

Employee Behavior and Company Stock Ownership

A thesis presented

by

Yumio Saneyoshi

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Author: Yumio Saneyoshi

Thesis Advisors: Professor Richard B. Freeman, Professor Richard E. Caves, and Professor Peter Tufano

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This thesis explores various relationships between company stock ownership and employee behavior. The first chapter, Company Stock Ownership and Turnover, studies the correlation between voluntary employee turnover and company stock ownership. Evidence suggests that employees with higher levels of company stock ownership are less likely to voluntarily quit their jobs. How an employee came to own that stock also matters. A dollar of stock awarded by the company has different effects on the employee's quit probability than a dollar of stock purchased by her. Employee quit decisions are also influenced by the vesting schedule of her stocks holdings.

The second chapter, Pay Dispersion and Turnover, examines whether pay dispersion within a group lowers group performance and increases turnover. There is evidence that relative position in the pay scale matters, even after taking into account absolute levels of pay. Further, effects of pay dispersion and rank position on turnover depend on whether the pay is in the form of salary or company stock.

The third chapter looks at cross sectional differences in individual purchasing decisions of company stock. Gender and Racial Differences in Company Stock Purchase finds statistically significant gender and racial differences in investment preferences regarding company stock; but the differences are only apparent when taking into account interactions with marital status and education levels.

The fourth chapter, Behavioral Theories Applied to Company Stock Ownership looks at two behavioral theories of personal investment: representativeness bias and peer effects. Employees may be more prone to behavioral biases when considering company stock because of their emotional attachment to their employers.

In conclusion, company stock ownership does influence employee behavior. But company stock ownership is not a magic compensation formula that solves all of the employee incentive and retention problems of the employer.

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It was after reading Ronald Coase's classic 1937 paper titled The Nature of the Firm that I knew I wanted to study economics as a way of understanding the world. The intellectual exhilaration of seeing the world in an entirely new perspective motivated me to pursue the study of economics at the graduate level.

As my thesis chairperson, Richard Freeman supported my research both intellectually and financially. His free spirited approach to all things curious allowed me to pursue research based on newly discovered data. His intellectual rigor helped me organize the mountain of data into something that tells an interesting story.

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1. INTRODUCTION

1.1. Company Stock Ownership

Fueled by the surge in public market stock values during the late 1990s, stock and option compensation have become commonplace for high technology companies to old-line industrial companies. The popularity of Employee Stock Ownership Plans (ESOPs) and giving employees investment choices through defined contribution pension plans have also greatly expanded the number of employees owning employer stock in the United States. The National Center for Employee Ownership reports that as of 1998 there were over 10,000 ESOPs in the U.S., with over 9 million workers participating in over \$210 billion of company stock. Defined contribution plans and 401(k) plans had over \$250 billion invested in the worker's company stock (Rosen 1998).

While stock compensation is most often associated with a limited number of senior executives at a company, a trend of the 1990s was small technology companies offering company stock and options to all of their employees. In a recent survey of 1000 small technology companies by ShareData, Inc., 74% of companies with less than \$50 million in sales offered stock option plans to all employees. According to compensation consultants, a typical small technology company allocated 24% of total shares outstanding to employee stock option plans in 1997, up from 15% in 1994. For a typical engineer at these technology companies, the median value of options granted equaled 37% of her salary. For a typical CEO, the median value of options equaled 265% of her base salary.¹

¹ Inc., February, 1998, pp.85-96.

The same trends encouraging company stock ownership by employees were visible among large non-technology companies as well. A 1995 survey by the Association for Quality and Participation found that 13% of Fortune 1000 companies offered company stock options to 60% or more of their employees. Large companies also used pension plans to encourage employees to own company stock. For example, Coca Cola invested 92% of its \$1.7 billion 401(k) plan in their own stock. As of 1996 in the U.S., 41% of 401(k) plan participants' money was in company shares according to the Profit Sharing/401(k) Council of America.²

One factor that motivated the spread of stock compensation in the latter half of 1990s was the strong bull market in equities. The Nasdaq Composite returned over 300% during the 3 years between March 1997 and March 2000. The extraordinary capital gains allowed many companies to minimize the dilution caused by the extensive distribution of stock to employees. At the same time, the increased media attention paid to dot-com millionaires increased the average employee's expectations of receiving stock in addition to base salary.

1.2. Theoretical Questions

Why does it matter whether employees are paid with cash or with company stock? One solution to the classic moral hazard problem is making the risk neutral agent a residual claimant to the returns generated by her effort (Jensen and Meckling 1976). Are employees more likely to put forth optimal levels of effort for companies that they own stock in? Theoretically, this is not the case because there is a free rider problem

² Money, August, 1997, pp.98-103.

inherent in any type of compensation that ties individual pay to group performance in the absence of perfect monitoring (Alchian and Demsetz 1972; Holmstrom 1982).

Kandel and Lazear suggest that peer pressure could be exerted to overcome the free-rider problem in small groups (Kandel and Lazear 1992). Norms may be enforced without formal contracts if members of a group sharing profits based on group performance undertake mutual monitoring. A study of group bonus payments at Continental Airlines showed that peer pressure could be an effective monitoring technology for small groups (Knez and Simester 1998). The existence of highly profitable law, accounting, and management consulting partnerships also point to the possibility of overcoming the free-rider problem inherent in shared ownership of asset returns.

But the theory behind peer pressure and the partnership examples rely on either small number of group members or members with homogeneous backgrounds and interests. There is no theory that adequately explains the popularity of company stock ownership among employees of large companies where there are thousands of employees with very different backgrounds and interests.

1.3. Previous Empirical Work

Data limitations force empirical researchers of economic phenomena inside firms to form hypotheses based on a small sample of firms. Some studies rely exclusively on

data from one company (Ehrenberg 1990; Ichniowski, Shaw et al. 1997)³. Despite the limitation of company-based research, almost all researchers agree that there is still too little empirical work exploring the nature of economic relationships inside firms (Lazear 1995; Gibbons 1998; Prendergast 1999).

The difficulty of generalizing findings from one company to the entire population of firms is outweighed by the level of detail and contextual qualitative data that is available with company level research. In addition, the manual process of collecting and organizing data is often a valuable way to gain insight into underlying economic phenomena. For example, I noticed a gender difference in investment patterns during the process of manually organizing stock transaction data. With no economic theory predicting a gender difference in financial decisions, this is not something I would have been looking for, had I not taken the time to manually organize the data.

In the early 1990s, most papers on employee ownership focused on estimating the effects of employee ownership on employee productivity (Blinder 1990; Kruse 1993; Blasi, Conti et al. 1996). The results of this literature have been inconclusive, due to the difficulty in controlling for the hypothetical of the employee owned firm not being employee owned.

During the latter half of the 1990s, finance and labor economists investigated company stock ownership from a personal portfolio management perspective. In addition to the studies exploring what company executives do with the millions dollars worth of

³ Other examples of empirical work based on human resources data from one company include a study of turnover at an accounting firm (Lane and Parkin 1998) and a study of wage policy and hierarchy of positions (Baker, Gibbs et al. 1994).

stock options that they receive (Hall and Liebman 1998; Ofek and Yermack 2000), there is now research on what rank and file employees do with their stock options and stock grants (Huddart and Lang 1996; Heath, Huddart et al. 1999).

Many of these studies incorporate behavioral theories to explain phenomena that cannot be reconciled with neoclassical economic theory. Despite finance theory's prediction that the chief concern of employees regarding company stock would be diversification and the high correlation between human and financial capital, the evidence suggests that several behavioral theories are better at explaining actual financial decisions by employees.

For example, Benartzi found that employees often exhibit "representativeness bias" when investing in company stock, buying excessively when stock prices are rising, regardless of the fundamental values and diversification costs (Benartzi 1999). Degeorge et al. found that employees at a French telecom company were not very concerned with the correlation of financial capital with their human capital. Employees with more firm-specific human capital were as likely to buy company stock as employees with low firm tenure (Degeorge, Jenter et al. 2000).

With regard to 401(k) plans, several authors found that instead of continuously optimizing allocation of assets as new information becomes available, a lot of employees follow simplistic allocation strategies to allocate their assets. Kusko and Wilcox found that employees maintain the same participation status and contribution rate year after year, despite substantial changes in the employer's match rate (Kusko and Wilcox 1994). A panel study of the Survey of Consumer Finances and TIAA-CREF data found that once workers make the decision to own stocks, there is very little effort to actively manage

their allocation decisions (Ameriks and Zeldes 2000). Another empirical case study of 401(k) plans found that employees seldom alter the default retirement plan that is chosen by the employer, even if it is not optimal for the employee (Madrian 2000). Another study found that an investor who buys one dollar of a particular mutual fund in period t invests an average of 75 cents in the same mutual fund in period $t+1$ (Patel, Zeckhauser et al. 1991) regardless of performance. Status quo bias, well known in experimental psychology (Kahneman 1992), is much better at explaining this phenomenon than a neoclassical explanation incorporating complicated risk management strategies.

1.4. The Company

The data for this thesis comes from a private business services firm based in the U.S. with the total number of employees ranging from 4,000 to 40,000 during the study period of 1983 to 2000. The workforce is very well-educated relative to the general population, as 70% have at least a college degree, and approximately 30% of the sample have a graduate degree. Approximately 35% of the employees in the sample are women, 65% of the sample are married, and the average employee is 40 years old.

The shares of this firm are not publicly traded. As a private corporation, company stock ownership is restricted to current employees, trustees, directors and officers of the corporation, as well as a few former employees. Current employees own close to 90% of all stock outstanding directly or through the company's 401(k), ESOP, and retirement plan⁴.

⁴ Prior to 1981, employees could keep the shares even after termination of employment.

1.5. Stock Price

The stock price of this company's shares is determined quarterly by the board of directors and certified by an independent appraisal firm. The board follows a set formula that is a multiple of the book value of equity and earnings per share from the previous period. The company operates an extensive internal stock market, which matches up buyers and sellers every quarter at this pre-specified price. Because the price is not a function of supply and demand, it is possible that not all sell or buy orders will clear in this internal stock market. However, the company has been able to accommodate almost every order for the last 13 years.

The stock price, which is a multiple of the book value of equity and earnings per share, is computed with the following formula:

$$P_T = \frac{E_{T-1}}{S_{T-1}} + \frac{M_T * \sum_{t=T-4}^{T-1} e_t}{\sum_{t=T-4}^{T-1} S_t}$$

$e =$ earnings per quarter
 $E =$ shareholder's equity (book value)
 $M =$ expectations factor⁵

$S =$ total shares outstanding = $\sum_{i=0}^N s_i$
 $s_i =$ number of shares held by investor i

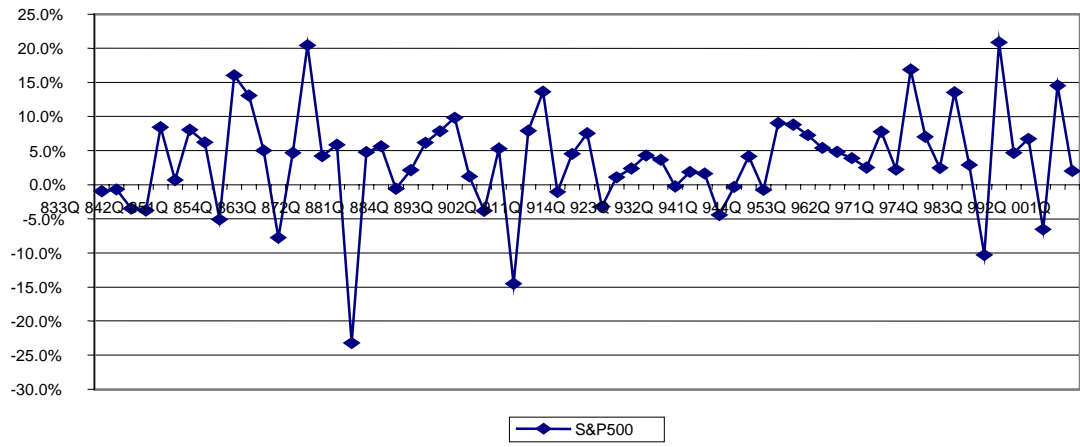
⁵ The expectations factor is a constant that is used to make the price reflect fair market value of the stock. The expectations factor is reviewed quarterly by the Board, in conjunction with a valuation appraisal prepared by an independent appraiser. The Board writes in the annual report that they determine the expectations factor after they consider performance of the general securities market, relevant industry groups, historical comparison of company's performance against competitors, prospect of future performance, stock price of the company's publicly traded investments, general economic conditions, and opinion of the independent appraisers.

1.6. Stock Performance

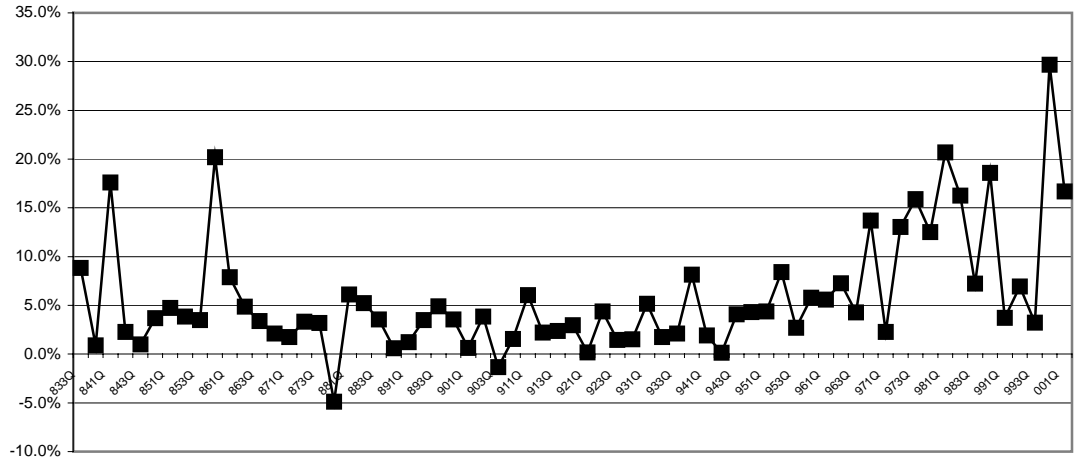
The stock has performed very well, especially in the three years between March 1997 to March 2000. During 1997-2000, the annual rate of return exceeded 180% per year, even higher than the 88% return for the Nasdaq Composite, and the 29% annual return of the S&P500. During the latter 1990s, the company spun off subsidiaries as publicly traded entities and earnings jumped up due to one-time capital gains from these public offerings. The stock also has a lower volatility than the S&P500, mostly because the stock pricing formula is a moving average of current and previous period earnings, and tends to smooth out single quarter aberrations. As the graph below indicates, the returns to this company stock have been negative only twice and have been less volatile than the S&P500. Standard deviations of quarterly returns for the entire period were 12% for the Nasdaq, 7% for the S&P500, and 6% for this company's stock.

<i>1983-2000 Annual Returns</i>	<i>1983-1985</i>	<i>1986-1988</i>	<i>1989-1991</i>	<i>1992-1994</i>	<i>1995-1997</i>	<i>1998-2000</i>
<i>Company</i>	28%	25%	13%	14%	31%	182%
<i>Nasdaq</i>	27%	11%	10%	16%	21%	92%
<i>S&P500</i>	4%	15%	15%	6%	23%	29%

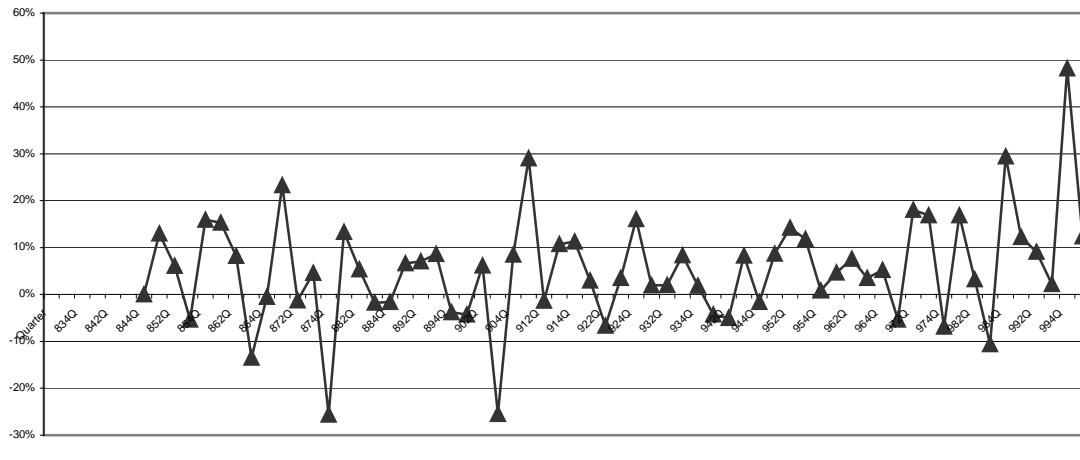
Asset Returns Comparison



S&P500



Company Stock



Nasdaq

1.7. Mechanics of the Internal Stock Market

The internal stock market is open four times a year. On the date of the quarterly trade, both purchase and sell orders are processed at the pre-announced price. Employees fill out either a purchase or sale order and send it to the market-clearing broker, which is a wholly owned subsidiary of the company. In addition, shares bought back from employees who have left the company (employees are obligated to sell back vested shares when they terminate employment with the company) are added into the supply of shares.

If supply exceeds demand, the company is authorized, but not obligated to satisfy demand by providing cash from its cash balance. The company has provided as much as 20% of the total purchase volume in times of slack demand. If there is a shortage of cash, the first 2000 shares (approx. \$60,000) of every seller will be matched with demand. Sales exceeding 2000 shares would be accepted on a pro-rata basis determined by dividing the total number of shares remaining under purchase orders by the total number of shares of sell orders. If the selling demand for the first 2000 shares cannot be met, purchase orders would be allocated equally among all proposed sellers. If demand for the stock exceeds supply, the company is again authorized but not obligated to sell new shares to meet demand. If the company chooses not to issue additional shares, individuals may not be able to purchase as many shares as they want.⁶

⁶ One concern economists may point out is that given that the price is rigid, and demand and supply are flexible, wouldn't current owners of the stock be motivated to discourage dilution by forbidding new owners? This has been a problem with many wholly employee-owned companies such as the lumber companies in the Pacific Northwest (Craig and Pencavel 1992). The company has avoided this problem mainly by growing earnings faster than the rate they grow their employee base.

Direct Purchase Timing During Trading Month:

1. Trade Price Announced for trade during quarter = t

M_t (market expectations factor) revealed

Investors decide # shares to purchase or sell

2. Trade Date -- supply and demand matched for t

S_t (# of shares outstanding after the trade) revealed

3. Fiscal End of Quarter t

e_t and E_t (earnings and equity for period t) revealed

As shown above, the stock price can be summarized as $M_t * (E_{t-1}) * (e_{t-1}) / S_{t-1}$ or as a multiple of last period book value equity and earnings per share. Assuming that the employee is interested in 3-month horizon returns, an employee in time period t is interested in the relevant variables for stock price in time t+1, which are E_t , e_t , S_t and M_{t+1} . The timing of the trade suggests that any news that an employee might have gathered about the future expected prospects of the company would be reflected in their prediction of E_t , e_t .

1.8. Employee Stock Holding

Employees hold this stock in two accounts: the trade account and the retirement account. Almost all employees hold some company stock through their retirement account, which the firm funds with company stock. About 40-50% of employees hold company stock in the trade account, acquired either through stock awards from the firm or through purchasing stock through the internal stock market.

The main difference between the accounts is the ease of disposition. A fully vested stock in the trade account can be sold at the prevailing price during any quarterly

trade date with a 2% brokerage fee, while company stock in the retirement account has more stringent disposition restrictions. Employees also have to sell all fully vested shares and exercise all fully vested options in their trade account back to the company at the prevailing price when they quit the company. In contrast, during the study period, employees were allowed to keep the company stock in the retirement plan, even after employment termination.

There are four ways for employees to accumulate this company's stock in their trade account: direct purchase, ESOP purchase, stock option conversion, and stock bonus awards. A direct purchase consists of placing a purchase order with the internal stock market. An ESOP purchase is conducted by requesting to withhold 3-10% of the employee's after-tax compensation to purchase company stock during the quarterly trade. There is a 10% price discount to ESOP purchases. Stock options are awarded to employees by management for incentive and retention purposes, but employees initiate conversion into stock by paying cash. Employees cannot purchase these stock options on their own. Managers award stock bonus, usually annually, to employees. The mean stock award was approximately \$3000 in 1999. Approximately 40% of employees in the sample have received some sort of stock or stock option award. All stock options and some straight stock bonus have a vesting schedule that vests 20% per year in the first, second and third years and the remaining 40% in the fourth year.

1.9. Thesis

This thesis does not try to explain why the company offers extensive company stock ownership to its employees. It assumes the presence of company stock ownership at this firm as a given. It investigate employee behavior in response to the company stock

ownership opportunities presented by the company. The first two chapters examine employee turnover probability in relation to company stock compensation and stock purchase opportunities presented by the firm. The last two chapters look at cross sectional differences in employee investment regarding company stock.

2.

EMPLOYEE STOCK OWNERSHIP AND TURNOVER

2.1. Introduction

One of the reasons firms purportedly use company stock and stock options in the compensation plan is to reduce the rate of employee turnover. While some turnover, especially of low productivity employees, can be desirable for employers, high voluntary turnover rates waste fixed recruiting and training costs. There are also high opportunity costs for the firm if the position cannot be filled for a long time with the appropriate candidate. In early 2000, the average length of time to fill exempt vacancies was two to three months in the U.S., at a cost of about \$10,000 per vacancy.⁷ The costs for high technology workers were estimated to be double or triple this amount.⁸

The link between compensation policy and turnover has been extensively studied. One of the first theoretical and empirical links to be studied between turnover and compensation was the examination of the incentive structure of vesting pensions on optimal retirement decisions (Kotlikoff and Wise 1988; Lazear and Moore 1988). Upwardly curved wage-tenure scales were hypothesized to be devices for turnover reduction; especially as Japanese labor management practices were closely examined in the late 1980s (Levine 1993). In a separate study of earnings history of the Panel Study of Income Dynamics, Blakemore, Low and Ormiston found that bonuses affected turnover (Blakemore, Low et al. 1987).

Researchers have also begun to study the popularity of stock compensation in high technology industries. As mentioned in the previous chapter, mainstream economic

⁷Cost Per Hire and Staffing Metrics Survey, Employment Management Association, 2000, "Summary of Findings."

⁸ American Electronics Association Survey, 2000.

theory discounts the incentive effect of stock compensation for rank and file employees because of the moral hazard problem inherent in making individual pay contingent on group output. Employees are not likely to find it optimal to put in extra unobservable effort when they are only guaranteed to be rewarded a fraction of the fruits of the effort but shouldering the full cost of the effort (Holmstrom 1982).

Why do firms use stock compensation for rank and file employees despite this incentive problem? Oyer theorizes that firms use stock compensation, not for direct incentive effects, but to adjust total compensation to reflect offers workers may receive from other firms. Assuming institutional rules make base salaries rigid, stock compensation are hypothesized to be better able to fluctuate in value with the ups and downs of the general state of the economy. This would explain why stock compensation is so prevalent in the high tech industry, where offers from other firms can fluctuate wildly with the state of the stock market (Oyer 2000).

Does stock compensation influence employee turnover decisions? A direct way stock compensation can influence turnover timing is through vesting schedules. By contractually prohibiting the sale of company stock until a certain time period, and requiring employees to forfeit unvested stock when they quit the firm, vesting schedules create incentives that influence the timing of quit decisions. For example, an employee is not likely to quit if her \$10,000 company stock bonus is just about to vest in one month. But that same employee may not wait a whole year for the same \$10,000 stock to vest, because of the value of outside opportunities that may be available.

Even without explicit vesting restrictions, company stock ownership may influence employee turnover intentions. If a certain company stock enjoys high returns

with low volatility and the ownership of company stock is restricted to employees, or if employees enjoy a price discount when purchasing company stock, being an employee of a firm may raise the return that employees can earn on their personal assets relative to the market rate of return. In this case, employees who are optimistic about future expected returns to company stock would be less likely to quit. These same employees will tend to own more company stock, and are also more likely to purchase company stock with their own money. There would be a correlation between incidence and levels company stock ownership and lower turnover.

There is another reason that company stock ownership and lower turnover may be related. A basic matching model would argue that employees who receive a lot of stock awards from the company are also those with a good productivity “match” with the firm, which increases their likelihood of staying (Jovanovic 1979). In this case, company stock ownership is an effect of an underlying good productivity match that results in lower turnover, not the cause of lower turnover.

To examine the relationship between company stock ownership and employee turnover, I use the seventeen-year panel of stock and options ownership data matched with compensation and personnel data for over 30,000 employees at the firm under study. The nature of the data and the company is explained in the introduction of this thesis. The firm that provided the data is in an industry where the chief input is highly educated and skilled human capital. Given the high fixed costs of recruiting and the high demand for skilled human capital in this labor market, employee turnover is one of the chief concerns of the firm’s senior management during the study period. One of the reasons

the firm institutionalized company stock ownership among the rank and file was its belief that stock ownership would ameliorate high turnover.⁹

This chapter will first discuss various covariates that influence quit decisions besides company stock ownership. Then I will use duration regression to estimate the effect of company stock ownership on employee turnover. And finally, I will estimate the effect of vesting restrictions on quit decisions by employees.

2.2. The Sample

The sample consists of 32,391 full-time white-collar professionals¹⁰ who worked for this firm for at least one day during the seventeen-year sample period between 1983 and 2000 without taking a leave of absence.¹¹ The unit of observation in the panel data is employee-quarter pairs. There is an observation for every fiscal quarter that an employee was employed with the firm. With 32,391 employees and 66 quarters (17 years), there were 472,539 total employee-quarter pairs. A binary dependent variable for the quit decision was recorded in the quarter when the employee voluntarily chose to leave the firm. Quits do not include layoffs, retirement, or death. They are treated as censored data, much like the employees who continued to work at the firm after the observation period.

⁹ From discussion with firm personnel.

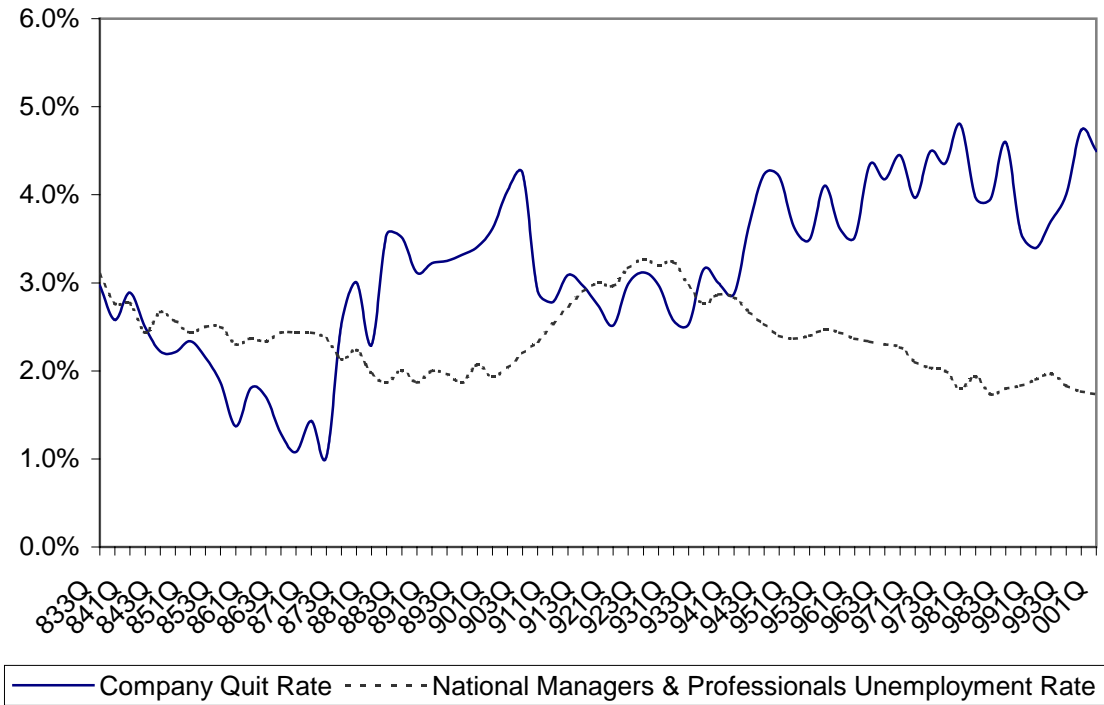
¹⁰ Examples of white-collar professionals include managers, engineers, scientists, and accountants. They constitute 67% of the full sample of workers available in the dataset. They exclude secretaries, lab technicians, plumbers, and other blue-collar and clerical job categories. The sample was limited to white-collar professionals because the analysis focuses on company stock ownership, and the white-collar workers are much more likely to be awarded stock as compensation and have significant enough company stock ownership to influence turnover decisions. Average turnover is significantly lower for white-collar workers. The effect of age and having a Bachelor of Arts as a terminal education degree were not statistically significant in the overall data, but is significant in the managers and white-collar professionals only sample.

¹¹ Excludes employees hired in the most recent 12 months because most of them have not yet had the chance to receive stock compensation.

During the seventeen-year period, there were 15,206 voluntary quits and approximately 4,000 involuntary exits including layoffs, retirement and death. The graph below maps the per quarter voluntary quit rates among the employees.

Figure 2-1

Company Quit Rates Vs. Industry Unemployment Rates

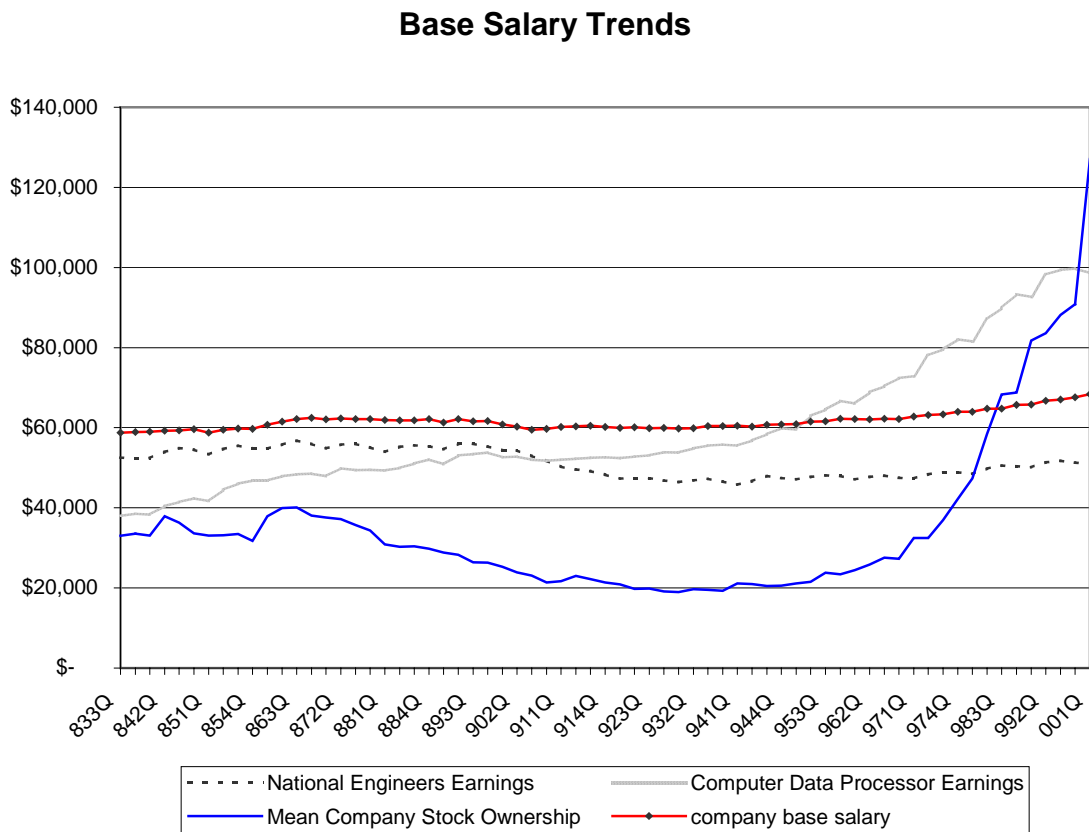


The company quarterly quit rates ranged from 1.0% to 4.7% with an average of 3.2%. Compared with the national unemployment rates of managers and professionals¹², the company quit rates had a roughly inverse relationship with the national unemployment rates for comparable workers. The company quit rates of white-collar professionals were lower between 1991 to 1993, coinciding with the higher unemployment rates in the general labor market due to the recession during this time

¹² Bureau of Labor Statistics, Current Population Survey. Numbers are seasonally adjusted.

period. In contrast, company quit rates were higher in the last five years reaching as high as 4.7% per quarter, reflecting the tight national labor market for managers and professionals. The Pearson correlation coefficient between the national unemployment rate for white-collar workers and the corresponding company quit rate was -.41.

Figure 2-2



The graph above shows the inflation-adjusted, mean company stock ownership¹³ and annual base salaries for white-collar professionals at the firm compared with the national mean earnings of engineers and computer data processors from the Current Population Survey. These two groups are comparison groups for employees at this firm

¹³ Does not include company stock held in the retirement portfolio.

because this firm employs a lot of engineers and computer professionals. It is also easy to notice that while the average wage for engineers have stayed relatively stable; employees with computer skills saw their wages more than double between the fourth quarter of 1994 and the first quarter of 2000.

Per Oyer's theory, the above graph shows how this firm could have maintained a high total compensation for certain highly demanded workers without changing the base salary structure. The company's base salary has remained relatively stable after inflation for seventeen years. In contrast, the value of company stock owned by employees has increased dramatically in the last five years, coinciding with the tremendous growth in the market valuation of high technology companies during the same time period.¹⁴ Stock compensation has allowed total compensation of employees at this firm to be correlated with the potential outside offers that these employees may receive from other high technology companies.

2.3. Empirics

There are several non-compensation related employee characteristics that can affect quit decisions. For example, married workers would have a lower propensity to quit because having children or a spouse increases the costs of quitting and relocating. Below is a plot of the probability of a married employee quitting, against the probability of a single employee quitting, given that the employee has not quit up to that point.

¹⁴ By taking the beginning and ending base salary, I estimate the base salary received by an employee at every quarter. I also reconstruct the actual constant dollar value of company stock and the Black-Scholes value of company stock options for each employee at each quarter.

Figure 2-3



The graph above shows that single employees are more likely to quit than married employees at each level of firm tenure. Implicit in the concave shape of the two curves is that while the probability of quitting increases as you stay longer with the firm, the marginal effect of each additional year of firm tenure on quit probabilities diminish.

People of different gender and race have also been known to exhibit different turnover rates. For example, Weiss found that quit rates differ by gender and race for semi-skilled production workers (Weiss 1984). Spurr and Sueyoshi found that female attorneys are slightly more likely to quit law firms than males (Spurr and Sueyoshi 1994). The sample of white-collar professionals at this firm exhibit the same pattern. Females and non-Whites exhibit higher quit probabilities than their male and white counterparts.

Figure 2-4

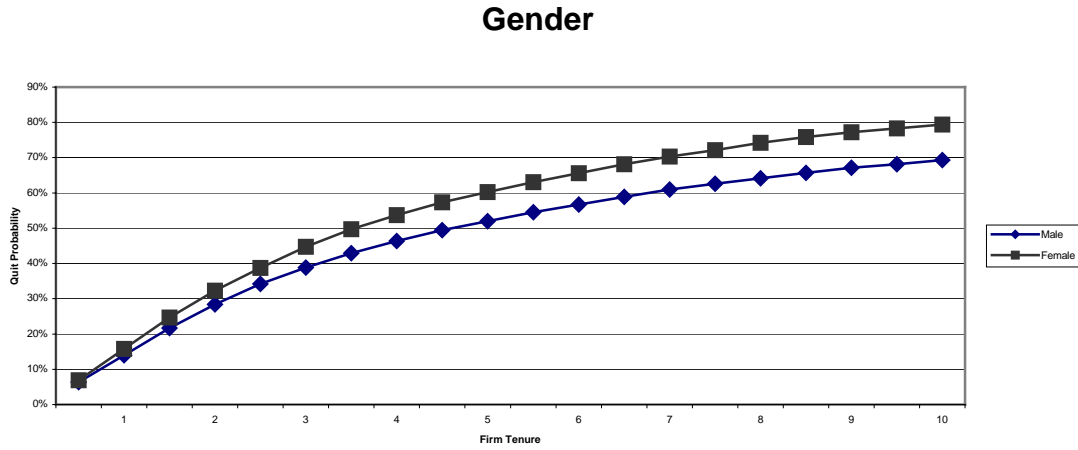
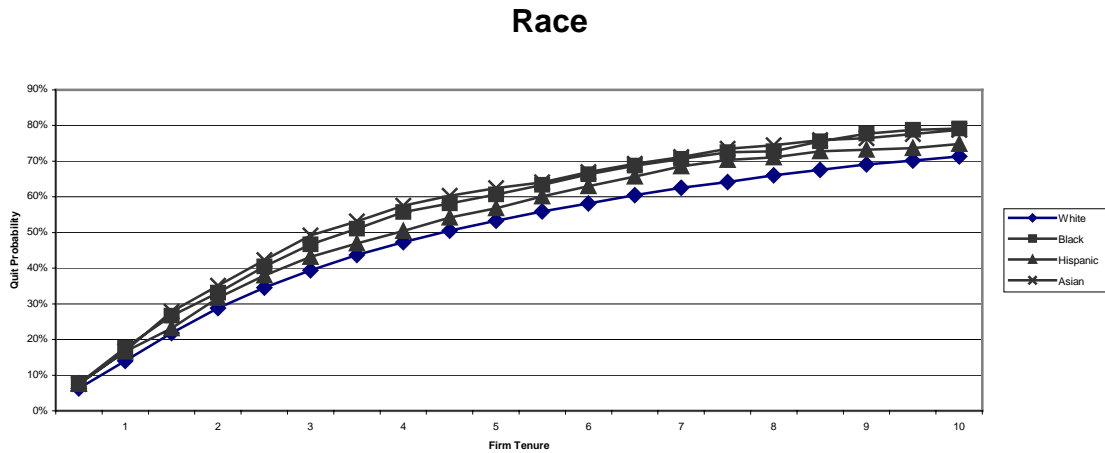


Figure 2-5

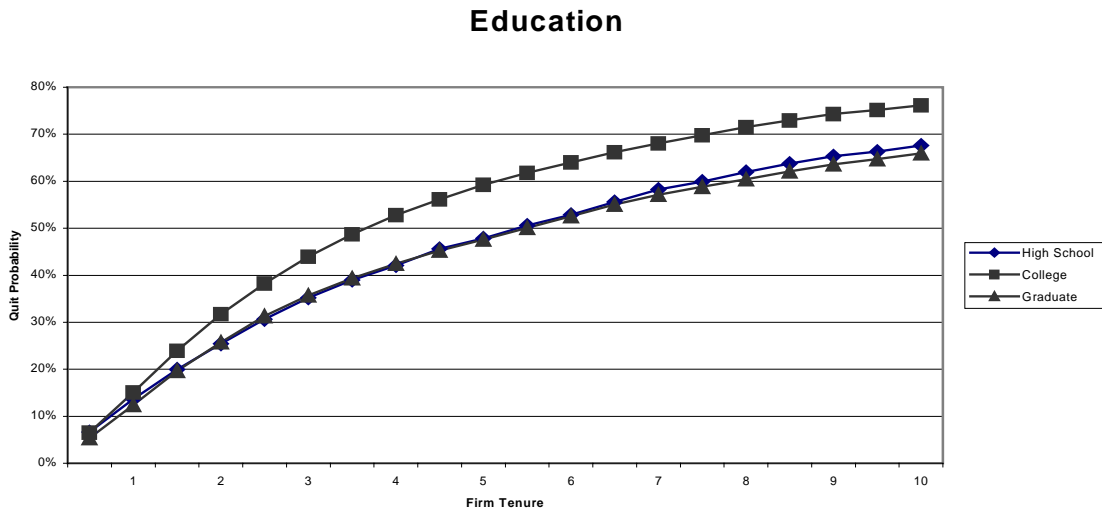


Most white-collar professionals at this firm are likely to have completed college education; 75% have at least some college education, and 28% have a Masters degree or a Ph.D.¹⁵ The graph below shows that employees with college degrees have higher quit probabilities than employees with no college education. This is most likely due to the

¹⁵ 11% of the sample does not report any educational information. I simply assumed that the missing sample exhibited the same distribution of education as the non-missing sample. In the regressions, there is a dummy for missing educational information instead of using this assumption.

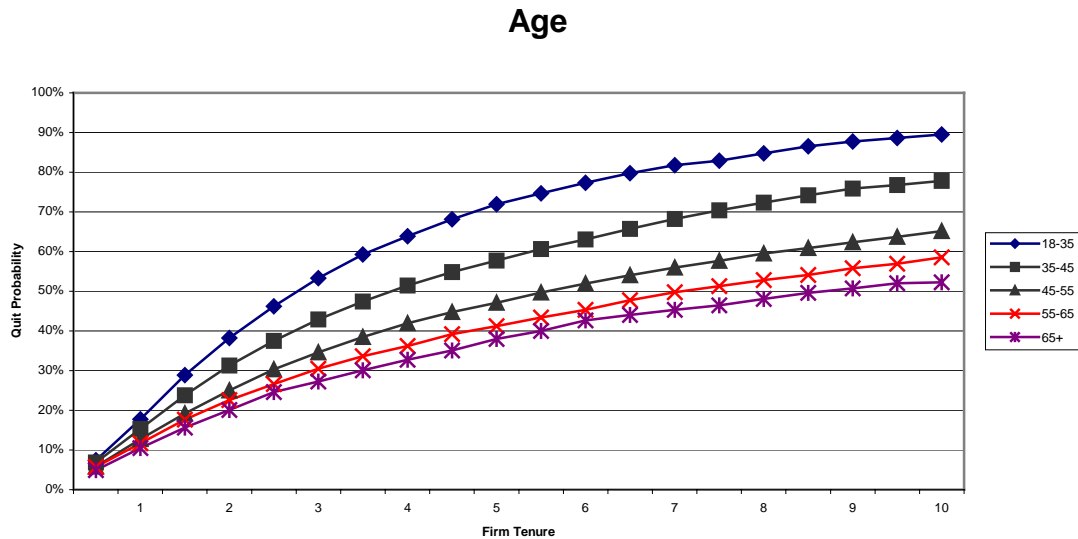
differences in outside labor market opportunities for those with higher education. Note that Weiss, in his analysis of semi-skilled production workers in 1984, found that higher educated workers were less likely to turnover (Weiss 1984). This suggests that the effect of education on turnover of individual workers is highly dependent on the industry and circumstance of the labor market. At first glance of the univariate analysis, it seems graduate degree holders have a lower quit probability than college educated workers. But this conclusion changes when stock ownership levels are controlled in the regression below.

Figure 2-6



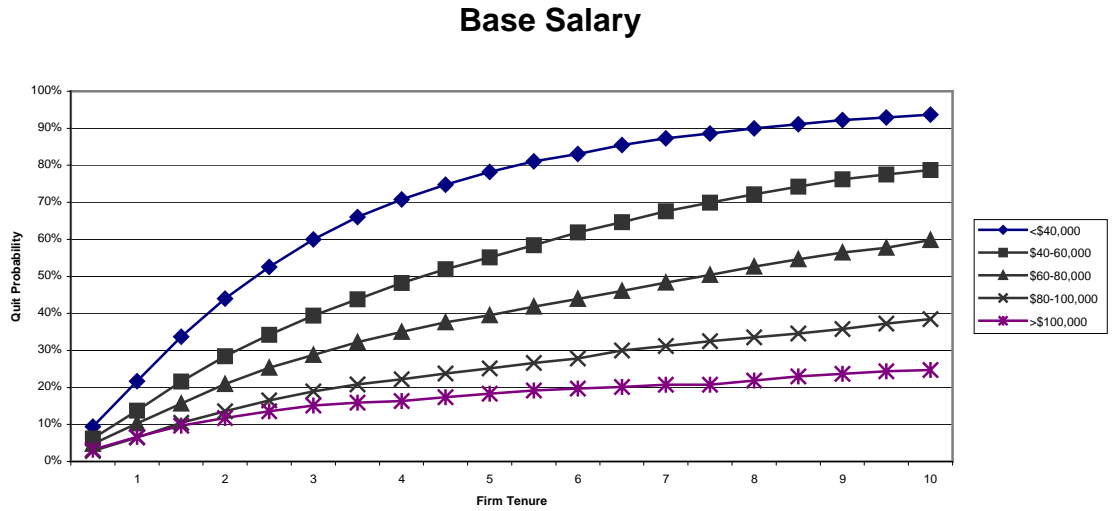
The matching theory of labor turnover gives the simplest explanation for why employees of different ages would exhibit different quit patterns. According to the matching hypothesis, younger workers are more likely to quit because they are trying out different jobs until they find the job that they are best suited for. Consistent with this theory, older employees in this sample are less likely to quit than younger employees.

Figure 2-7



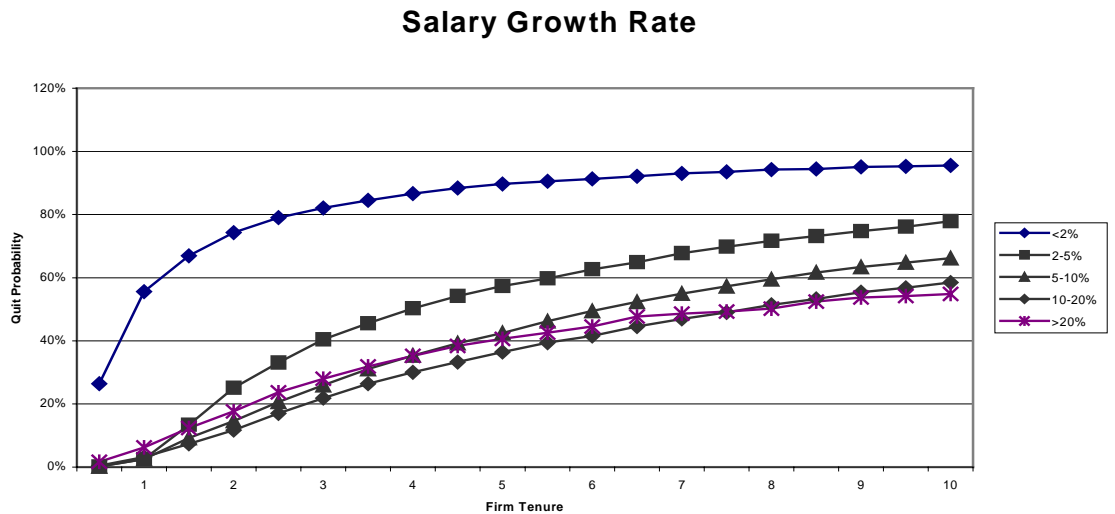
The distribution of base salaries among the sample employees are as follows: 4% under \$40,000, 33% between \$40,000 and \$60,000, 20% between \$60,000 and \$80,000, 8% between \$80,000 and \$100,000, and 4% over \$100,000. Base salary level is hypothesized to be an important factor in quit decisions because whether base salary levels meet and exceed reservation wages determine quit decisions in many turnover models. Most models predicts that turnover probability decline with higher salary levels. The graph below supports this hypothesis as employees with higher base salaries have uniformly lower turnover probabilities.

Figure 2-8



In a cross section of jobs, Topel and Ward found that workers in high wage growth jobs were less likely to quit than workers in low wage growth jobs (Topel and Ward 1992). Munasinghe argues that it high wage growth rate jobs are inherently more valuable than low wage growth rate jobs, and therefore high wage growth jobs see lower turnover probabilities (Munasinghe 2000).

Figure 2-9



As can be seen in the above graph, the data from this company supports Topel and Ward's proposition that workers are less likely to quit jobs with higher wage growth. In the first few years of firm tenure, the difference in quit probability curves are insignificant among the group of employees whose salaries rose more than 2% per year. But in later years, employees with higher salary growth exhibit lower quit probability.

Figure 2-10

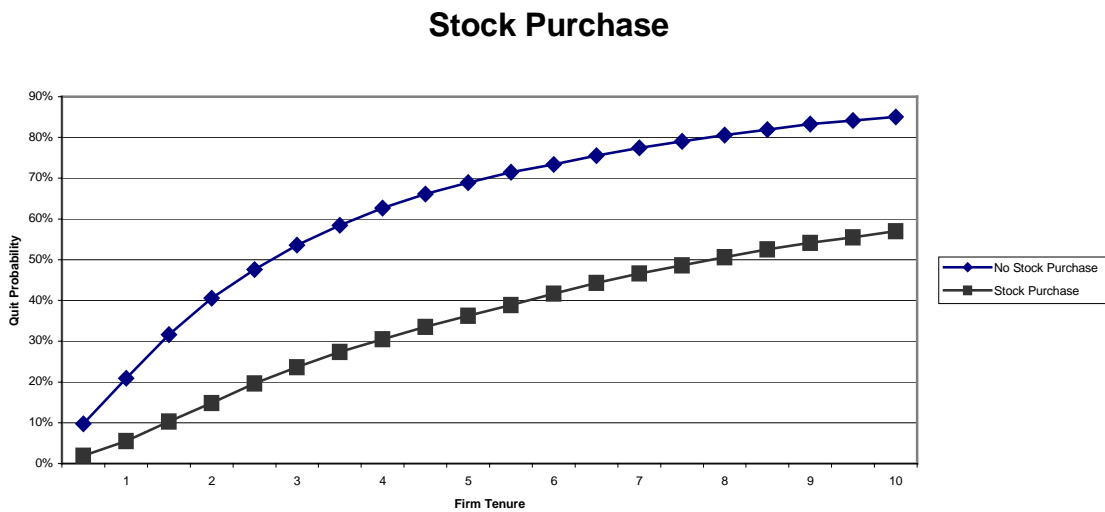


Figure 2-11

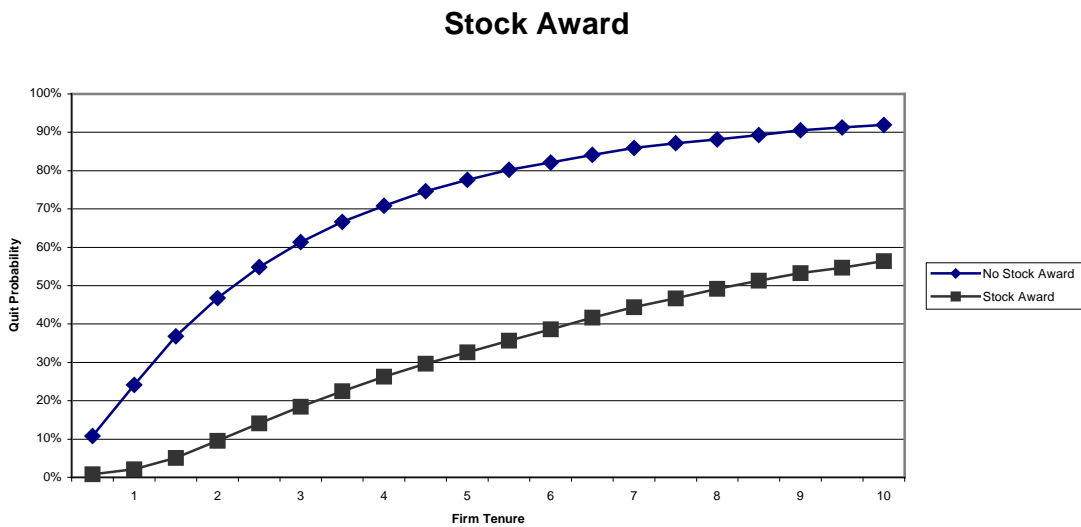


Figure 2-10 above compares the quit probability curves of the 41% of employees in the sample who have purchased company stock and the 59% of employees who have never purchased stock. Figure 2-11 compares the quit probability curves of the 43% of employee who have been awarded stock against the 57% of employees who have never received stock.¹⁶ It is clear from both of these graphs that stock ownership and low turnover are correlated.

Note that the shape of the quit probability curve for the first three years of firm tenure is different between company stock owners (awardees and purchasers) and non-owners. The quit probability curve is concave for employees who do not own company stock, while the curves are slightly convex for owners of company stock. This supports the hypothesis that employees with a good productivity match are identified in the first few years and given stock awards or employees realize they have a good match, and purchase the company's stock. Thus, employees with a good match are much less likely to quit, and they are more likely to become owners of company stock.

2.4. Weibull Duration Models

To estimate the effect of stock ownership and other covariates on the quit decision independently of each other, I estimate a multivariate duration model. I use the Weibull proportional-hazard duration model because proportional hazard models allow the coefficients to be interpreted as hazard ratios, and the Weibull specification allows the quit probability to depend monotonically on firm tenure.

¹⁶ Approximately half of awardees were also purchasers.

Let $h(t | \mathbf{x})$ be the hazard rate, or the probability that an employee quits in period t given that the employee did not quit before t . \mathbf{x} is the vector of covariates that influence the hazard rate. For example, the hazard ratio of quit probabilities for females as compared to males would be:

$$\frac{h(t | female = 1)}{h(t | female = 0)} = \frac{h_0(t) \exp(\beta_{female})}{h_0(t)} = \exp(\beta_{female})$$

The null hypothesis of no effect of a covariate is a hazard ratio of one. Hazard ratios greater than one signify that the covariate increases the quit probability; and hazard ratios less than one signifies that the covariate decreases the quit probability. The full hazard rate model for employee i at time t to be estimated is:

$$h(t | \mathbf{X}_i, \mathbf{Z}_{i,t}, \mathbf{N}_{i,t}) = h_0(t) * \exp(\alpha + \beta_i \mathbf{X}_i + \gamma_{i,t} \mathbf{Z}_{i,t} + \delta_{i,t} \mathbf{N}_{i,t})$$

where \mathbf{X} represents employee characteristics like gender and race that don't change with time, \mathbf{Z} represents employee characteristics like age and salary that change with time, and \mathbf{N} represents the stock ownership variables that change with time.

Proportional hazard models differ from each other by the assumptions regarding the shape of the baseline hazard rate $h_0(t)$ that all employees share. The Weibull assumes that the baseline hazard, $h_0(t)$, is monotonically related to firm tenure, which seems to be a good assumption given the shape of the quit probability curves observed above.

$$\text{Weibull (a,k) : } h_0(t) = kt^{k-1} \exp(a)$$

The ancillary parameter k is estimated along with the coefficients of the covariates. If $k > 1$, the baseline hazard is increasing in firm tenure; if $k < 1$ the baseline hazard is decreasing in firm tenure.

Table 2-1

<i>Weibull Distribution</i>		(1)	(2)	(3)	(4)
		<i>Hazard Ratio</i>		<i>Quit Probability</i>	
1	<i>Stock Award (recipient)</i>		0.290 (-62.21)		-71.0%
2	<i>Stock Purchase (purchaser)</i>		0.574 (-29.31)		-42.6%
3	<i>\$1000 of Fully Vested Stock</i>		0.972 (-23.88)		-2.8%
4	<i>\$1000 of Fully Vested Options</i>		0.987 (-5.45)		-2.3%
5	<i>Education: B.A.</i>	1.337 (10.79)	1.548 (16.47)	33.7%	54.8%
6	<i>Education: M.A. or Ph.D.</i>	1.190 (5.76)	1.607 (16.16)	19.0%	60.7%
7	<i>Female</i>	1.113 (5.78)	1.039 (2.09)	11.3%	3.9%
8	<i>Black</i>	1.183 (4.46)	0.962 (-1.02)	18.3%	-3.8%
9	<i>Hispanic</i>	1.034 (0.70)	0.926 (-1.62)	3.4%	-7.4%
10	<i>Asian</i>	1.169 (4.98)	1.105 (3.19)	16.9%	10.5%
11	<i>Base Salary (\$'000)</i>	0.995 (-10.65)	1.001 (6.55)	-0.5%	0.1%
12	<i>Age (1 year)</i>	0.979 (-20.53)	0.980 (-20.95)	-2.1%	-2.0%
13	<i>Married</i>	0.863 (-8.34)	0.925 (-4.41)	-13.7%	-7.5%
14	<i>Unemployment Rate (1%)</i>	0.607 (-25.30)	0.704 (-18.42)	-39.3%	-29.6%
15	<i>k (Firm Tenure)</i>	1.008	1.187		
16	<i>Likelihood Ratio (chi-sq)</i>	2343	9109		

Asymptotic t-stats below hazard ratios.

The results of table 2-1 confirm the basic intuition gained from the quit probability plots of the previous section. They also reveal the importance of controlling for company stock ownership. Rows 1 and 2 of the table shows a very significant and large effect that receiving and purchasing company stocks have on employee quit probabilities. A recipient of a stock bonus is 71% less likely to quit than an employee

who has never received a stock bonus. An employee who has purchased company stock with her own money is 23% less likely to quit than someone who has never purchased company stock. The fact that the coefficient on stock awards is large supports the notion that the firm can affect employee turnover by awarding stock to employees they would like to keep.

Rows 3 and 4 of the table shows that not only is being an owner of company stock significant in affecting quit probabilities, but the amount of stock ownership is also relevant. Owning \$1000 worth of fully vested stock lowers quit hazard ratio by 3%; owning \$1000 worth of fully vested options lowers quit hazard ratio by 2%.

Including stock ownership in a multivariate analysis also shows the effect stock ownership propensities can have on univariate statistics like the probability plots seen above. Comparing columns 3 and 4 for row 5 and 6 shows that controlling for stock ownership raises the effects of education on quit probabilities. One way to interpret this is to say that highly educated employees who have a much larger chance of being recruited elsewhere are staying with this firm because they own company stock. The firm may be awarding stock only to difficult-to-replace employees, and the reward policy may be having its intended effect.

Rows 7 through 10 show that the coefficients signifying the differences in quit probabilities by gender and race are also affected by inclusion of stock ownership variables. In the first column, coefficients in column 3 show that women, non-Whites are more likely to quit than their male, White counterparts. But coefficients for gender variables are different for columns 3 and 4. The inclusion of stock ownership variables dramatically decreases the effect of gender and race on turnover probabilities. For

example, Blacks are 18% more likely to quit in the first equation, but they are 4% less likely to quit in the second equation, where stock ownership variables are in the regression. The same pattern is true for Hispanics. This suggests that the high turnover rates of groups like females and minority employees at this firm can be mitigated partially through awarding company stock.

Rows 11 and 12 confirm the pattern found in the graphs above concerning age and marital status. Younger employees are more likely to quit than older employees. A 30-year-old worker is 20% more likely to quit than a 40-year-old worker. Unlike race or gender, the effect of age on quitting probability is not affected by stock ownership. For the reasons mentioned above, married employees are 8% less likely to quit than single employees.

Another very interesting result of the regression is that after controlling for stock ownership, employee A who earns \$1000 more than employee B is more likely to turnover than employee B. This is in stark contrast to the negative effect a \$1000 increase in company stock ownership has on turnover probability. This further suggests that stock awards are effective in reducing employee turnover, much more so than increasing base salary.

And finally, the quarterly national unemployment rates of managers and professionals have a large effect on the quitting rates of employees at this company. A percentage increase in the national unemployment rate decreases quit probability by 30% when controlled for stock ownership. This is no surprise, since higher unemployment in the labor market decreases the chances that an employee will receive an outside offer that is better than her current job.

2.5. Model of Vesting Restrictions

Vesting schedules are designed to minimize turnover, as employees would be leaving money on the table if they quit before the end of the vesting period. Previous empirical work have found that vesting schedules influence employee turnover decisions. Lazear and Moore found that workers time their retirement decision to optimize against the vesting schedules of their pension plans (Lazear and Moore 1988). Pesando, Hyatt and Gunderson also found that vesting schedules influenced the retirement decisions of Canadian workers (Pesando, Hyatt et al. 1992).

Following the option value approach used by Lazear and Moore, an employee will stay with the firm until the end of quarter T if the expected value of vested stock at the end of quarter T (N^T) is larger than the expected value of vested company stock at the end of quarter T-1 (N^{T-1}) multiplied by a return that can be earned outside the firm (r_m).

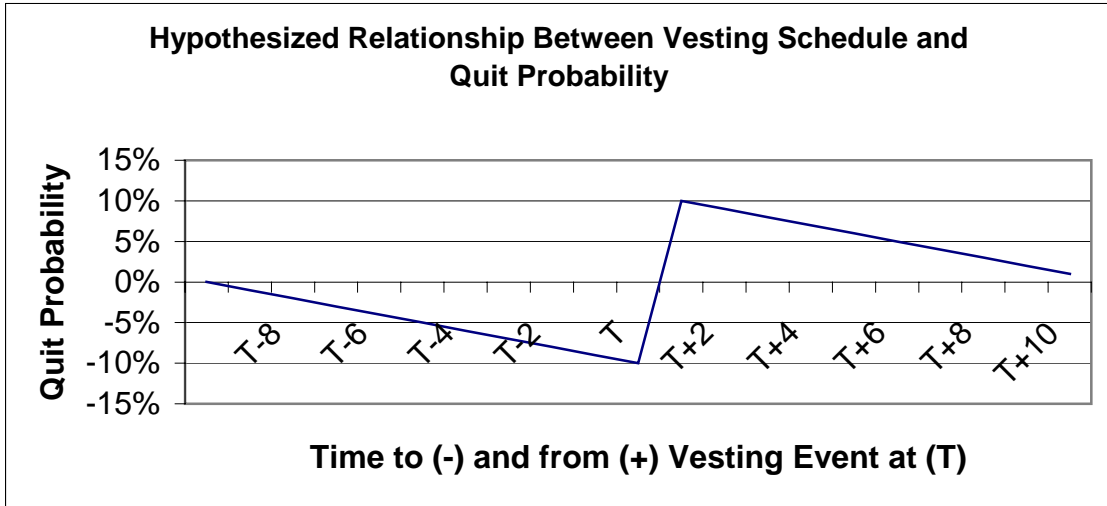
$$V^T = N^T - N^{T-1}(1+r_m)$$

$$V^{T-1} = \max[N^{T-1}, N^T / (1+r_m)] - N^{T-2}(1+r_m)$$

$$V^{T-2} = \max[N^{T-2}, N^{T-1} / (1+r_m), N^T / (1+r_m)^2] - N^{T-3}(1+r_m)$$

So if N dollars of company stock vest in quarter T, the effect on quit decisions is strongest the closer it is to quarter T. The further away from T, the smaller the influence of vesting since N gets discounted by $1+r_m$ for each period away from T. Also, higher quit rates are expected right after T because employees who were delaying their quits due to the vesting schedule of their stock will now quit.

Figure 2-12



The vesting schedule for stock and options awarded to employees at this firm is 20% per year for the first 3 years, and 40% at the end of the fourth year. The average vesting stock award is \$2,588 after adjusting for inflation. The average Black-Scholes value of vesting stock options is \$22,000. Of the approximately 15,000 employees who quit the firm during the sample period of 1983-2000, there were about 5,700 employees who quit despite forfeiting more than \$1,000 of unvested company stock or company stock options in their portfolios. The mean amount of stock and mean Black-Scholes value of company stock options forfeited was \$454 and \$1,976, respectively. The maximum stock and stock option forfeited by one employee was approximately half a million dollars.

The full hazard model accounting for the vesting schedule for employee i at time t to be estimated is:

$$\begin{aligned}
 h(t|\mathbf{X}_i, \mathbf{Z}_{i,t}, \mathbf{N}_{i,t}) = & h_0(t) * \exp(\alpha + \beta_i \mathbf{X}_i + \gamma_{i,t} \mathbf{Z}_{i,t} + \delta_{i,t-3} \mathbf{N}_{i,t-3} + \delta_{i,t-2} \mathbf{N}_{i,t-2} + \delta_{i,t-1} \mathbf{N}_{i,t-1} + \delta_{i,t} \mathbf{N}_{i,t} \\
 & + \delta_{i,t+1} \mathbf{N}_{i,t+1} + \delta_{i,t+2} \mathbf{N}_{i,t+2} + \delta_{i,t+3} \mathbf{N}_{i,t+3})
 \end{aligned} \tag{2}$$

where X represents employee characteristics like gender and race that don't change with time, Z represents employee characteristics like age and salary that change with time, and N represents the leading and lagged vesting stock and unvested stock amounts.

The coefficients for the hazard ratios of the leading and lagged vesting stock and unvested stock variables in the table below are followed by graphs. Unvested stock means stock that has been given to an employee, but has not yet vested, and subject to forfeiture if the employee decides to quit the firm.

Table 2-2

<i>Weibull Distribution</i>	(1)	(2)	(3)	(4)
	<i>\$1000 Unvested Stock</i>		<i>\$1000 Vesting Stock</i>	
	<i>STOCK</i>	<i>OPTIONS</i>	<i>STOCK</i>	<i>OPTIONS</i>
<i>T-3</i>	0.947 (-6.03)	0.999 (-0.55)	0.999 (-0.06)	1.007 (1.70)
<i>T-2</i>	0.998 (-0.26)	1.004 (1.68)	0.991 (-0.33)	1.006 (1.26)
<i>T-1</i>	0.969 (-6.81)	1.003 (1.30)	1.032 (1.39)	0.995 (-1.23)
<i>T</i>	0.885 (-14.31)	0.987 (-3.69)	1.111 (7.51)	1.022 (6.14)
<i>T+1</i>	1.212 (11.36)	0.991 (-1.73)	1.109 (6.08)	1.028 (5.71)
<i>T+2</i>	0.968 (-1.59)	1.019 (2.54)	1.111 (3.81)	1.029 (5.64)
<i>T+3</i>	1.038 (4.05)	1.010 (1.64)	1.088 (2.82)	1.057 (8.12)

Asymptotic t-stats below the hazard ratios.

Figure 2-13

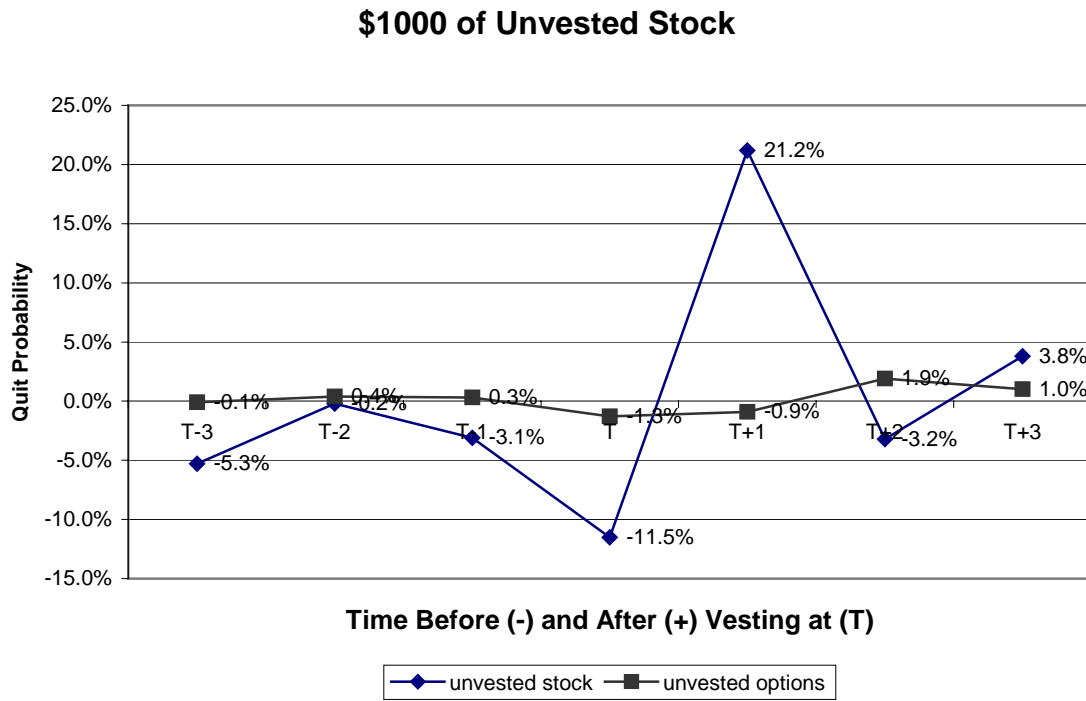
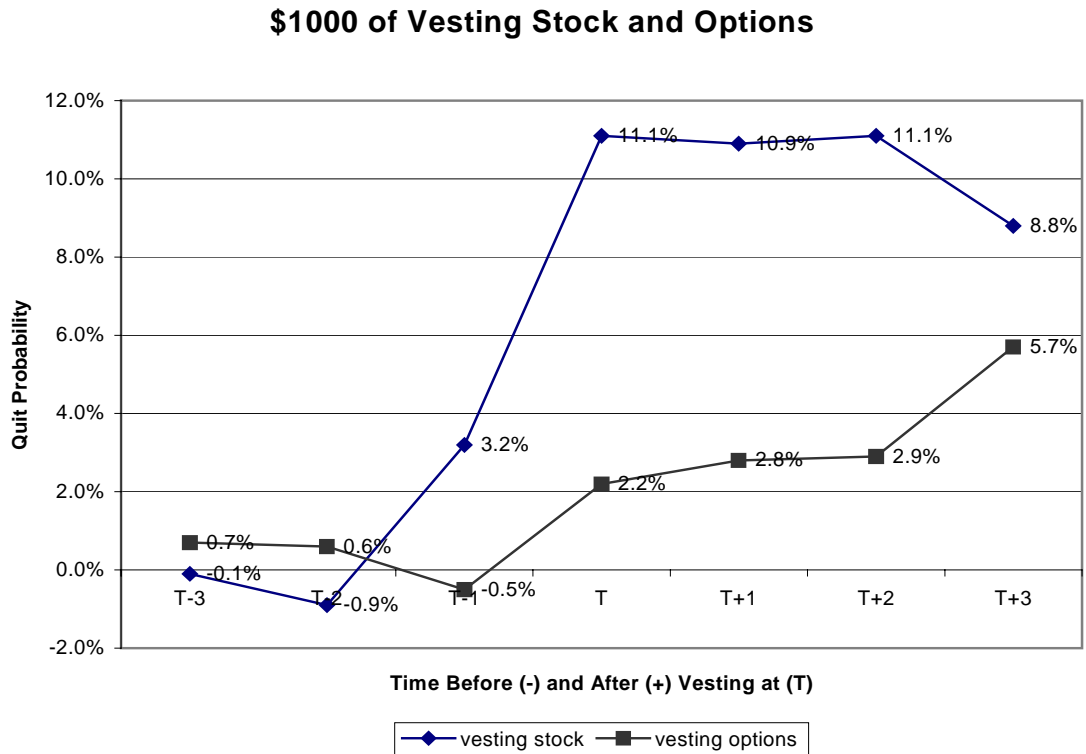


Figure 2-14



The two graphs map out the effect of having unvested or vesting stock in periods T-3, T-2, T-1, T, T+1, T+2, and T+3 on quit probabilities at period T. According to the estimates, employees who owned a \$1000 worth of unvested stock in period T were 11.5% less likely to quit in period T. An employee who owned a \$1000 worth of unvested stock in period T-1 was 21.2% more likely to quit at period T. Note that the graph of the effect of unvested stock is very similar to the graph for the predicted model.

Vesting stock variables used in the regression are the dollar amount of stocks or options that vested in period T. An employee for whom \$1000 in stock vested in period T was about 11% more likely to quit after period T which also fits the predicted relationship. The quit probability decreases to 8% in period T+3. The hazard ratio estimates for the vesting schedule of stock options are mostly very small, although there is a clear trend of higher quit probability after vesting than before vesting.

2.6. Conclusion

We come back to the question of whether the firm can influence employee turnover intentions through stock compensation. Evidence in this chapter shows that employee stock ownership is correlated with lower turnover. The strongest correlation is between lower turnover and employees who have been awarded company stock. Even after controlling for human capital variables, the 43% of employees who have been awarded stock are 71% more likely to stay with the company than employees who have never received stock awards at this company.

These results are in agreement with matching theory that predicts that higher productivity employees are more likely to stay with the firm. Given that firms want to

keep high productivity employees, employers will try to award stock to more productive employees.

Company stock awards seem to be more effective in retaining high productivity employees than higher salaries. According to the estimates, a \$1000 increase in salary increases turnover probability, while a \$1000 increase in company stock ownership decreases turnover probability.

Despite the correlation between firm-specific human capital and company stock, employees who are more likely to stay with the firm are also more likely to purchase company stock. From this evidence, it seems employees are not basing their investment decisions regarding company stock on diversification concerns between human and financial capital.

Vesting provisions seem to influence turnover probabilities in the predicted manner. Employees whose stock is about to vest are much less likely to quit. They will delay quitting until the stock vests. The effect of vesting provisions of stock options is not as strong as the effect of vesting provisions of straight stock. Although theoretically a the face value of straight stock and the Black-Scholes value of options is similar, employees are much more likely to delay their turnover if they own vesting stock, than if they own vesting options.

3.

PAY DISPERSION AND EMPLOYEE TURNOVER

3.1. Introduction

The previous chapter introduced evidence that employees who own stocks in the company they work for are less likely to voluntarily leave the company. There was also evidence that employees who are awarded stock by the firm are less likely to quit. It would seem that if absolute amount of compensation was all that mattered, differences in salary could be used to accomplish the same objectives. But salaries are often constrained to be within a narrow range, and salaries can often only be raised if the employee gets promoted or stays longer with the firm. According to table 2-1 from the previous chapter, an employee who is awarded \$1000 in company stock is more likely to stay with the company than an employee who earned a \$1000 more in base salary.

Given that company stock ownership reduces employee turnover probabilities, the company would like to award stock to employees that they want to keep. One of the consequences of using stock awards to differentiate between employees though, is that it will widen the compensation gap between the highest paid employee and the lowest paid employee. For example in 1996, average CEO compensation in the United States rose by 54% from the previous year, while the average United States worker's pay only increased by 3%. Much of this difference was a result of the proliferation of stock options as part of CEO compensation. The average American CEO earned \$2.3 million, or 83 times the pay of an average employee in salary and cash bonuses. But including stock options and

retirement benefits, the average CEO earns \$5.8 million, or 209 times the pay and retirement benefits of an average employee.¹⁷

3.2. Theory: Pay Dispersion

A pay distribution within a firm can reflect many things, among them different levels of human capital and effort levels among employees. In addition, in a world of asymmetric information, employers may introduce incentive schemes that elicit otherwise unobservable information about a worker's ability or effort levels. High-powered incentive schemes like the piece rate system are designed so that the pay dispersion within a group reflects the difference in output among employees within a group.

Piece rate systems require costly monitoring and verifiable measurement of employee output. When such individual output measurements and monitoring are difficult, relative compensation schemes such as tournaments are introduced. Tournament style incentive systems are common in many white-collar jobs, where two or more workers compete for one prize such as a promotion. Pay dispersion forms the heart of tournament theory. Tournament-style compensation systems skew the pay structure toward the top (i.e., CEO earns many times more than a staff assistant) to motivate non-CEO employees to work hard to try to be promoted to CEO (Lazear and Rosen 1981; MacLeod and Malcomson 1988).

Sociologists and psychologists argue that relative comparisons of compensation among members of a peer group influence individual utility independent from the absolute level of compensation. They argue that high pay dispersion within peer groups

¹⁷ "Executive Pay," Business Week, April 21, 1997.

can have many negative effects, irrespective of whether the dispersion accurately reflects the productivity differences among workers (Pfeffer 1990). Psychologists and sociologists believe that wide disparity in compensation causes direct psychic disutility among employees who are at the bottom of the wage distribution. Laboratory experiments have found that relative comparisons can have direct utility consequences for people. For example, one psychology experiment found that people who received \$5 and were told their counterparts received \$6 were happier than those who received \$10, but were told their partners received \$20 (Frank 1984).

Several economic theories also explain why excessive inequality in compensation can be counter-productive. Milgrom and Roberts argue that a high disparity in subjectively determined bonus awards leads some employees to spend time trying to influence the evaluating manager instead of being engaged in productive activity (Milgrom and Roberts 1988). Lazear formalized the notion that zero sum competition among workers for a fixed bonus pool would lead some employees to engage in sabotage of their colleague's efforts (Lazear 1989).

Despite an intuitive appeal of these theories, there is little systematic evidence outside of laboratories and case studies that pay dispersion has a productivity impact on firms. In a cross section sample of 769 companies, Main, O'Reilly and Wade failed to find any connection between measures of compensation dispersion among senior management teams and the firm's economic performance (Main, III et al. 1993).

There is however, empirical evidence that wage dispersion increases employee turnover. Pfeffer and Davis-Blake found that a college administrator's position in the salary rank order and the overall extent of salary dispersion affect the administrator's

turnover propensities, even after controlling for absolute levels of salaries. They found that administrators whose salaries are low relative to peers are more likely to quit than administrators whose salaries are high relative to peers. They also find that administrators with low salaries are less likely to leave when they work for an institution with an egalitarian salary distribution than if they work for an institution with a skewed distribution (Pfeffer and Davis-Blake 1992). This evidence supports the long-standing belief among sociologists and psychologists that individuals who feel they are not rewarded appropriately often deal with the situation by leaving the organization (Adams 1965).

This chapter will explore whether pay dispersion that is introduced through stock compensation has an effect on productivity and turnover as hypothesized above. The pay dispersion introduced through differential stock compensation within divisions will be compared with pay dispersion of base salary within divisions. The chapter will also examine whether the impact of pay dispersion is stronger for employees working in divisions with highly skewed distribution of pay as opposed to employees working in divisions with an egalitarian pay distribution.

3.3. Data

To examine the effect of bonus and salary dispersion on productivity and turnover rates, I first take division level data from 62 divisions at the company under study. Using an unbalanced panel of revenue-generating divisions within the company under study, I estimate a panel regression to test whether there is a link between wage dispersion and division productivity and turnover rates over a five-year period.

Next I use employee-level data for over 4,000 workers over a 5-year period to test whether individual turnover decisions are affected by pay dispersion within the divisions. I also test whether employees at the higher end of the pay distribution are less likely to quit than employees at the lower end of the distribution.

As in the previous chapter, turnover data is separated into voluntary and involuntary (retirement, layoffs, death) quits, and only voluntary quits are recorded as turnover for this paper. The coefficient of variation, the standard deviations of bonus and salary divided by their respective means, are used to measure dispersion in division compensation. The mean division bonus is calculated by averaging each employee's bonus for each fiscal year, which is the cash award, dollar value of vesting and nonvesting stock at time of award, and the Black-Scholes value of stock options at the time of award. Each employee is assigned to a division number per fiscal year according to the predominant division that the employee received her bonus from that year.

The output of this firm is a completion of a business service contract with a client. Contracts can either be fixed price or cost-plus and are usually won through open bidding against competitors. Each division competes for multiple contracts within a year, wins a certain percentage of those contracts, and earns revenue for contracts completed.

To reward and motivate employees, at the end of the fiscal year company headquarters subtracts the cost of labor (base

Revenue (wage rate charged to client)
- Cost (wage rate paid to employee)
- <u>GS&A</u> (overhead, bidding expense, admin)
Profit (allocated as division bonus pool)

salary, benefits), allocation of company-wide overhead and general and administrative expenses from the revenues of the divisions to calculate division profits. Headquarters

then calculates a bonus pool for the division based on the division's profitability and annual revenue growth. The division manager allocates this bonus pool to her employees as she sees fit either as a reward for a job well done or as motivation to work hard next year. The managers have a lot of leeway to structure the bonuses to reflect their desired incentive system.

The division performance measures and quit rates of 62 divisions during 1995-1999 are used to examine whether bonus and salary dispersion have effects on division performance and quit rates. Divisions in the sample were based in the U.S. and had at least 50 employees for two consecutive years during 1995-1999. The sample was also restricted to revenue generating divisions, i.e., cost-center divisions like marketing, R&D and administration were not included in the sample.

The division performance measure is an annual number that is used internally by the firm's management to evaluate division performance every year. It is a nonlinear weighted average of profit margin and percentage annual revenue growth, and it ranges from 0 to 5, with 5 being the highest rating. The median rating is 1, indicating that half of the divisions typically end up between 0 and 1, where the other half end up between 1 and 5. Quit rates are calculated from personnel records of voluntary turnover and latest division affiliation information.

62 separate divisions with an average of 2.7 years worth of data results in 167 observations over five years between 1995 to 1999. There are a wide variety of divisions represented in this sample. Revenue per employee range from \$15,000 to almost \$1 million and annual quit rates range from 0% to 71%. The distribution of bonus within a division is much more skewed than the distribution of base salary. Mean salaries for

divisions fall within a narrow range between \$43,000 and \$68,000, while mean division bonus range from \$600 to \$21,000. The pay dispersion measure, the coefficient of variation, is 0.3 ~ 1.3 for base salary and 0.6 ~ 3.7 for bonuses.

Table 3-1

<i>DESCRIPTIVE STATISTICS (167 divisions)</i>			
	<i>Mean</i>	<i>Median</i>	<i>Range</i>
<i>Revenue/Employee</i>	\$250,000	\$230,000	\$15,000~\$970,000
<i>Performance Measure</i>	1.50	1.00	0~5.00
<i>Quit Rates</i>	18%	15%	0-71%
<i>Avg. Division Bonus</i>	\$3700	\$3300	\$600 ~ \$21,000
<i>Avg. Division Salary</i>	\$52,000	\$53,000	\$43,000~\$68,000
<i>% Bonus Recipients</i>	49%	48%	1% ~ 100%
<i>Coefficient of Variation (Bonus)</i>	1.8	1.7	.6~3.70
<i>Coefficient of Variation (Salary)</i>	.52	.42	.3~1.3
<i># of employees</i>	172	148	52~746
<i>mean age</i>	40	40	34~48
<i>mean firm tenure</i>	3.9	3.7	1.1~7.9
<i>% college</i>	74%	78%	1~95%
<i>mean bonus/salary %</i>	8%	7%	2 ~ 31%

3.4. Division Level Estimation

To estimate the effect of wage dispersion on group performance and turnover rates, I perform a random effects panel regression on this sample of divisions. Lagged values of the compensation variables are used. Because division bonuses are distributed at the end of the year, to measure the effect of bonus on performance and quit behavior, it is most appropriate to observe what happened during the year right after bonuses were distributed. Regressing lagged moments of the bonus variable on performance measures assumes that the causation flows from pay dispersion to performance. There are still endogeneity concerns since I am trying to use compensation at t-1 to predict division performance at time t, and compensation at t-1 is correlated with division performance at

t-1. If division performance at t-1 is strongly correlated with division performance at t, the estimator for compensation will be biased.

Column 1 in table 3-2 displays the results of regressing the first and second moments of the compensation variables on the natural log of the division performance measure. The equation passes the F-test, as the Wald chi-squared value (18.64) is well within the 5% significance level for rejecting the null hypothesis for the joint effect.

According to the estimates, a 10% reduction in the lagged dispersion measure of bonuses increases division performance by 2%. Higher mean salary also increases division performance in the subsequent year. \$1000 higher average salary for the division translates to about 2% higher division performance. A higher percentage of college-educated employees also improve division performance.

Table 3-2

<i>Dependent Variable:</i>	<i>ln Division Performance</i>	<i>Quit Rate (%)</i>
<i>Unbalanced Panel: 62 divisions x 3 years</i>		
<i>167 observations</i>		
<i>Lag ln Coefficient of Variation (Bonus)</i>	-0.203	3.074
	(-2.10)	(1.42)
<i>Lag ln Coefficient of Variation (Salary)</i>	0.010	3.766
	(0.11)	(2.31)
<i>Lag Mean Bonus (\$1000)</i>	0.013	-0.123
	(0.78)	(0.33)
<i>Lag Mean Salary (\$1000)</i>	0.018	-5.19
	(2.08)	(-2.65)
<i>Lag % Bonus Recipient</i>	-0.169	6.164
	(-0.89)	(1.45)
<i>Mean Firm Tenure (year)</i>	-0.042	-2.680¹⁸
	(-1.21)	(-2.69)
<i>% College Degree</i>	0.424	-4.507
	(1.69)	(-0.60)
<i># Employees (10 employees)</i>	0.005	-0.012
	(1.25)	(-1.05)
<i>R-square (Overall)</i>	0.124	0.228
<i>Wald chi2</i>	18.64	29.37

*Asymptotic t-stats in parentheses. Figures in bold are statistically significant at 10% level.

The other division level performance variable is the quit rate. As explained in the previous chapter, the company is in an industry where employee retention and minimizing turnover is one of the key objectives. It is therefore reasonable to expect that the company would structure compensation policy with at least some intention of minimizing employee turnover.

According to the second column in table 3-2, divisions with higher levels of pay dispersion have higher quit rates. Both salary and bonus dispersion, as measured by coefficient of variation, increase the quit rate of the division by 3 to 4% in the year after the bonus was distributed. One explanation for this pattern in dispersion and quit rates is

¹⁸ As in the analysis for chapter 2, we again find that firm tenure has a negative effect on turnover.

that high pay dispersion within divisions makes it more likely that employees at the bottom of the pay distribution receive the signal that they are not a good match with the firm, and are more likely to quit.

The one surprising finding is that the percentage of the bonus recipients within a division does not follow the same pattern as the relationship between bonus dispersion and the quit rate. Controlling for the first two moments of the distribution, the higher the percentage of the division that received bonuses, the lower is the division performance in the subsequent year. If bonuses do have a motivational effect on employees beyond that of the face value of the stock awarded, we would expect that divisions with a higher percentage of workers receiving a bonus would be more productive or have lower quit rates.

It is likely that there is a measurement error problem with the bonus recipient percentage variable. Because of turnover and the number of temporary workers, it is very difficult to measure the number of employees working for a particular division at any particular time. The numerator, the number of bonus recipients is an accurate count of bonus recipients, but the denominator, the number of employees in the division, is estimated. In the second half of the empirical section, we move to individual employee level analysis where there is less likelihood of measurement error problems.

3.5. Employee Level Estimation

As in the previous chapter's analysis, all the regressions control for gender, race, education level, age, firm tenure, career stock awards and stock purchases dummy.

Table 3-3

<i>Logistic Regression with Dependent Variable: Probability of Quit</i>				
<i># observations: 18,471</i>				
<i>unbalanced panel with 5 years of data</i>	<i>Odds Ratio</i>	<i>Odds Ratio</i>	<i>Odds Ratio</i>	<i>Odds Ratio</i>
	<i>(1)</i>	<i>(2)</i>	<i>(3)</i>	<i>(4)</i>
<i>ln Coefficient of Variation (Bonus)</i>	62.2%		60.0%	6.0%
	(3.53)		(3.21)	(0.30)
<i>ln Coefficient of Variation (Salary)</i>	145.6%		88.5%	101.0%
	(2.88)		(1.97)	(2.17)
<i>Bonus (\$1000)</i>	-32.3%			-31.1%
	(-8.80)			(-6.70)
<i>Salary (\$1000)</i>	0.4%			-2.7%
	(1.08)			(-4.58)
<i>Salary Distribution Rank</i>				
<i>5th Quintile</i>		-42.6%	-66.9%	-65.6%
		(-3.85)	(-5.99)	(-5.78)
<i>4th Quintile</i>		-22.8%	-41.2%	-40.1%
		(-1.88)	(-3.58)	(-3.45)
<i>2nd Quintile</i>		30.2%	66.8%	65.6%
		(1.81)	(3.30)	(3.25)
<i>1st Quintile</i>		44.2%	190.9%	184.7%
		(2.05)	(4.89)	(4.79)
<i>Bonus Distribution Rank</i>				
<i>5th Quintile</i>		186.3%	115.8%	9.6%
		(7.79)	(5.46)	(0.41)
<i>4th Quintile</i>		44.1%	38.2%	28.0%
		(2.38)	(2.06)	(1.57)
<i>2nd Quintile</i>		-3.7%	50.8%	46.3%
		(-0.23)	(2.35)	(2.18)
<i>1st Quintile</i>		-45.1%	122.9%	126.3%
		(-2.88)	(3.24)	(2.31)
<i>Interaction Effects</i>				
<i>Bonus Dispersion * 5th Quintile</i>				202.0%
				(3.84)
<i>Bonus Dispersion * 1st Quintile</i>				4.2%
				(0.09)
<i>Pseudo R-sq</i>	.102	.089	.1236	.1269

* Absolute value of asymptotic t-stats in parentheses. Figures in bold are statistically significant at the 10% level. The coefficients for the relative rank dummies are in comparison to the median quintile.

Table 3-3 displays the estimates from regressing pay dispersion and pay distribution rank variables on the probability of quits at the individual level. Column 1

confirms the group level findings that employees belonging to a division with a high bonus and salary dispersion are more likely to quit. Similar to analysis on chapter 2, coefficient estimates show that a \$1000 in bonus reduces quit rates by 30%, whereas \$1000 of salary does not have a statistically significant effect.

Column 2 of table 3-3 shows the estimates of regressing the distribution rank variables on quit probability. The effects of salary rankings are different from the effects of bonus rankings. Employees at the bottom of the salary distribution are less likely to quit (-43%) and employees at the top of the salary distribution are more likely to quit (44%). This most likely reflects the higher quit probabilities of managers and highly skilled engineers who are in demand by the external labor market. On the other hand, employees at the bottom of the bonus distribution are more likely to quit (187%), and those at the top of the division bonus hierarchy are less likely to quit (-45%). Rankings based on stock bonuses seem to be correlated with the desire by the current employer to retain the employee.

Column 3 of table 3-3 shows that part of the bonus-salary dichotomy seen in column 2 disappears when we control for bonus and salary amounts in the regression. The salary pattern remains the same, where employees at the top of the salary distribution in the division are more likely to quit. But controlling for absolute bonus levels, being an employee in the top quintile of the bonus distribution and being an employee at the bottom of the distribution now exhibit the same effect on quit probability. The top and bottom employees in the bonus distribution are more likely to quit than employees in the median ranks.

From column 3, one may conclude that all that matters is the amount of bonus, since the employee's relative bonus ranking within the division is positively correlated with higher turnover probability. The estimates, in column 4, of a regression equation with an interaction term between bonus dispersion and the bottom and top quintile bonus rankings suggests a more complex explanation.

The regression with the interaction term examine the hypothesis that employees at the bottom of the bonus distribution are more likely to quit if they work for a division that has a high dispersion of bonuses. The coefficients of the interaction terms suggest that the effect of being in the bottom quintile of bonus distribution has a larger effect on employee turnover in a division with a skewed bonus distribution than in a division with an egalitarian bonus distribution. The coefficient of the interaction term between the dummy variable for belonging to the bottom quintile of bonus distribution and the variable for the measure of bonus dispersion is strongly positive (202%), while the interaction term is not statistically significant for the dummy variable for being at the top of the distribution in a highly skewed distribution..

The division level analysis shows that divisions with high bonus dispersion have lower performance measures and higher quit rates. If this were a causal relationship in a simple universe with bonus dispersion as the only relevant variable, division managers' optimal actions would be to lower bonus dispersion. But individual level logistic regression shows that employees at the lower end of the bonus distribution are more likely to quit. This is especially true in divisions with high bonus dispersion. This suggests that the high quit rates among high wage dispersion divisions may be a result of intended turnover of employees who are not as productive as the ones that stay.

3.6. Employee Opinion Survey

The evidence presented so far suggests that employees react differently to receiving a \$1 of company stock than receiving a \$1 in base salaries. In the final section of this chapter, I examine this hypothesis using data obtained from an internal employee opinion survey that was conducted by the company in 1998 with a response rate of 45%. The respondent group is similar in characteristic to the general population of employees in the company.¹⁹

Table 3-4

<i>Satisfaction Regarding</i>	<i>Distributing Bonus Fairly</i>	<i>Competitive Base Salaries</i>
<i>Very Good (1)</i>	<i>7.2%</i>	<i>5.3%</i>
<i>Good (2)</i>	<i>24.8%</i>	<i>26.6%</i>
<i>Average (3)</i>	<i>29.6%</i>	<i>43.6%</i>
<i>Poor (4)</i>	<i>20.8%</i>	<i>18.4%</i>
<i>Very Poor (5)</i>	<i>17.8%</i>	<i>6.2%</i>
<i>Mean</i>	<i>3.17</i>	<i>2.94</i>
<i>Std. Deviation</i>	<i>1.19</i>	<i>0.95</i>

Table 3-4 shows that satisfaction with bonus distribution fairness is not as high as satisfaction with base salaries. Close to 40% of respondents rated bonus distribution fairness as poor or very poor as opposed to the 25% of respondents who felt the same way about base salaries.

To test whether employees' satisfaction with bonus fairness is influenced by the egalitarian or non-egalitarian distribution of bonuses, I divide the universe of divisions into egalitarian and non-egalitarian. The classification is based on whether the division's

¹⁹ Because the employee opinion survey was conducted anonymously, I cannot match the individual survey response to the individual employee demographic and compensation information. However, I can match each respondent to the division that they belong to, and so I calculate division averages for each satisfaction rating.

1998 fiscal year coefficient of variation (standard deviation/division mean) is above or below the median of the group of divisions. The division is categorized as egalitarian if the division dispersion measure was below the median and non-egalitarian if the measure was above the median. In addition, I divide the employees into two groups: one group owned more than 500 shares of stock as of 1998, and the other group owned less than 500 shares as of 1998. These two classifications are used to run a couple of difference of means t-tests to see if the mean bonus fairness satisfaction ratings among the two groups of employees are different.

Table 3-5

<i>Mean Satisfaction on Bonus Distribution</i>	<i>Low Bonus Dispersion</i>		<i>High Bonus Dispersion</i>		<i>Total</i>	
	<i>mean</i>	<i>std. error</i>	<i>mean</i>	<i>std. error</i>	<i>mean</i>	<i>std. error</i>
<i>+500 share owner</i>	3.05	.07	3.11	.05	3.08	.05
<i><500 share owner</i>	3.13	.09	3.30	.06	3.22	.06
<i>Total</i>	3.10	.08	3.25	.05		

Low numbers correspond to higher satisfaction. Sample of 40-41 divisions for FY98

Not surprisingly, owners of more than 500 shares of stock are more satisfied with their bonus than owners with less than 500 shares (3.08 vs. 3.22). In general, employees are more satisfied with bonus distribution fairness in low dispersion divisions than in high dispersion divisions (3.10 vs. 3.25). Both differences are statistically significant.

In high dispersion divisions, employees owning more than 500 shares are more satisfied about bonus fairness than those with less than 500 shares. In low dispersion divisions, there is no statistically significant difference in the satisfaction ratings. One way to explain these results is to go back to the explanation of the psychologists and sociologists. In egalitarian divisions, even employees who didn't receive a lot of shares are satisfied with the "fairness" with which the stock bonus is distributed. In contrast,

there is a clear difference in the satisfaction levels between those with a lot of shares and those with few shares in divisions with a skewed distribution.

3.7. Conclusion

This paper examined pay dispersion within divisions of one company. After establishing that different incentive schemes impose different degrees of pay dispersion, the first section tried to estimate the effect of a percentage change in pay dispersion on division economic performance and division quit rates. Measurement error and endogeneity in the data make it difficult to accurately estimate these effects, but there does seem to be a correlation between higher bonus dispersion and lower division performance and higher quit rates.

As in chapter 2, we find that a \$1 of salary and \$1 of bonus stock have different effects on employee turnover propensity. I find in the individual employee regressions that dispersion of bonus and salary in a division increases that division's worker's chance of turnover. But I also find that the worker's relative standing in that distribution has an effect on that worker's turnover propensity. Employees at the bottom of the salary distribution are less likely to quit, but employees at the bottom of the bonus distribution are more likely to quit. When not controlled for absolute amounts of bonus, employees at the top of the bonus distribution are less likely to quit.

In conclusion, the first two chapters concentrated on stock compensation and its influence on employee turnover. I find that stock bonus and salary are used in different ways, and employees react to them differently. Stock bonus seems to be effective in encouraging employees to stay with the firm. I also evidence that pay dispersion matters independent of levels of pay. Employees who are at the bottom of the bonus distribution

in a division with a highly skewed bonus distribution are more likely to quit than employees at the bottom of the distribution in a division with an egalitarian bonus distribution.

4.

GENDER & RACIAL DIFFERENCES IN COMPANY STOCK PURCHASE

4.1. Introduction

The previous two chapters examined the relationship between employee behavior and stock compensation policy from the perspective of the firm. Employees who own company stock are less likely to quit, and the firm can influence who leaves the organization by adjusting stock awards within divisions. But while the employer can certainly influence the amount of company stock the employees own, employees make the ultimate decision on how much company stock they will own. Through the internal stock market, employees at this company can purchase and sell company stock to adjust their total company stock holdings. The next two chapters will examine the employee's purchase decisions of company stock.

This chapter will examine cross sectional differences in employee investment decisions that are not easily explained by neoclassical theories of optimal portfolio allocation. This chapter investigates gender and racial differences in investment patterns regarding company stock. Surveys and experimental psychologists present evidence that there are gender differences in financial decision-making (Hersch 1996; Powell and Ansic 1997). Most cross sectional studies of pension asset allocation and Survey of Consumer Finance studies have confirmed the findings of psychologists (Hinz, McCarthy et al. 1997; Jianakoplos and Bernasek 1998; Sunden and Surette 1998)²⁰.

Even after controlling for factors like education, income, and marital status, the studies still find gender differences in investment allocation decisions. In a similar vein,

²⁰ Papke finds no difference in allocation between equity and non-equity, but her sample excludes single males, an important demographic with regard to financial choices (Papke 1998).

behavioral finance economists have found that men are more likely to be overconfident about their financial decision-making ability. The overconfidence results in men buying and selling equity much more frequently than women (Barber and Odean 2000).

The empirical evidence does not necessarily support the hypothesis that men prefer equity investments more than women. Two studies have found that women are just as likely to invest in equity as men, but women are less likely to invest in their employer's company stock. In cross sectional studies of 401(k) plans, studies find a gender gap in equity investments because company stock constitutes a large part of many people's 401(k) plans (Bajtelsmit and VanDerhei 1997). For example, a Watson Wyatt Worldwide study of 150,000 U.S. employees found that women with incomes over \$75,000 were 12% more likely to participate in 401(k) plans than men, and allocate a higher percentage of their plans toward equities than men, except when company stock was an investment option. The human resource consulting firm's study found that "women generally treat company stock as a substitute for other equities, whereas men lower the proportion of fixed income and other equity investments in favor of company stock." (1998) Women also tended to hold a much lower percentage of 401(k) balances in company stock than men (29% vs. 45%).

Racial differences in investment have not been studied very much, most likely because personal investment data often does not include information on race. In one study, Jianakoplos and Bernasek found that single black women on average held more risky assets than single white women and single black men. In another study, Hersch found that black men were more likely to engage in risky consumer choices, although the

difference disappears when controlled for income and education (Hersch 1996; Jianakoplos and Bernasek 1998).

Several recent studies suggest that gender and racial differences in investment patterns are sensitive to the investment method and choices available. For example, Madrian and Shea found that there are large differences in 401(k) participation rates between males and females, and between different races, when the default choice was non-participation. These gender and racial differences either disappeared or narrowed considerably when the default choice was participation (Madrian 2000). In France, Degeorge, Jenter, Moel and Tufano found that when offered a choice of discrete investment options involving company stock, female employees of France Telecom were 5% more likely to participate in their own company's stock offering than male employees, but on average bought less and bought plans with longer holding periods (Degeorge, Jenter et al. 2000). Most recently, a study by Choi, Laibson & Metrick found that young males were much more likely to use online methods of investing their 401(k) plans than young females (Choi, Laibson et al. 2000).

Why would there be gender and race differences in investment preferences, especially after controlling for income, wealth and human capital differences? One hypothesis is that there are gender and racial differences in the individual's amount of investment knowledge. There is evidence that financial education greatly increases participation in 401(k) plans among those least inclined to participate (Bernheim and Garrett 1996). This explanation is especially intriguing, as this chapter will show that females and some non-Whites were more likely than males and Whites to buy company

stock during 1998-2000, when the popular press was filled with articles about stocks and dot com millionaires.

Another hypothesis is that the gender difference is based on how men and women use financial knowledge to make investment decisions. As in Barber and Odean's overconfidence thesis, the real gender difference may lie in the difference in confidence levels men and women place on information about investment choices, and their abilities to act appropriately to that information. Using data from a company-wide opinion survey, this chapter finds evidence supporting this claim.

4.2. Demographic Composition of Sample

The sample consists of a 17 year panel of over 40,000 employees' purchasing and selling transaction records of their employer's company stock, as well as a one year cross section of their portfolio allocations of their retirement plans. The data is described in detail in the first chapter of this thesis.

Throughout 1983-2000, women accounted for 30-36% of the total sample population. During the same time period 87-94% of the sample population were White, 2-6% were Black, and 4-7% were Asian²¹. Men in the sample tended to have higher educational backgrounds, earned higher salaries, were more likely to be married and owned more company stock. White and Asian employees had higher educational backgrounds than Black employees on average, and Whites earned the highest salaries and owned more stocks on average.

²¹ Hispanics were not separated from Whites in the study to make the racial comparison between Whites, Blacks and Asians easier to see.

There are three types of data. The first data comes from the retirement portfolio allocations of 9,200 employees as of May 1999. The retirement portfolio of a typical full time employee at this company consists of company stock, risk free investments and publicly available mutual funds. The retirement account is composed of a defined contribution plan funded with company stock and cash²², a 401K plan with a company match provided in company stock²³, and a profit share plan which the company decides the allocation level and the employee decides the allocation between assets. Employees can accumulate company stock in their retirement account by a) deferring a part of their salary into the 401k plan and allocating it to company stock, and by b) allocating their profit share into company stock. They can sell the non-match portion of their company stock held in the retirement fund, but company stock in the retirement account can only be bought through payroll deferral. During the study period, employees could keep their company stock in the retirement plan after employment termination.

The second set of data comes from purchase and sales records of company stock of over 30,000 different full time employees during 1983-2000. There are two ways to purchase this company's stock: directly purchase the stock in the quarterly internal stock market at the quoted quarterly price, or through the ESOP (employee stock ownership plan), where any full-time employee can purchase up to 10 percent of his or her base salary with a 10% price discount. Company stock that is purchased via these two methods and via bonus stock and stock option awards from the company is placed in a trade

²² Company makes an annual contribution in the amount of 6-8% of base salary

²³ 50% match in company stock for first \$2000 of deferral and then 15% match for amounts above that, up to 10% of base salary. The match is immediately vested, but cannot be exchanged for cash or rolled over into another mutual fund unless employee terminates employment.

account, which is separate from the retirement account. The final data comes from an employee opinion survey conducted in the summer of 1998. Several questions on the survey regarding employees' investment attitude toward company stock are analyzed.

There are several types of variables that need to be controlled to estimate the effect of gender and race on company stock investment. First, there are human capital variables proxied by education level and firm tenure. Education level proxies for general human capital and firm tenure proxies for firm-specific human capital. General human capital should increase overall wealth allocation toward company stock because higher human capital lowers income risk, and because general human capital is not necessarily correlated with company stock returns (Bodie, Merton et al. 1991). Firm-specific human capital on the other hand, should decrease the probability of company stock purchase and the amount of purchase because of the presumed correlation between human and financial capital returns.

Marital status and age affect investment preferences due to differences in household wealth and the effect of different stages of the life cycle on savings preferences. Unless both spouses work for the same company, having a working spouse with another income diversifies the household portfolio, and increases the threshold for holding more of this company's stock. Married employees should be more likely to invest in company stock.

While there is a theoretical debate over what effect age should have on the allocation between risky and less risky assets (Bodie, Merton et al. 1991; Cocco, Gomes et al. 1999), most financial planners counsel older people to invest less in risky assets. Given that older employees have less of human capital in the form of unrealized earnings

to cushion a fall in the value of company stock, and assuming older employees are less likely to be able to switch jobs (Jovanovic 1979), older employees should be less inclined to purchase company stock.

Employees' current salary, retirement account balance and company stock trade account balance are used to proxy for employees' net worth. Although they are imperfect measures, it is reasonable to assume that employees' retirement accounts and their holdings of company stock are a majority of their net worth outside of residential assets. High net worth increases the likelihood that employees will invest in company stock.

4.3. Empirics: Retirement Allocation

The first parts of both analyses, retirement portfolio allocation and company stock purchase, look at means between gender and race, and several gender subgroups. The second parts of both analyses estimate regression equations and look at the coefficients of the gender and race variables while controlling for proxies on human capital, income and wealth.

Table 4-1

<i>Retirement Portfolio Allocation</i>						
<i>Mean Comparisons</i>	<i>female</i>		<i>male</i>	<i>White</i>	<i>Black</i>	<i>Asian</i>
<i>Company Stock</i>	52%		53%	53%	54%	50%
<i>Risk Free Assets</i>	6%		5%	5%	6%	5%
<i>Mutual Funds</i>	42%		42%	42%	40%	45%
	<i>Female</i>			<i>Male</i>		
	<i>High School</i>	<i>College</i>	<i>Graduate</i>	<i>High School</i>	<i>College</i>	<i>Graduate</i>
<i>Company Stock</i>	63%	49%	45%	59%	52%	52%
<i>Risk Free Assets</i>	7%	5%	5%	7%	4%	5%
<i>Mutual Funds</i>	30%	45%	50%	34%	43%	43%
	<i><\$40K</i>	<i>\$40-80K</i>	<i>80K+</i>	<i><\$40K</i>	<i>\$40-80K</i>	<i>80K+</i>
<i>Company Stock</i>	54%	51%	49%	50%	53%	55%
<i>Risk Free Assets</i>	5%	6%	5%	4%	5%	5%
<i>Mutual Funds</i>	41%	43%	46%	46%	43%	40%
	<i>White</i>	<i>Black</i>	<i>Asian</i>	<i>White</i>	<i>Black</i>	<i>Asian</i>
<i>Company Stock</i>	52%	55%	47%	53%	52%	51%
<i>Risk Free Assets</i>	5%	6%	6%	5%	6%	4%
<i>Mutual Funds</i>	43%	39%	47%	42%	41%	45%

At first glance there does not seem to be much evidence of gender or racial differences in the percentage of retirement wealth allocated toward company stock. Women at this company allocated 52% of their retirement accounts in company stock, while men allocated 53%. Whites allocated 53%, Blacks allocated 54% and Asians allocated 50% on average toward company stock. But there are more interesting patterns when gender is divided into education and income subgroups. For example, while the difference in allocation percentage between employees with high school degrees and those with graduate degrees for women is 18% (63% for high school, 45% for graduate degree holders), the difference is only 7% for men (59% for high school, 52% for

graduate degree holders). Higher education levels dramatically reduce allocation toward company stock for women, whereas education levels do not lower allocation toward company stock as much for men.

Similarly, the difference in allocation percentages between employees with high salaries and those with low salaries is a negative 5% for women (48% for >\$80K salaries, 53% for <40K salaries), but it's a positive 5% for men (55% for >\$80K salaries, 50% for <40K salaries). There is also a statistically significant difference between Asian and Black females, which is not evident between Asian and Black males. Asian females allocated an average 47% in company stock, whereas Black females invested 55% in company stock.

The importance of the interaction effects of gender with education, marital status, and salary is further suggested by the results of the ordinary least square (OLS) regressions below. With allocation percentage toward company stock as the dependent variable, in the initial regression of allocation percentages without the interaction effects, the estimated coefficient for the female dummy is a negative 2%. But when controlled for interaction effects between gender and marital status, education, and salary, the coefficient of the female dummy is a positive 4%. This suggests that single females without a college education and low salaries are more likely to allocate their retirement portfolio toward company stock than their male and female counterparts.

If education levels are proxies for general human capital levels, they should have a positive relationship with company stock allocation rates. The results are reverse of what is expected. Employees with college degrees allocate on average 3% less, while female employees with a college education allocate an additional 3% less in company

stock. It was hypothesized above that married employees would allocate more toward company stock. Indeed, we see that married employees allocate on average 2% more toward company stock than single employees. But married females allocate less toward company stock on average, which does not square with the previous explanation.

The signs of the coefficients on the rest of the controls are also not in the hypothesized direction. In terms of wealth, the larger the retirement account and higher the salary, the lower is the company stock allocation. Employees with higher trade account balances allocate a higher percentage of retirement wealth into company stock. These results suggest that employees are not substituting allocation of retirement account wealth with the company stock in their trade account.

A negative relationship between firm tenure and company stock allocation was hypothesized above, but the regression results show a strongly positive relationship. As shown in the introduction to the dissertation, the value of this company's stock rose much higher than most publicly available mutual funds. Given evidence that employees often leave default allocation settings of 401(k) portfolios (Ameriks and Zeldes 2000), it is most likely that this positive relationship between firm tenure and company stock allocation is a result of employees not changing their original allocation ratios between company stock and mutual funds.

Table 4-2

<i>Ordinary Linear Regression</i>		
<i>Dependent Variable: % allocated company stock in May 1999</i>		
<i>9,128 observations</i>		
<i>female</i>	-2.3%	4.0%
	(-3.80)	(2.43)
<i>black</i>	3.1%	3.1%
	(2.78)	(2.79)
<i>asian</i>	-0.5%	-0.3%
	(-0.43)	(-0.33)
<i>college</i>	-4.4%	-3.0%
	(-5.28)	(-3.05)
<i>graduate</i>	-5.7%	-4.5%
	(-6.26)	(-4.32)
<i>married</i>	1.4%	1.9%
	(2.45)	(2.55)
<i>age</i>	0.1%	0.1%
	(4.80)	(4.56)
<i>firm tenure</i>	3.3%	3.3%
	(37.18)	(37.13)
<i>salary (\$'000)</i>	0.0%	0.0%
	(-3.22)	(-2.12)
<i>trade account (\$'000)</i>	0.0%	0.0%
	(2.29)	(2.06)
<i>retirement account (\$'000)</i>	0.0%	0.0%
	(-13.17)	(-13.25)
<i>female x married</i>		-1.3%
		(-1.12)
<i>female x college+</i>		-3.1%
		(-2.23)
<i>female x salary</i>		0.0%
		(-2.38)
<i>_cons</i>	38.4%	36.6%
	(25.61)	(23.32)
<i>Adjusted R-Square</i>	0.187	0.188

t-statistic in parentheses.

4.4.

Empirics: Company Stock Purchase

As mentioned in the introduction, there are two ways employees can purchase stock at this company. The first is through direct purchases in the quarterly trades. The second is through ESOP purchases with salary deferrals. The differences in the two methods are that ESOPs offer a 10% price discount, but are limited to 10% of an employees' base salary; and employees have to fill out a request for direct purchases every quarter, but purchases through ESOPs are automatic once an employee decides to participate. The price discount and the automatic nature of the purchase method make it more likely that employees will purchase company stock through the ESOP than through direct purchase.

The mean comparisons and the regressions are divided into 6 three-year periods from 1983-2000. The average annual returns of this stock were 28% for 1983-1985, 25% for 1986-1988, 13% for 1989-1991, 14% for 1992-1994, 31% for 1995-1997, and 182% for 1998-2000.

Table 4-3

<i>Mean Participation Rates</i>	<i>Direct Purchase</i>		<i>ESOP</i>		<i>Combined</i>	
	<i>Male</i>	<i>Female</i>	<i>Male</i>	<i>Female</i>	<i>Male</i>	<i>Female</i>
<i>1983-1985</i>	<i>18%</i>	<i>6%</i>	<i>17%</i>	<i>11%</i>	<i>30%</i>	<i>15%</i>
<i>1986-1988</i>	<i>28%</i>	<i>14%</i>	<i>19%</i>	<i>15%</i>	<i>39%</i>	<i>25%</i>
<i>1989-1991</i>	<i>25%</i>	<i>12%</i>	<i>9%</i>	<i>9%</i>	<i>31%</i>	<i>19%</i>
<i>1992-1994</i>	<i>25%</i>	<i>20%</i>	<i>11%</i>	<i>9%</i>	<i>31%</i>	<i>26%</i>
<i>1995-1997</i>	<i>24%</i>	<i>17%</i>	<i>18%</i>	<i>16%</i>	<i>35%</i>	<i>28%</i>
<i>1998-2000</i>	<i>39%</i>	<i>37%</i>	<i>35%</i>	<i>37%</i>	<i>55%</i>	<i>56%</i>

Table 4-4

<i>Mean Participation Rates</i>	<i>High School</i>		<i>College+</i>	
	<i>Male</i>	<i>Female</i>	<i>Male</i>	<i>Female</i>
<i>Direct Purchase</i>				
1983-1985	5%	3%	22%	10%
1986-1988	11%	8%	33%	21%
1989-1991	11%	6%	28%	18%
1992-1994	16%	16%	28%	24%
1995-1997	12%	11%	28%	20%
1998-2000	22%	21%	44%	45%
<i>ESOP</i>				
1983-1985	10%	9%	19%	13%
1986-1988	14%	13%	20%	17%
1989-1991	8%	7%	10%	10%
1992-1994	11%	9%	11%	9%
1995-1997	15%	14%	19%	18%
1998-2000	27%	32%	38%	40%

The chart above shows that gender differences are primarily in direct purchase participation, and most pronounced between college educated men and women. But even the gender differences disappear during the most recent three-year period, 1998-2000.

Table 4-5

<i>Mean Participation Rates</i>	<i>Direct Purchase</i>			<i>ESOP Purchase</i>			<i>Combined</i>		
	<i>White</i>	<i>Black</i>	<i>Asian</i>	<i>White</i>	<i>Black</i>	<i>Asian</i>	<i>White</i>	<i>Black</i>	<i>Asian</i>
1983-1985	14%	2%	10%	15%	5%	13%	25%	6%	21%
1986-1988	24%	7%	21%	17%	11%	21%	35%	17%	35%
1989-1991	21%	6%	23%	9%	5%	12%	27%	9%	31%
1992-1994	24%	12%	27%	10%	8%	15%	30%	17%	35%
1995-1997	23%	10%	25%	17%	13%	23%	33%	21%	39%
1998-2000	40%	19%	49%	35%	32%	46%	56%	43%	65%

Table 4-6

<i>Mean Participation Rates</i>	<i>High School</i>			<i>College</i>		
<i>Direct Purchase</i>	<i>White</i>	<i>Black</i>	<i>Asian</i>	<i>White</i>	<i>Black</i>	<i>Asian</i>
<i>1983-1985</i>	<i>4%</i>	<i>0%</i>	<i>4%</i>	<i>20%</i>	<i>5%</i>	<i>13%</i>
<i>1986-1988</i>	<i>10%</i>	<i>3%</i>	<i>7%</i>	<i>31%</i>	<i>14%</i>	<i>28%</i>
<i>1989-1991</i>	<i>9%</i>	<i>2%</i>	<i>5%</i>	<i>26%</i>	<i>11%</i>	<i>30%</i>
<i>1992-1994</i>	<i>17%</i>	<i>9%</i>	<i>9%</i>	<i>27%</i>	<i>15%</i>	<i>32%</i>
<i>1995-1997</i>	<i>11%</i>	<i>5%</i>	<i>16%</i>	<i>27%</i>	<i>13%</i>	<i>27%</i>
<i>1998-2000</i>	<i>25%</i>	<i>7%</i>	<i>30%</i>	<i>44%</i>	<i>29%</i>	<i>54%</i>
<i>ESOP</i>	<i>High School</i>			<i>College</i>		
<i>1983-1985</i>	<i>9%</i>	<i>6%</i>	<i>9%</i>	<i>18%</i>	<i>3%</i>	<i>15%</i>
<i>1986-1988</i>	<i>13%</i>	<i>11%</i>	<i>19%</i>	<i>20%</i>	<i>10%</i>	<i>22%</i>
<i>1989-1991</i>	<i>8%</i>	<i>4%</i>	<i>13%</i>	<i>10%</i>	<i>6%</i>	<i>13%</i>
<i>1992-1994</i>	<i>9%</i>	<i>8%</i>	<i>13%</i>	<i>10%</i>	<i>8%</i>	<i>17%</i>
<i>1995-1997</i>	<i>13%</i>	<i>9%</i>	<i>17%</i>	<i>19%</i>	<i>16%</i>	<i>24%</i>
<i>1998-2000</i>	<i>29%</i>	<i>32%</i>	<i>32%</i>	<i>38%</i>	<i>38%</i>	<i>50%</i>

As in gender differences, racial differences are less pronounced in ESOP purchase participation than in direct purchase participation. Asians are more likely to buy company stock in both college and high school education subgroups. The differences between Blacks and Whites disappear for ESOP participation in 1998-2000.

Probit and Tobit regressions below are used to estimate the magnitude of gender and race differences in company stock purchase probability after controlling for differences in human capital and estimates of wealth. This time, the dummy variable for females has a statistically significant negative coefficient five out of the six time periods for direct purchases, and the effects are significant. Females purchase probabilities are 5% to 13% lower than for males.

Compared to Whites and Asians, Blacks are consistently less likely to purchase company stock throughout the entire study period, except for ESOP purchases during

1998-2000. Asians, on the other hand are consistently more likely to purchase company stock than Whites or Blacks. Since these estimates are controlled for salary and education levels, it seems likely that there are in fact racial differences in investment preferences. The higher likelihood of company stock purchase by Asians is magnified during the 1998-2000.

Contrary to the results of the regression on retirement portfolio allocation, the education variable has a positive relationship with probability of company stock purchase. Tobit results also show that those with higher education also buy a higher amount of company stock. Both results are consistent with the hypothesis that employees with higher general human capital are more likely to purchase company stock. However, the probit results show that women with a college degree are less likely to purchase company. Females with college degrees are also less likely to have made ESOP purchases during 1998-2000, the time period when females in general showed an increase in company stock purchase participation.

Employees with higher firm tenure are less likely to purchase company stock, at least after 1992. This is consistent with a view that employees with higher firm tenure also possess higher firm-specific human capital, and have higher diversification concerns with regard to company stock. While married men are less likely to purchase company stock, married women are more likely to purchase stock, at least during 1992-2000. As in the retirement portfolio regressions, older employees are more likely to invest in company stock. These results are contrary to the hypothesis that older employees are more concerned about diversification and prefer not to concentrate their wealth in one stock.

Base salary has a positive relationship with stock purchase probability and the amount of stock purchased. Company stock ownership levels have a negative relationship to direct purchase probability and amount between 1983-1994, and a positive relationship between 1994-2000. And finally, employees seem to substitute between purchased stock and awarded stock. The dollar amount of company stock awarded is negatively related to purchase probability consistently.

Table 4-7 Probit with Direct Purchase and ESOP Participation during 3 years as Dependent Variable -- % calculated at the mean													
(# obs)	1983-85 (2,427)		1986-88 (3,737)		1989-91 (5,253)		1992-94 (7,165)		1995-97 (9,539)		1998-2000 (11,102)		
	Direct	ESOP	Direct	ESOP	Direct	ESOP	Direct	ESOP	Direct	ESOP	Direct	ESOP	
female	-8.2%	2.9%	-13.3%	6.2%	-10.9%	0.3%	2.6%	-5.1%	-4.4%	-7.8%	-5.2%	7.6%	
	(-1.24)	(0.44)	(-2.28)	(1.19)	(-2.42)	(0.10)	(0.66)	(-1.96)	(-1.39)	(-2.92)	(-1.58)	(2.34)	
black	-11.8%	-6.3%	-10.8%	2.4%	-8.2%	-2.2%	-7.4%	1.1%	-10.3%	-0.9%	-19.4%	4.7%	
	(-1.34)	(-0.82)	(-1.70)	(0.45)	(-1.84)	(-0.74)	(-2.44)	(0.48)	(-4.61)	(-0.41)	(-9.39)	(2.28)	
asian	-3.3%	-2.0%	1.0%	6.6%	12.3%	6.5%	7.1%	9.2%	5.7%	6.8%	12.0%	13.2%	
	(-0.77)	(-0.46)	(0.25)	(1.85)	(3.90)	(2.81)	(2.81)	(4.79)	(2.98)	(3.85)	(6.17)	(6.83)	
college+	14.0%	9.7%	15.5%	0.9%	12.0%	0.0%	9.1%	-1.3%	13.6%	1.2%	18.1%	4.8%	
	(4.82)	(3.30)	(5.70)	(0.38)	(5.40)	(0.03)	(4.34)	(-0.86)	(7.50)	(0.72)	(9.59)	(2.55)	
married	-0.7%	0.6%	0.3%	-1.3%	-4.3%	-0.6%	-2.6%	-1.8%	-2.0%	-8.0%	-2.6%	-6.1%	
	(-0.30)	(0.22)	(0.14)	(-0.64)	(-2.35)	(-0.46)	(-1.62)	(-1.49)	(-1.51)	(-6.35)	(-1.89)	(-4.39)	
firm tenure	-0.4%	1.4%	0.2%	1.3%	0.1%	0.1%	-1.7%	-0.4%	-2.0%	-1.8%	-2.4%	-2.2%	
	(-1.48)	(4.48)	(0.67)	(5.87)	(0.52)	(0.85)	(-10.43)	(-3.20)	(-14.70)	(-13.99)	(-18.60)	(-17.59)	
age	0.3%	0.3%	0.4%	0.1%	0.5%	0.1%	0.5%	0.1%	0.5%	0.2%	0.4%	0.0%	
	(3.43)	(3.09)	(3.86)	(1.45)	(6.01)	(1.95)	(7.14)	(2.76)	(8.84)	(3.73)	(6.23)	(0.11)	
salary	0.5%	-0.5%	0.4%	-0.2%	0.4%	-0.1%	0.0%	-0.1%	0.1%	0.0%	-0.1%	0.0%	
	(6.49)	(-6.17)	(6.24)	(-4.20)	(8.92)	(-2.12)	(1.12)	(-3.24)	(2.39)	(-0.82)	(-2.47)	(1.66)	
female x college	-9.9%	-6.4%	-10.4%	1.5%	-2.1%	-1.5%	-5.0%	-1.1%	-7.7%	-3.9%	-0.2%	-10.8%	
	(-2.13)	(-1.40)	(-2.36)	(0.39)	(-0.58)	(-0.61)	(-1.70)	(-0.53)	(-3.17)	(-1.78)	(-0.08)	(-4.37)	
female x salary	0.7%	0.0%	0.8%	-0.2%	0.3%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	
	(3.06)	(0.14)	(4.77)	(-1.68)	(3.16)	(1.24)	(0.73)	(1.53)	(2.64)	(2.28)	(2.12)	(0.48)	
female x married	-3.9%	-6.6%	-3.2%	0.2%	2.6%	-0.2%	1.9%	2.6%	2.0%	12.8%	5.0%	8.9%	
	(-0.91)	(-1.62)	(-0.78)	(0.05)	(0.82)	(-0.12)	(0.70)	(1.28)	(0.87)	(5.65)	(2.13)	(3.86)	
stocks awarded	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
	(-1.57)	(1.10)	(-2.85)	(0.22)	(-3.03)	(-0.84)	(-2.01)	(2.57)	(-2.50)	(0.90)	(-3.30)	(-0.78)	
stocks owned	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
	(-3.76)	(3.27)	(-3.70)	(1.34)	(-2.88)	(1.48)	(-0.17)	(2.42)	(1.00)	(3.30)	(3.37)	(1.96)	
LR	228	80	285	80	417	35	250	54	489	315	776	538	

Table 4-8 Tobit with Direct Purchase and ESOP Participation during the 3 year time interval as Dependent Variable													
(# obs)	1983-1985 (2,427)		1986-1988 (3,737)		1989-1991 (5,253)		1992-1994 (7,165)		1995-1997 (9,539)		1998-2000 (11,102)		
	Direct	ESOP	Direct	ESOP	Direct	ESOP	Direct	ESOP	Direct	ESOP	Direct	ESOP	
female	-3,478	-871	-6,244	665	-1,629	-257	117	-3,331	-4,157	-3,777	-3,478	-871	
	(-0.78)	(-0.48)	(-1.88)	(0.41)	(-0.99)	(-0.14)	(0.11)	(-2.27)	(-2.20)	(-4.18)	(-0.78)	(-0.48)	
black	-9,002	-2,331	-7,373	-238	-2,344	-172	-2,245	339	-6,340	-1,485	-9,002	-2,331	
	(-1.25)	(-0.97)	(-1.84)	(-0.14)	(-1.38)	(-0.09)	(-2.42)	(0.28)	(-4.09)	(-2.04)	(-1.25)	(-0.97)	
asian	-3,036	-614	3,546	1,451	3,638	4,536	1,901	4,174	2,670	1,607	-3,036	-614	
	(-1.04)	(-0.49)	(1.75)	(1.38)	(3.78)	(3.87)	(2.93)	(4.92)	(2.49)	(2.98)	(-1.04)	(-0.49)	
college+	8,326	2,762	7,716	1,495	4,147	623	1,256	-550	6,924	492	8,326	2,762	
	(3.93)	(3.24)	(4.83)	(1.88)	(4.93)	(0.62)	(2.08)	(-0.69)	(5.92)	(0.90)	(3.93)	(3.24)	
married	844	163	-2,123	-819	-1,910	-497	-1,087	-877	-1,109	-2,217	844	163	
	(0.55)	(0.24)	(-1.77)	(-1.27)	(-3.17)	(-0.61)	(-2.49)	(-1.44)	(-1.43)	(-5.69)	(0.55)	(0.24)	
firm tenure	-363	585	280	769	138	248	-206	38	-718	-242	-363	585	
	(-2.02)	(6.92)	(2.17)	(10.93)	(2.23)	(3.13)	(-4.68)	(0.64)	(-9.08)	(-6.13)	(-2.02)	(6.92)	
age	222	97	271	49	165	94	124	84	283	94	222	97	
	(3.77)	(3.68)	(5.56)	(1.89)	(6.51)	(2.96)	(6.89)	(3.31)	(8.97)	(5.82)	(3.77)	(3.68)	
salary	323	-89	281	-37	181	-16	58	-11	10	4	323	-89	
	(7.70)	(-4.26)	(9.32)	(-2.15)	(13.12)	(-0.80)	(6.11)	(-0.79)	(1.66)	(1.14)	(7.70)	(-4.26)	
female x college	-5,169	-2,049	-4,481	-238	-1,008	-620	-28	-512	-3,637	-1,177	-5,169	-2,049	
	(-1.54)	(-1.53)	(-1.74)	(-0.19)	(-0.77)	(-0.42)	(-0.03)	(-0.45)	(-2.37)	(-1.60)	(-1.54)	(-1.53)	
female x salary	307	53	246	-54	40	43	-11	55	84	52	307	53	
	(2.39)	(0.86)	(2.95)	(-1.15)	(1.18)	(0.98)	(-0.50)	(1.84)	(2.78)	(3.53)	(2.39)	(0.86)	
female x married	-1,763	-1,936	1,781	354	1,024	471	1,035	1,402	1,362	3,584	-1,763	-1,936	
	(-0.62)	(-1.62)	(0.79)	(0.31)	(0.95)	(0.36)	(1.41)	(1.35)	(0.99)	(5.26)	(-0.62)	(-1.62)	
stocks awarded	0	0	0	0	0	0	0	0	0	0	0	0	
	(-0.80)	(1.95)	(-1.32)	(0.96)	(-0.58)	(-0.05)	(-0.86)	(1.93)	(4.77)	(1.76)	(-0.80)	(1.95)	
stocks owned	-13	4	-8	1	-10	2	-2	2	4	2	-13	4	
	(-4.28)	(2.92)	(-3.97)	(1.28)	(-4.33)	(1.13)	(-2.07)	(1.44)	(4.40)	(3.57)	(-4.28)	(2.92)	

4.5. Analysis

There are three noteworthy results from above. First, gender differences in company stock investment depend a lot on the education levels of the employees. Females with college educations are less likely to purchase company stock throughout the study period. In contrast, in 1999 females without a college degree are allocating on average 4 percent more toward company stock than males, and they are also 7.6 percent more likely to purchase company stock through ESOPs than males.

Given that the coefficients for the female variable in the ESOP participation equation are negative or not statistically significant during 1983-1998, we assume that this result is very specific to the time period 1998-2000. What makes 1998-2000 so special? This is a time period when the returns to this company's stock averaged 182% annually. This incredible return beats the Nasdaq which had a 85% return for 1999. The overall participation rate in this company's ESOP increased from 17% in 1995-1997 to 36% of employees in 1998-2000. One plausible theory why company stock investment increased among women without college education during this time period is that the incredibly high returns earned by the stock increased the visibility of the company stock. The increased visibility would have affected employees who were previously not inclined to invest in company stocks.

Second, married women allocated a slightly lower percentage of retirement wealth in company stock in 1999, but were much more likely to purchase company stock during 1998-2000. Married men allocated a 2 percent higher toward company stock in their retirement portfolio in 1999, but were less likely to purchase stock either through ESOPs or through direct purchase during the same time period. One explanation of why

married females would be more willing to participate in company stock purchase is that married females are more likely to be part of a two-income household than married males. As part of a two income household, married women have less diversification concerns for the household, and are more likely to invest in company stocks. This does not, however, explain why the pattern is reversed in retirement portfolio allocation.

And finally, there are significant race differences in company stock investment patterns. Blacks allocated 3 percent higher portion of their retirement account in company stocks, and were 5 percent more likely to make ESOP purchases in 1998-2000. But they were 19 percent less likely to purchase company stock through direct purchase methods. Asians on the other hand were more likely than Blacks and Whites to purchase company stock through direct purchase and ESOP methods. I do not know of other studies which have explicitly looked at investment preferences of Asian-Americans, but in a study regarding employee tax-deferred account (TDA) participation at Harvard University, Duflo and Saez find that presumably Asian employees at the Asian-Studies library had the highest TDA participation rate (73%) of any department in the whole university (Duflo and Saez 2000).

ESOPs and retirement accounts seem to more effective in females and non-Whites to invest in company stock. The 1998-2000 period seems to be an outlier in terms of stock returns and overall investment climate. As Madrian & Shea found in their study, automatic nature of ESOPs and retirement accounts are better suited for increasing participation among previously underrepresented groups.

4.6.

Employee Opinion Survey

To examine gender differences beyond what can be gleaned from stock purchase records, I use the results of an employee opinion survey conducted by the firm in the summer of 1998. The following tables summarize the answers to survey questions by aggregating several categories into two categories, and a category for “Don’t Know”.

Question 1: How satisfied are you with the company?

			<i>College</i>		<i>High School</i>	
	<i>Females</i>	<i>Males</i>	<i>Females</i>	<i>Males</i>	<i>Female</i>	<i>Male</i>
<i>Satisfied</i>	68%	70%	66%	69%	73%	72%
<i>Dissatisfied</i>	30%	30%	33%	30%	25%	28%
<i>Don't Know</i>	1%	0%	1%	1%	1%	1%

Question 2: I can generally believe the information I get from management.

			<i>College</i>		<i>High School</i>	
	<i>Females</i>	<i>Males</i>	<i>Females</i>	<i>Males</i>	<i>Female</i>	<i>Male</i>
<i>Agree</i>	63%	70%	63%	71%	64%	65%
<i>Disagree</i>	36%	29%	35%	28%	35%	34%
<i>Don't Know</i>	1%	1%	2%	1%	1%	1%

Question 3: How well is the company communicating information on the financial performance of the company?

			<i>College</i>		<i>High School</i>	
	<i>Females</i>	<i>Males</i>	<i>Females</i>	<i>Males</i>	<i>Female</i>	<i>Male</i>
<i>Good</i>	82%	84%	83%	85%	79%	81%
<i>Avg/Poor</i>	17%	15%	16%	14%	19%	17%
<i>Don't Know</i>	1%	1%	1%	1%	2%	2%

Question 4: I understand the various ways I can invest in company stock.

			<i>College</i>		<i>High School</i>	
	<i>Females</i>	<i>Males</i>	<i>Females</i>	<i>Males</i>	<i>Female</i>	<i>Male</i>
<i>Agree</i>	67%	79%	71%	81%	60%	69%
<i>Disagree</i>	30%	20%	26%	18%	35%	28%
<i>Don't Know</i>	3%	1%	3%	1%	4%	3%

Question 5: I have confidence in the company stock pricing and in the internal market system.

			<i>College</i>		<i>High School</i>	
	<i>Females</i>	<i>Males</i>	<i>Females</i>	<i>Males</i>	<i>Female</i>	<i>Male</i>
<i>Agree</i>	69%	67%	69%	67%	69%	67%
<i>Disagree</i>	20%	27%	21%	28%	17%	23%
<i>Don't Know</i>	11%	6%	10%	5%	14%	10%

Question 6: I believe that stock ownership at this company is more valuable than stock in most other companies.

			<i>College</i>		<i>High School</i>	
	<i>Females</i>	<i>Males</i>	<i>Females</i>	<i>Males</i>	<i>Female</i>	<i>Male</i>
<i>Agree</i>	52%	58%	52%	59%	53%	56%
<i>Disagree</i>	31%	33%	33%	33%	27%	31%
<i>Don't Know</i>	16%	8%	15%	8%	19%	13%

Question 1 asks employees a general question about their feelings toward the company. There are no gender differences in satisfaction rates regarding the company. Answers to question 2 shows that there is a statistically significant difference between men and women regarding whether they believe the information provided by management. Further, the overall gender difference is due to the difference between college educated women and college educated men. On average, college educated women are less willing to believe the information from management than college educated men. However, the answers to question 3 show that there is no statistically significant difference in the employee attitudes toward information about the financial performance of the company.

Question 4 shows that there is a significant gender difference in whether employees think they understand the various ways to invest in company stock. Women in general were more likely to think that they don't understand the ways to invest in the company stock. Women were more likely than men to answer that they didn't know the

answer to the question regarding the confidence in the pricing system. the than men; and women were also more likely to answer “Don’t Know” when asked whether they thought this company’s stock was more valuable than another company’s stock.

These response patterns supports the hypothesis that females are less confident about investing in company stock. The gender differences do not disappear when we look at education subgroups.

4.7. Conclusion

There are statistically significant gender differences in investment preferences for company stock. The difference is subtle, as it interacts with marital status, education levels, and race. While the exact causal mechanism is unclear, during the most recent three-year period, 1998-2000, mean participation rates of women and Blacks increased, especially for ESOP purchases. The annual returns during 1998 to 2000 were much higher than the historical average for this stock, as well as for the overall public stock market. Why previously underrepresented groups like females and Blacks are more likely to invest in company stock during booms is an interesting avenue of research.

Another finding is that there are statistically significant differences in investment choices for Asian-Americans. While much social science research focuses on racial differences between Whites and non-Whites, or Whites and Blacks, this chapter shows that there are some important differences that are specific to Asian-Americans. Studies conducted with dummy variables segregating only between Whites and non-Whites may be lumping together two categories, Blacks and Asians, that exhibit very different investment preferences. This will become more prevalent as the proportion of Asian-Americans increase in the United States.

5. BEHAVIORAL THEORIES APPLIED TO COMPANY STOCK OWNERSHIP

5.1. Introduction

Given the numerous experimental and empirical evidence documenting the average investor's susceptibility to non-optimal behavioral biases in personal investment choices (Thaler 1993; Shiller 1998), and the special nature of employer stock as an investment vehicle, it is important to investigate how employees invest in company stock. Recent work on this subject have found evidence of employees exhibiting behavioral biases as opposed to following the predictions of neoclassical theories of portfolio optimization that depend solely on risk aversion and wealth levels. The evidence includes a study of executive stock options in public U.S. companies (Heath, Huddart et al. 1999), a survey of the prevalence of company stock in retirement plans (Benartzi 1999) and a detailed investigation of a French initial public offering of company stock to employees (Degeorge, Jenter et al. 2000).

Employee decisions regarding company stock ownership is likely to be prone to behavioral biases that are not consistent with neoclassical portfolio models. Because of the correlation between firm-specific human capital and company stock returns, most portfolio models predict that company stock would not be very popular among employees. Yet, as we have seen throughout this thesis, company stock ownership is very popular at this company. Second, there is evidence that most investors are not very well informed about finance and probability theory (Bernheim 1994; Bernheim and Garrett 1996). Rank and file employees who are exposed to company stock ownership through their job are most likely first time investors who do not know much about optimal diversification and portfolio theory.

The behavioral finance literature has postulated that these financially “unsophisticated” investors follow certain biases when making financial decisions. Kahneman and Riepe grouped these biases into three categories: 1) psychological attitudes toward risk as opposed to mathematical calculation of risk, 2) formation of expectations based on heuristics rather than Bayesian analysis, and 3) differing decisions on the same problem based on the framing of the problem (Kahneman and Riepe 1998).

While all three categories are interesting to analyze in the context of company stock ownership, this chapter will focus on the formation of expectations based on heuristics. To make an optimal investment decision, neoclassical portfolio theory would predict that an employee would need to calculate expected returns and expected volatility of the company stock, as well as likely future growth paths of the employee’s human capital and the current stage of the life cycle of the employee’s investment profile. But economic theory does not provide a simple formula to calculate optimal allocation percentages for privately-held company stock. Without a simple formula to follow, it is more likely that employees will follow a heuristic rather than try to figure out the optimal allocation percentages using dynamic programming models.

5.2. Representativeness Bias

Absent a widely accepted formula, it is very likely that employee investors will follow the representativeness heuristic. Investors following the representativeness heuristic (Kahneman and Tversky 1972) assume incorrectly that they are observing a representative sample of a long-term sequence of returns after observing only a short sequence of returns. For example, many people believe that a series of coin tosses that result in the following sequence Heads-Heads-Heads-Heads-Heads is indicative of a

Heads-only coin, and a sequence like Heads-Tails-Heads-Tails-Heads is indicative of a fair coin. But probabilistically, both sequences are just as likely to occur with a fair coin. By the same token, without any additional information, investors extrapolating that a company stock that returned 25% per year for five years straight is much more likely to return 25% the next year than a stock that returned 5%, 25%, 3%, 10%, and 6% during the same five years also suffers from representativeness bias. Representativeness bias has been used to explain phenomena such as stock market overreaction to news (DeBondt and Thaler 1985; DeBondt and Thaler 1987) and positive correlation of flow of mutual fund investment and past performance (Patel, Zeckhauser et al. 1991)²⁴. Benartzi found that allocation to one's employer's stock in one's retirement portfolio is positively correlated with immediate past performance of the stock (Benartzi 1999).

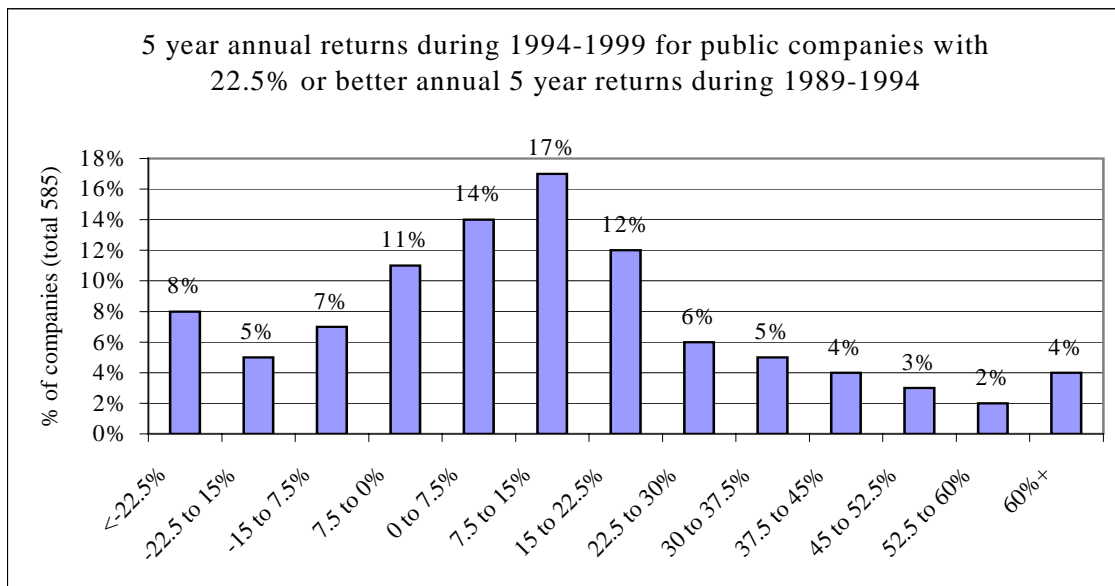
As seen in the first chapter, this company's stock has had higher average returns than the Nasdaq with less volatility than the S&P500 for the last ten years. An investor following the representativeness heuristic would be very prone to investing in this company. In fact, given the historical return-volatility ratios, if the company stock were publicly traded, a simple CAPM portfolio allocation model would recommend allocating 120% of one's assets in this company's stock.

But holding only one stock in a portfolio exposes the investor to a lot of risk, regardless of the historical return-to-volatility ratio. First, past performance is not necessarily a good indicator of future performance. The graph below shows the

²⁴ Patel, Zeckhauser et al. found that prior period stock price change of more than 10 percent induced a 6 percent change in the same direction in mutual fund investments by households regardless of informative news.

economic performance of 584 publicly traded firms during 1994-1999 who had earnings growth in excess of 22.5% per annum (the average five year earnings growth of this firm) for the five previous years from 1989-1994. It shows that almost a third of the firms earned negative returns for five years following the five profitable years²⁵.

Figure 5-1



There is also a pure diversification cost to holding a portfolio concentrated in only one stock. Brennan and Torous ran a simulation model that shows that the certainty equivalent of holding a one-stock portfolio is equivalent to 36 cents to the dollar (Brennan and Torous 1999). This exact figure does not apply to privately held stock, but this calculation does point out the magnitude of diversification risk inherent in a one-stock portfolio.

²⁵ Data from Compustat.

It is beyond the scope of this paper to compare actual employee transactions with a neoclassical prediction of purchases and sales. There is a no neoclassical empirical method to evaluate expected returns and expected volatility of non-publicly traded assets. Instead, this chapter examines whether there are identifiable patterns in transactions that resemble representativeness bias by using 17 years worth of transaction data for over 50,000 employees.

For example, the quarter containing Black Monday of October 1987 is especially interesting because the remarkable drop in equity prices during the third week of October, 1987 was precipitated by virtually no dramatic news that would justify such a drop. Looking at the stock purchase rates for the fiscal third quarter of 1987, which corresponds to October 1987, on table 5-1 we see that the employees reacted to the negative shock in the public stock market by reallocating their wealth into this company's stock. Direct purchase rates shoot up to 8.9 percent and then 10.2 percent in the fourth quarter compared to the 2.7 percent purchase rate average for preceding periods.

This is rather odd because according to the stock price formula for this company stock, it is obvious that a large negative shock like Black Monday in October 1987 will eventually be reflected in the company stock price through the expectations factor, which is partially tied to the performance of public company comparables. Accordingly, a truly rational investor would have shied away from company stock until the Black Monday factor was priced into the company stock, and instead allocated into non-equity investments.

TABLE 5-1: Purchase and Sale Participation Rate by Quarters

<i>Quarter</i>	<i>Stock Price Growth</i>	<i>Direct</i>	<i>ESOP</i>	<i>Sell</i>	<i>Quarter</i>	<i>Stock Price Growth</i>	<i>Direct</i>	<i>ESOP</i>	<i>Sell</i>
84Q4	1.0%	3.7%	11.3%	6.7%	92Q1	0.2%	4.7%	5.8%	10.7%
85Q1	17.4%	4.3%	11.9%	7.7%	92Q2	4.4%	3.6%	5.9%	12.3%
85Q2	2.4%	2.6%	12.3%	8.5%	92Q3	1.5%	4.8%	6.3%	9.9%
85Q3	1.0%	2.7%	12.1%	6.4%	92Q4	1.5%	3.3%	6.7%	11.3%
85Q4	3.6%	1.5%	11.8%	8.6%	93Q1	5.2%	4.0%	7.1%	11.7%
85Q1	4.8%	2.4%	12.7%	10.5%	93Q2	1.7%	4.2%	7.2%	11.6%
85Q2	3.9%	1.4%	12.8%	9.9%	93Q3	2.1%	4.2%	7.3%	9.5%
85Q3	3.3%	2.2%	13.1%	7.5%	93Q4	8.2%	4.2%	7.6%	11.7%
85Q4	20.3%	2.6%	13.7%	7.6%	94Q1	1.9%	2.9%	7.4%	9.9%
86Q1	7.9%	2.8%	14.5%	10.5%	94Q2	0.1%	3.6%	7.6%	11.7%
86Q2	5.0%	2.6%	15.7%	12.3%	94Q3	4.1%	3.3%	8.2%	11.9%
86Q3	3.4%	3.3%	16.4%	8.4%	94Q4	4.3%	4.0%	8.8%	9.6%
86Q4	2.1%	2.6%	16.1%	16.6%	95Q1	4.4%	5.5%	9.7%	11.8%
87Q1	1.8%	3.4%	16.6%	10.7%	95Q2	8.4%	3.1%	9.9%	11.7%
87Q2	3.4%	2.3%	8.0%	9.1%	95Q3	2.7%	3.6%	10.4%	10.6%
87Q3	3.2%	8.2%	9.0%	8.0%	95Q4	5.8%	4.0%	11.3%	10.8%
87Q4	-4.9%	10.9%	8.9%	10.9%	96Q1	5.6%	4.1%	11.5%	13.6%
88Q1	6.1%	5.1%	8.1%	10.0%	96Q2	7.3%	4.5%	12.3%	10.1%
88Q2	5.2%	4.1%	8.4%	9.5%	96Q3	4.3%	4.4%	12.7%	10.1%
88Q3	3.6%	5.9%	8.8%	7.0%	96Q4	13.7%	4.0%	13.2%	10.0%
88Q4	0.6%	5.7%	8.6%	8.2%	97Q1	2.3%	4.7%	15.2%	14.7%
89Q1	1.2%	4.9%	8.1%	11.1%	97Q2	13.0%	4.4%	16.4%	11.2%
89Q2	3.5%	3.6%	7.9%	11.5%	97Q3	15.9%	5.8%	18.0%	10.8%
89Q3	4.9%	4.4%	7.5%	8.5%	97Q4	12.5%	5.6%	19.3%	9.7%
89Q4	3.6%	5.1%	7.1%	7.4%	98Q1	20.7%	7.4%	20.8%	11.8%
90Q1	0.6%	3.5%	6.7%	11.6%	98Q2	16.3%	7.9%	22.8%	8.6%
90Q2	3.8%	2.9%	6.6%	15.6%	98Q3	7.2%	5.6%	23.9%	9.6%
90Q3	-1.3%	2.8%	6.5%	11.8%	98Q4	18.6%	8.3%	25.3%	9.3%
90Q4	1.6%	2.9%	6.3%	9.4%	99Q1	3.7%	6.9%	26.3%	10.4%
91Q1	6.0%	2.8%	6.1%	11.0%	99Q2	6.9%	10.2%	28.0%	10.4%
91Q2	2.2%	2.9%	6.3%	13.7%	99Q3	3.3%	7.5%	29.4%	12.0%
91Q3	2.4%	2.5%	6.2%	8.0%	99Q4	29.7%	7.7%	30.1%	11.4%
91Q4	3.0%	5.6%	5.9%	10.2%	00Q1	16.7%	9.4%	31.3%	12.8%

But in response to a highly negative shock in the public market, employees flocked to the company stock, which until the fourth quarter of 1987, did not have a negative stock growth rate for a long time. More pointedly, after the initial surge in company stock purchase through direct purchase, the participation rate goes back down

to the historical average of about 3 to 4 percent for the next 10 years, indicating that employees sought a one-time refuge from the turmoil in the public market, not a permanent reallocation of assets based on long term expectations.

As another example of representativeness bias, look at the average annual returns and the percentage of eligible employees who purchased and sold company stock on table 5-1. Note that beginning in 1995, the returns increased much faster compared to the historical average. The simple average annual return between 1984-1994 was 14%, whereas the average annual return from 1995-1999 was 50%. Correspondingly, the average annual ESOP purchase rates jumped from a historical average of 9% to 20% in the last five years. In the beginning of 1995, 9% of employees purchased company stock through ESOP salary deferrals. By the end of 1999, 30% of employees purchased company stock through the ESOP.

Clearly, more employees purchased company stock during 1995-2000 than in any other time period in the history of this company. If this buying spree was based on rational calculations of expected future earnings, expected volatility of these earnings, and correlation of financial and human capital returns, neoclassical theory would have to assume that as returns increased between 1995-2000, future expected returns increased even faster.

5.3. Representativeness Bias: Empirics

Employees exhibiting representativeness bias extrapolate future returns from short term trends. Accordingly, employees are more likely to purchase, and purchase larger amounts of company stock, the higher the stock price growth of the previous quarters.

Table 5-2 and table 5-3 try to quantify the difference in participation and mean purchase amounts per previous period stock price percentage increase. The first two columns in each table show the results of a probit regression for purchase participation rates. The next two columns show coefficients and t-statistics from an ordinary least squares regression with the amount of stock purchase as the dependent variable. The last two columns show the coefficients of a Tobit regression that assumes censoring at zero. Independent variables can be divided into two groups: ones that change per quarter like base salary, firm tenure, age, previous period ownership, awards and options exercised; and ones that are assumed constant throughout the time periods like education levels, gender, and race.

The explanatory variables of interest are percentage change of the stock price from the previous quarter and percentage change of book equity value from the previous quarter. A positive and significant coefficient for the percentage change of the stock price in the regressions would be consistent with the hypothesis that employees suffer from representativeness bias. Given the mechanical relationship between book value equity and stock prices in this market, positive and significant coefficient for the percentage change in book value equity is to be expected if employee-investors rely on news about earnings and the asset value of the company to make predictions about future returns.

In table 5-2, the coefficients for both the price growth rate and the equity growth rate are below one percent, but they are both positive and statistically significant. The coefficients in the ordinary least squares equations show that among purchasers, a one percentage increase in stock price increases the purchase amount by \$95, and one percentage increase in equity value increases direct purchase by \$45. The Tobit results

show that a increase of one percent in stock return increases direct purchase of stock by roughly \$166 per employee and a percentage increase in equity increases direct purchase by \$121. Since mean stock awards from the company for the last five years was about \$3000, a percentage increase in stock price growth accomplishes about 5% of what an outright stock award increase does to employee stock ownership.

The ESOP purchase model in table 5-3 has higher coefficients for the probit regression. One percentage increase in the stock price translates to a 2.6 percent increase in the probability of making an ESOP purchase, while a percentage change in equity induces a 1.1 percent increase. This is much higher than the effect on the direct purchase model, and indicative of the higher mean participation rates for ESOP purchases. Percentage change of the stock price from the previous quarter and percentage change of book equity value from the previous quarter have negative effects on dollar amount of ESOP purchase. This could be because high purchase participation rates mean that these employees who are newly participating in the ESOP do not purchase as much as employees who were already participating in the ESOP. The Tobit equations show a net positive coefficient for the effect of the change in stock price and equity per percentage, of \$40 and \$18, respectively. The sum of the effects is that more money is going into buying company stock.

Both sets of regressions are consistent with the behavioral hypothesis that asset demand is higher when current performance is higher, even after controlling for changes in the fundamental expected return of the asset.

Table 5-2: Direct Purchase Regressions

Dependent Variable	Probability of Direct Purchase per Quarter		\$ Direct Purchase Per Quarter		\$ Direct Purchase Per Quarter	
	Probit (1)	Probit (2)	OLS (1)	OLS (2)	TOBIT (1)	TOBIT (2)
% chg stock price (t,t-1)		0.009 (20.65)**		95.571 (9.85)**		166.088 (23.55)**
% chg equity (t,t-1)		0.007 (23.70)**		44.51 (6.99)**		120.290 (24.63)**
stock owned at t-1 (\$ '000)	0 (1.99)*	0 (1.88)*	10.626 (25.04)**	10.372 (24.48)**	0.458 (4.54)**	0.451 (4.45)**
options exercised in t (\$ '000)	-0.001 (3.99)**	-0.001 (4.13)**	66.733 (8.47)**	67.069 (8.54)**	-3.811 (-0.93)	-4.326 (-1.06)**
stock awarded in t (\$ '000)	0.005 (5.80)**	0.006 (7.19)**	64.233 (2.67)**	85.873 (3.57)**	80.240 (6.21)**	97.351 (7.73)**
female	-0.066 (9.27)**	-0.07 (9.84)**	-1141.58 (6.52)**	-1240.69 (7.09)**	-1,323.000 (-11.14)**	-1,396.382 (-11.78)**
black	-0.278 (15.43)**	-0.303 (16.76)**	-1383.93 (2.84)**	-1592.3 (3.28)**	-4,643.396 (-15.17)**	-5,079.582 (-16.60)**
asian	0.193 (16.74)**	0.183 (15.80)**	676.669 (2.55)*	576.269 (2.17)*	3,176.104 (16.53)**	2,974.300 (15.52)**
college	0.415 (42.15)**	0.403 (40.79)**	681.269 (2.53)*	563.929 (2.10)*	6,712.520 (39.87)**	6,444.648 (38.41)**
firm tenure (year)	-0.036 (39.69)**	-0.036 (39.89)**	111.82 (5.07)**	104.699 (4.76)**	-509.149 (-33.89)**	-511.715 (-34.18)**
age (year)	0.014 (44.58)**	0.014 (43.27)**	42.438 (5.64)**	41.563 (5.54)**	229.833 (43.41)**	222.027 (42.04)**
estimated base salary (\$'000)	0.001 (19.06)**	0.001 (15.96)**	26.459 (13.69)**	24.149 (12.47)**	24.900 (21.69)**	21.412 (18.51)**
Constant	-2.479 (154.16)**	-2.551 (156.63)**	-110.351 -0.26	-855.328 (1.99)*	-41,985.970 (-123.96)**	-43,050.540 (-125.69)**
# Observations	540,807	540,807	26,199	26,199	540,807	540,807
Rsq			0.06	0.07		
	All Employee-Quarter Combinations		Employee – Quarter w/ Direct Purchase		All Employee-Quarter Combinations	

Probit % measured at mean. Absolute value of t-statistics in parentheses. * significant at 5% level; ** significant at 1% level

Table 5-3: ESOP Purchase Regressions

Dependent Variable	Probability of ESOP Purchase per Quarter		\$ ESOP Purchase Per Quarter		\$ ESOP Purchase Per Quarter	
	Probit (1)	Probit (2)	OLS (1)	OLS (2)	TOBIT (1)	TOBIT (2)
% chg stock price (t,t-1)		0.026		-7.423		40.167
		(84.65)**		(26.98)**		(78.54)**
% chg equity (t,t-1)		0.011		-1.033		17.995
		(49.90)**		(5.58)**		(49.57)**
stock owned at t-1 (\$'000)	0	0	0.474	0.481	0.050	0.053
	(3.80)**	(4.09)**	(38.65)**	(39.40)**	(5.70)**	(5.92)**
options exercised in t (\$'000)	0	0	0.976	0.852	1.641	1.691
	-0.81	-1.63	(6.55)**	(5.74)**	(6.41)**	(6.69)**
stock awarded in t (\$'000)	0.005	0.009	0.854	-0.208	12.103	16.646
	(6.29)**	(11.40)**	-1.57	-0.38	(11.14)**	(15.59)**
female	0.028	0.009	-102.739	-94.813	-30.367	-47.025
	(5.70)**	(1.87)*	(20.92)**	(19.36)**	(-3.70)**	(-5.69)**
black	-0.013	-0.073	-82.923	-69.899	-51.419	-141.898
	-1.28	(7.01)**	(7.97)**	(6.75)**	(-2.94)**	(-8.13)**
asian	0.256	0.234	134.738	138.509	454.140	415.623
	(30.27)**	(27.27)**	(17.42)**	(17.99)**	(32.02)**	(29.55)**
college	0.198	0.197	47.386	51.01	426.279	376.943
	(32.40)**	(31.66)**	(7.15)**	(7.73)**	(41.09)**	(36.00)**
firm tenure (year)	-0.021	-0.021	5.128	4.498	-31.276	-30.719
	(34.11)**	(32.80)**	(8.00)**	(7.04)**	(-30.26)**	(-29.90)**
age (year)	0.009	0.009	6.413	6.264	19.721	18.403
	(37.99)**	(37.60)**	(27.77)**	(27.25)**	(52.28)**	(48.00)**
estimated base salary (\$'000)	0.003	0.001	14.422	14.913	5.407	4.230
	(48.04)**	(22.11)**	(149.01)**	(151.86)**	(254.72)**	(40.59)**
Constant	-1.669	-1.849	-163.262	-115.297	-3,158.212	-3,379.844
	(155.63)**	(168.14)**	(14.78)**	(10.33)**	(-153.56)**	(-161.78)**
# Observations	540807	540807	76233	76233	540807	540807
Rsq			0.42	0.42		
	All Employee-Quarter Combinations		Employee - Quarter w/ Direct Purchase		All Employee-Quarter Combinations	

Probit % measured at mean. Absolute value of t-statistics in parentheses. * significant at 5% level; ** significant at 1% level

5.4.

Peer Effects

The second part of this chapter on behavioral theories focuses on the influence of social interactions on investment decisions. If rank and file employees are not very informed about optimal investment strategies, they may base their decisions on suggestions of colleagues at work, even if the usefulness of the information is questionable. If employees base their decisions on what others in their office did, the theory of peer effects may explain how company stock ownership may become very popular in one office, while not at all in another office.

Many papers examine the existence of peer effects on a variety of social phenomena such as crime (Glaeser, Sacerdote et al. 1996), welfare participation (Bertrand, Mulainathan et al. 1998), and teenage behavior (Case and Katz 1991). More recently, there has been interest in applying the concept of peer effects to savings decisions at the workplace. One study found evidence of peer effects in the investment participation decisions of groups of university workers (Duflo and Saez 2000) and another found evidence of peer effects in savings plan participation at a large insurance company (Madrian and Shea 2000).

The theory of peer effects assumes that due to information cascades and/or peer pressure, peer decisions affect one's own decisions. Peer effects would seem to be especially relevant in company stock purchase for several reasons. First, company stock price is surely a common topic at the proverbial office water cooler. Information and opinions regarding company stock is a likely conversation topic among co-workers. If the theory of information cascades (Banerjee 1992) holds true, even though the underlying

asset is the same, some offices may have a lot of company stock investors, and others none at all. are likely to base their investment decisions on them.

A good example of the effect of an information cascade is the example of two restaurants and a hundred customers. Assume all customers have no knowledge of whether one restaurant is better than the other and the 100 customers decide between the two restaurants sequentially. Also assume that the customers don't know that the other customers don't know anything about the restaurants. Then, the choice of the first customer will be random, because there is no information to improve the 50-50 odds that one restaurant is better than the other. But the second customer will see that the first customer chose one of the restaurants. Absent any other information, the second customer is now more inclined to choose the same restaurant that the first customer chose, by assuming that the first customer knows something that the second customer doesn't. The third customer would follow the same strategy, and pretty soon, all 100 customers will choose the same restaurant as the first customer, purely based on the chance choice of the first customer.

There are several reasons why peer effects are difficult to identify empirically. Members of the same group are likely to share a common environment that cannot be captured by an independent variable. There is also the possibility of self-selection bias, since agents are likely to join groups whose members share an unobservable characteristic. Econometrically, the way around the problem is to find an instrumental variable that is correlated with group average participation, but not with individual participation decisions.

As explained in detail in by Manski (Manski 1993), there are several levels of effects that are intertwined when analyzing peer effects. There is a pure peer effect on company stock purchase decisions if the information gleaned from the water cooler leads an employee to buy company stock. Separate from the peer effect is the selection effect, where employees who are more likely to purchase company stock, perhaps because they earn higher salaries or are wealthier, are also more likely to be working in the same office. There is also the possibility of an environment effect, where working in a particular office exposes the employees to a stimulus, perhaps a poster explaining the benefits of company stock, that causes employees in that group to purchase company stock. The ideal test of peer effects would be a random assignment of employees to various divisions within the company and observing stock purchase activity.

5.5. Peer Effects Empirics

Groups in this sample are defined as employees working in the same office. Because I use group averages extensively, any group with less than 20 employees were taken out of the sample. After this initial cut, the sample consisted of 13,600 employees, belonging to groups ranging from 20 to 313 members. The average group participation rate for direct purchase of company stock was 53%. Participation is defined as positive if an employee has purchased stock at least once in her career.

Table 5-4

<i>Avg Group Participation</i>	<i>% of sample</i>	<i>Avg. # emps</i>	<i>Avg. Share Ownership</i>	<i>Avg. Firm Tenure</i>	<i>Avg # Shares Awarded</i>
0-20%	5%	89	\$2,100	0.6	33
20-40%	14%	60	\$26,400	2.1	358
40-60%	49%	77	\$70,600	3.5	789
60-80%	30%	64	\$126,500	4.8	1744
80-100%	2%	40	\$387,100	7.9	8379

Table 5-4 shows that groups with high direct purchase participation rates have higher average ownership shares, longer firm tenure, and higher base salaries. The key will be trying to isolate the effect of peer effects from the effects of firm tenure, shares owned, and shares awarded to the employee from the company.

Table 5-5

<i>Direct Purchase Dummy</i>	<i>OLS</i> <i>Rsqr = .169</i>	<i>2SLS</i> <i>Rsqr = .165</i>
<i>average office participation in direct purchase of stock</i>	.516 (20.83)	.320 (8.47)
<i>firm tenure</i>	.003 (1.64)	.004 (2.56)
<i>first year of tenure</i>	.114 (10.96)	.121 (11.53)
<i>age</i>	.003 (7.73)	.003 (7.55)
<i>education</i>	.024 (11.61)	.026 (12.27)
<i>female</i>	.018 (2.08)	.021 (2.39)
<i>black</i>	-.073 (-4.87)	-.081 (-5.35)
<i>asian</i>	.072 (4.52)	.074 (4.62)
<i>hispanic</i>	-.050 (-2.30)	-.050 (-2.32)
<i>salary (\$'0,000)</i>	.014 (6.91)	.015 (7.12)
<i>shares owned (10,000 shares)</i>	.071 (3.97)	.069 (3.87)
<i>retirement wealth (\$'000,000)</i>	.015 (3.03)	.015 (2.99)
<i># shares awarded (10,000 shares)</i>	-.036 (-4.10)	-.035 (-3.96)

t-stats in parentheses.

The empirical model would look like this: $y_i = \alpha + \beta E_{-i}(y | x) + \eta E(Z | x) + u$.

y_i is the participation dummy of employee i , and x is the offices that employees belong to. $E(y|x)$ is the group average participation rate excluding employee i . β is the coefficient estimate of the peer effect of group x on the company stock purchase of

employee i . $E(Z|x)$ represents averages of other observable characteristics of the group such as the average age or average firm tenure of the group. u represents characteristics of the members of the group that are unobservable to the econometrician, such as personal risk preferences.

The ordinary least squares regression results on table 5-5 shows that there is a strong effect of β , the peer effect. Employees that belong to groups with high average stock purchase participation rates are also more likely to participate in stock purchase. There is a strong effect of the number of employees in

The two-stage least squares (2SLS) regression in the second column of table 5-5 uses group averages of firm tenure, age, base salary and education levels as instrumental variables. They are valid instruments because while group averages of firm tenure, age, base salary and education levels are strongly correlated with group averages of purchase participation, they do not directly influence employee i 's purchase participation decision.

The peer effect coefficient in the 2SLS regression is smaller in magnitude than the peer effect coefficient in the OLS. An individual's decision to purchase company stock is positively influenced by the average direct purchase participation of the worker's group, but at least some of the peer effect is due to η , the effect of observable group characteristics and employee's membership in that group.

The 2SLS specification assumes that there is no direct causal relationship between department characteristics (group's average firm tenure, average salary, etc.) and an individual employee's purchase decision. It also assumes that the group average of stock purchase participation, $E(y|x)$ is not correlated with u , the unobservable group characteristic that may influence the individual purchase participation decision.

5.6. Conclusion

The evidence in this chapter showed that employees investing in company stock may be subject to behavioral biases like representativeness bias and peer effects. These theories of personal investment are attractive complements to the standard neoclassical portfolio allocation models, especially in explaining the popularity of company stock as an employee investment option. High levels of company stock ownership by rank and file employees are not explained very well with standard neoclassical theories. Most rank and file employees do not have enough authority for their efforts to directly affect the stock price, so holding company stock for purely economic incentive reasons does not make sense. Further, diversification concerns stemming from the correlation of financial capital with human capital predict that employees would stay away from company stock.

But evidence presented in this chapter suggests that the nature of company stock ownership, investing in the company you work for, makes it especially prone to representativeness bias and peer effects. A common assumption in the two behavioral theories is that employees base their company stock investment decisions on easy-to-acquire information. Following the representativeness heuristic only requires the observation of a short-term trend. Peer effects only require the observation or acquisition of information from an office colleague. Assuming that rank and file employees base their financial decisions on easy-to-acquire information is ultimately more believable than a model that assumes these employees process vast amounts of financial data and theories as the efficient market models predict.

6.

CONCLUSION

This dissertation presented four empirical studies regarding company stock ownership and company stock compensation. Besides the issues addressed in the four chapters, there are some intriguing questions that are still outstanding. The first chapter showed that company stock ownership reduces the likelihood of employee turnover. The chapter did not, however, address the question of whether increased retention of employees is worth the costs of providing stock compensation to these employees. The company under study does not have many outside, non-employee shareholders. But in a publicly traded firm, non-employee shareholders would surely not want the stock diluted unless there were clear productivity gains from stock compensation.

The second chapter dealt with the consequences of wage dispersion on division productivity and turnover rates, as well as the effect of bonus dispersion on employees in different bonus distribution rankings. An interesting question that was not addressed in this chapter is the consequence of stock compensation differentials due to the timing of employee's entry into a firm. Strike prices of employee stock options are usually set at-the-money when an employee starts with the firm. Instead of compensation differing only by a few thousand dollars between an engineer with one and two years of firm tenure, the gap can easily be as large as a few hundred thousand dollars if the first engineer joined the firm before an IPO and the second engineer joined after the IPO.

As a consequence an employee's wealth may depend on when an employee started at a firm, rather than her productivity value to the firm. A desk clerk who has been with the firm since the founding could have more options with a lower strike price than a

high-salaried engineer who just started with the firm. Such pay dispersion can have effects on morale and productivity that would be interesting to investigate.

The increased use of defined contribution plans in employee pension plans in lieu of defined benefit plans has made it easier for employees to choose to invest in their employer's stock. 45% of companies with 401(k) plans surveyed by Buck Consultants offer their stock as an investment choice in 1997, up from 30% in 1991. But with more individual choice comes potential for heterogeneity in wealth as a result of these investment decisions. The third chapter suggests the existence of gender and racial differences in the willingness to invest in company stock. These differences could over time create a large gap in wealth accumulation by gender and race, another area that would be interesting to study.

And finally, economists are now only beginning to investigate the possibility of behavioral theories to explain a lot of personal investment phenomena that does not fit into the neoclassical portfolio optimization models. Representativeness bias and peer effects are two of the behavioral theories that are finding increasing acceptance in the mainstream economics world, but there are surely others that explain the richness of factors that influence employee's willingness to buy company stock.

In the end, company stock ownership is not just an accounting trick, nor is it a magic bullet that solves all of the company's morale, incentive, and turnover problems. For every success that is attributed to employee ownership like the company studied here, there is a failed form of employee ownership. It is not a revolutionary new way of organizing capitalism, but a form of compensation whose implications are not yet well understood.

Stock compensation can be a great way to reward employees that contribute to raising the market value of the company, thus solving the fundamental incentive problem of aligning the interests of the agent (employee) with that of the principal (investors). But there is no easy way of avoiding the risk of individual employees being too dependent on the market value of the company, something that is not under the control of any one employee.

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