0.490	0.000	***	-0.489	0.000	***	-12.937	-11.83***	-12.920	-11.81***	-12.868	-11.76***
High-Technology	0.136	0.000	***	0.137	0.000	***	0.136	0.000	***	44.425	53.90***	44.565	53.99***	44.485	53.78***
Past 1-year return	-0.004	0.722		-0.004	0.767		-0.004	0.695		-0.004	-0.26	-0.005	-0.32	-0.004	-0.28
Past 2-year return	0.000	0.140		0.000	0.161		0.000	0.128		0.066	9.97***	0.066	10.01***	0.066	9.95***
Stdev(1-year return)	0.017	0.900		0.017	0.936		0.017	0.854		0.193	2.90***	0.196	2.94***	0.192	2.89***
Stdev(2-year return)	0.003	0.000	***	0.003	0.000	***	0.003	0.000	***	-0.622	-7.89***	-0.625	-7.93***	-0.625	-7.93***
Adjusted R-square															
Observations	167,116			167,116			167,116			167,116		167,116		167,116	

Table 3. Factors that Influence Investors' Tendency to Invest in Employer Stocks

Table 4 Costs to Owning Company Stock

The fraction invested in employer stocks is obtained from Panel B of Table 2. Average monthly return in 1999 is the average of portfolio raw returns for all 167,116 employees. Average monthly standard deviation of portfolio return in 1999 is the average of the standard deviation of monthly portfolio return for each investor portfolio in 1999. Average monthly return for the market index and risk-free rate is obtained from the TEJ. Sharpe ratio is the average of the Sharpe ratio for each individual investor portfolio in 1999, calculated as the difference between portfolio raw return and market index return, divided by the standard deviation of portfolio returns. Sharpe ratio without under-diversification is the average of the Sharpe ratio for each individual investor's hypothetical portfolio that replaces holdings in employer stocks with the market portfolio. Cost of under-diversification in Sharpe ratio is the difference between Sharpe ratio and Sharpe ratio without under-diversification. C*standard deviation of returns is the cost of under-diversification in Sharpe ratio for each individual times the standard deviation of monthly portfolio return for each investor, resulting in the cost of under-diversification in monthly returns. Cost of under-diversification in annualized foregone return is calculated by first converting the 'C*standard deviation of returns' into annualized return for each individual and then averaging across all sample investors.

	Investors' portfolio	Market Portfolio
Fraction invested in Employer Stocks	47.4%	
Average Monthly Return in 1999	1.637	2.338
Avg Monthly Standard Deviation of portfolio	12.752	10.484
Risk Free Rate		0.288
Sharpe Ratio	0.068	
Sharpe Ratio without under-diversification	0.099	
Cost of under-diversification Sharpe Ratio (C)	-0.031	
C*Standard deviation of Returns	-0.631	
Cost of under-diversification in Annualized Foregone Returns (%)	-4.89%	

Table 4. Costs of Investing in Employer Stocks

Table 5 Foregone Returns in Retirement Investment from Bias toward Employer Stocks

Panel A calculates the foregone return resulting from Taiwanese investors' investing in employer stocks. Starting balance is the median portfolio value for all Taiwanese investors. The investment horizon is set to be 27 years given that the median age of employees is 38. The expected annual return is the average of annual returns between 1993 and 2003. The portfolio with bias toward employers is assumed to obtain 4.89 percent less than the portfolio that invests in the market index. Panel B calculates the foregone return resulting from the bias toward employer stocks for U.S. investors. The expected annual return is the average of annual returns between 1953 and 2003. The portfolio with bias toward employers is assumed to obtain 4.89 percent less than the portfolio that invests in the market index.

	Investing in Market Index	Bias toward Employer
	Panel A. Taiwanese Invesetors	
Starting balance	$NT 339,906	$NT 339,906
investment horizon	27 years	27 years
Annual market return (1993-2003)	10.48%	5.59%
Cumulative return over the investment horizon	1474.55%	434.33%
Terminal value if investing in market index	$NT 5,012,077.77	$NT 1,476,298.43
	Panel B. U.S. Investors	
Starting balance	$57,668	$57,668
investment horizon	20 years	20 years
Annual market return (1953-2003)	12.31%	7.42%
Cumulative return over the investment horizon	1019.46%	418.51%
Terminal value if investing in market index	$587,902.19	$241,346.35

Table 5. Foregone Returns in Retirement Investment from Bias toward Employer Stocks

Cumulative TAIEX Returns between January 1993 and December 2003