

# Money left on the table: An analysis of participation in employee stock purchase plans

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## ABSTRACT

We analyze participation decisions in employee stock purchase plans. These plans allow employees to buy company stock at a discount from the market price and resell it immediately for a sure profit. Although an average employee stands to gain \$3,079 annually, only 30% of individuals take advantage of this risk-free opportunity. Participation is more likely among employees who are familiar with stocks, more educated, less financially unconstrained, and those who make fewer errors in valuing financial securities. Our results suggest that compensation plans requiring active decisions by individuals can result in poor financial outcomes for employees of lower socioeconomic status.

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Are individuals good at making investment choices? This question has been debated in a number of different contexts, such as participation in the equity market and saving for retirement (see, e.g., Mankiw and Zeldes (1991); Haliassos and Bertaut (1995); and Benartzi and Thaler (2007)). However, since a wide variety of unobserved factors (e.g., individual risk aversion) can determine the optimal choices of individuals in these contexts, it is often difficult to find definitive evidence of suboptimal behavior. Additionally, the interpretation of evidence often depends on the specification of the model of market equilibrium against which rationality is judged (Shleifer (2000)). In this study, we avoid these issues by analyzing a unique setting provided by employee stock purchase plans (ESPPs) and empirically analyze a fundamental prediction of economic theory – that individuals should always take up an investment opportunity with positive profits and zero risk.

In essence, ESPPs are company-run programs that allow participating employees to buy company stock at a discount. The typical explicit discount is 15%, but the actual value provided by these plans is often higher because of a lookback feature – i.e., the option to buy stock at the lower of the prices at two points in time. Most ESPP plans allow participating employees to sell the stock immediately after purchasing it, and most of our analysis focuses only on such plans. This contractual feature gives employees an opportunity to secure a substantial profit choice without taking any downside risk.<sup>1</sup> For example, the average return provided by ESPPs in our sample is 33.3%.<sup>2</sup>

Despite the obvious attractiveness of ESPPs, we find that most employees fail to take advantage of this money-making opportunity. In our sample of large publicly traded U.S. firms (S&P 500, Midcap 400, and Nasdaq 100), the average participation rate is below 31%. Employees who do not participate in the plan leave a considerable

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<sup>1</sup>It is possible that holding the stock purchased through an ESPP is optimal for some employees (e.g., for tax avoidance purposes). However, participating in the ESPP and selling immediately should dominate the strategy of not participating at all.

<sup>2</sup>Since the period over which the money is invested is typically much less than a year, the *annualized* return from participation is substantially higher.

amount of money on the table, forgoing, on average, \$3,446 each year. Even after we account for transaction costs, taxes, and the possibility of employee separation from the firm, the average employee loss is still equivalent to an annual salary increase of \$3,079, or approximately 5.4%. These numbers translate to aggregate employee losses of over \$7 billion per year across the 239 firms in our sample. If we make an additional extreme assumption that all employees are liquidity constrained and would need to borrow on their credit cards at a 14% interest rate in order to participate in an ESPP, we still find that non-participating employees forfeit, on average, a value of \$2,877.

Consistent with a standard cost-benefit analysis framework, we find that participation rates are higher for plans with greater benefits – i.e., plans with higher discount rates and higher-value lookback options. Since plans that do not allow an immediate stock resale impose an additional cost on employees of having to bear the equity risk, we expect participation rates to be lower in such plans. Indeed, we find that the average participation rate is 4.7% lower in these cases. If employees are liquidity constrained, they may be unable to put aside the money necessary for ESPP contributions, leading to under-participation. We find evidence that is broadly consistent with this effect. In the firm-level data, we find that participation rates are positively related to average employee salary and to the value realized by employees from the exercise of their stock options. Similarly, there is a negative (albeit small) effect of the length of the contribution period on participation rates.

We find that a number of other factors related to employee learning costs and understanding the terms of an ESPP are important determinants of participation rates. Specifically, more experience dealing with stocks, a higher level of employee education, and better financial knowledge are all associated with higher level of participation. Further, there is some evidence that these effects are weaker when the dollar benefits of participation are higher, which can be attributed to the existence of fixed costs of participation (e.g., taking time to understand the plan) that is reduced with education, financial knowledge, or stock market experience. As found in many other financial

decision making contexts, we find that age shows an inverted U-shaped pattern with participation. Middle-aged individuals show the highest level of participation. Younger people (under 25 years of age) participate less, presumably because they lack the experience necessary to understand plan benefits. Older people (over 55 years of age) also participate less, perhaps because of declining cognitive ability.

Finally we find that employee loyalty to and trust in the company and its management are positively related to participation. For example, a one standard deviation increase in a CEO's approval rating by employees is associated with a 2.4% higher participation rate. In individual-level data, we find that the effect of trust on participation is larger for employees with less education. This suggests that at least in some contexts trust can substitute for a lack of education.

Overall, our analysis of ESPP participation rates using firm-level and individual-level data suggests that the factors that show the strongest relation to non-participation are lack of familiarity with buying and selling stocks, a low level of education and financial illiteracy, low income, and very young or old employee age. These results imply that households in the lower strata of socioeconomic status are more likely to make investment mistakes such as foregoing participation in a company ESPP. Such mistakes could result in poor financial outcomes for these households and can contribute to increasing wealth inequality in the population.

The individual-level survey data also allow us to examine whether employees sell the stock they acquire through the company ESPP. It should be noted that a decision to hold the stock is not necessarily irrational. For example, there may be tax reasons for holding, or employees may have favorable information about their firm's prospects. Nevertheless, this decision is likely to be suboptimal in many cases since the typical employee is undiversified and has a substantial fraction of wealth invested in company stock. Moreover, between 39 and 59% of employees who bought stock through an ESPP never sell it over their tenure with the firm. We find that females, employees with lower salaries and fewer promotions, and employees who make more mistakes

in valuing financial securities are less likely to sell the company stock. For example, employees who believe that out-of-the money options with several years to maturity have no value are 13.6% more likely to hold company stock obtained through an ESPP.

The results in this study can be contrasted with findings in the large literature on equity market participation (see, e.g., Mankiw and Zeldes (1991); Ang, Bekaert, and Liu (2005); Campbell (2006)). For example, Vissing-Jorgensen (2002) argues that the benefit of participating in equity markets is less than \$50 for half of the non-participating households. In comparison, the benefits of participating in an ESPP are of a much larger magnitude, and non-participation cannot be explained by transaction costs. We also find that several non-risk-based explanations that have been offered for low stock market participation, such as trust, awareness, lack of familiarity, and financial illiteracy (Hong, Kubik, and Stein (2004); Brown et al. (2008); Guiso, Sapienza, and Zingales (2008); Grinblatt, Keloharju, and Linnainmaa (2011); and Rooij, Lusardi and Alessie (2011)), are relevant in the context of ESPP participation, a setting in which the investment has no downside risk.<sup>3</sup>

Our study is related to several studies in behavioral economics arguing that individuals fail to take advantage of arbitrage opportunities. For example, Poteshman and Serbin (2003) and Barraclough and Whaley (2012) document that traders exercise their publicly traded stock options suboptimally. It is possible, however, that some of the suboptimal exercises are driven by complicated tax-minimizing strategies on the part of individuals. Similarly, Gross and Souleles (2002) present evidence that households simultaneously carry high-interest credit card debt and hold low-interest checking account balances. However, since credit cards are not perfect substitutes for cash accounts it can be optimal for households to hold cash even while maintaining credit card debt (see, e.g., Telyukova (2012) and Bertaut, Haliassos, and Reiter (2009)). Scholes and Wolfson (1989) study the discount dividend-reinvestment plans that allow existing

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<sup>3</sup>It is conceivable that lack of trust is relevant only in conjunction with having to take on some downside risk, but not otherwise. On the other hand, it is possible that someone who lacks trust will not trust that there is really no downside risk.

shareholders to purchase stock at a small discount. They show that investment in these plans is profitable and provide anecdotal evidence of low participation by shareholders. However, since an individual has to wait for several weeks for share delivery, it is difficult to construct a strategy with *riskless* profit in this setting.<sup>4</sup> Moreover, many plans quickly removed the discounts in order to eliminate this investment opportunity.

The three studies that are most closely related to ours are those by Engelhardt and Madrian (2004), Degeorge, Jenter, Moel, and Tufano (2004), and Choi, Laibson, and Madrian (2011). Engelhardt and Madrian (2004) discuss the individual and corporate tax treatment of ESPPs and identify conditions under which ESPPs are preferred to cash compensation from a tax perspective. They also analyze the ESPP participation data at one large health services company, but do not specify whether the plan allows employees to sell the stock immediately after purchasing it.

Similarly, Degeorge et al. (2004) examine individual employees' decisions to invest in a company stock in the context of France Telecom's privatization. For political and economic reasons, the company was keen to induce high participation by employees in the privatization and offered several financially attractive plans to lure employees. Degeorge et al. (2004) find that many employees were not willing to participate despite large potential rewards, and firm specificity of human capital had little effect on employees' investment decisions. None of the plans offered by France Telecom, however, allowed employees to receive financial benefits without taking some risk at the same time.

Finally, Choi, Laibson, and Madrian (2011) analyze 401(k) contributions by employees at seven companies who are able to make penalty-free 401(k) withdrawals because they are older than  $59\frac{1}{2}$ . They find that employees often do not contribute up to the employer-matched contribution limit, forgoing \$507 annually. Because they focus on older employees who are nearing retirement age and constitute 3% of the total employee population, the extent to which their results are generalizable is not clear. Since ESPPs

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<sup>4</sup>Scholes and Wolfson (1989) use expensive hedging strategies to minimize the price risk.

are open to virtually all employees, non-participation in ESPPs can be studied among employees of all ages. Further, we are able to show that this phenomenon is widespread in a large sample of firms and quantify the aggregate employee losses.<sup>5</sup>

This paper is organized as follows. Section I describes our data sources and presents summary statistics on plan characteristics. Section II discusses the non-participation rates and losses of individuals. Section III explores the determinants of failing to participate in an ESPP at both the firm and individual levels. Section IV investigates the employee's decision not to sell the stock following its purchase. Section V concludes with a brief summary.

## I. Background and Data

An employee stock purchase plan (ESPP) is a company-run program that allows participating employees to purchase company shares at a discounted price. Some plans allow employees to buy stock using their own money, but most plans are designed so that employees contribute through payroll deductions over the purchase period. Almost all plans allow employees to withdraw funds prior to the date of purchase, and all plans allow withdrawal in the event of the employee's separation from the firm. On the purchase date, the company uses the accumulated funds to purchase shares at the discounted price.

The discount is typically set at the 15% of the reference price.<sup>6</sup> In some plans, the reference price is the prevailing market price at the time of the purchase. Most

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<sup>5</sup>The average individual loss from non-participation is considerably larger in our setting than that found by Choi, Laibson, and Madrian (2011) (\$3,079 as compared to \$507). The absolute magnitude of gains is important if individuals have large opportunity costs of time and therefore prefer to avoid the hassle of participation if rewards are small. For example, Degeorge et al. (2004) find that many employees were not interested in profitable investment opportunities during the privatization of France Telecom unless they could afford to invest a large dollar amount.

<sup>6</sup>The clustering of discounts is due to Section 423 of Internal Revenue Code, which states that to preserve the tax-qualified status, the discount cannot be higher than 15%. A tax-qualified ESPP results in a lower individual tax for employees since it treats a larger fraction of the profits as capital gains. Further, prior to a change in expensing rules by FASB in 2004, tax-qualified plans were considered noncompensatory, which gave them favorable accounting treatment.

ESPPs, however, have a built-in option, called a lookback feature. This feature sets the reference price at the lower of the two: i) the price at the end of the purchase period (i.e., the prevailing market price at the time of the purchase), and ii) the price at the beginning of the purchase period. This option increases the potential benefit of ESPP participation.

To join an ESPP, an employee has to opt in (typically by filling out a short form indicating what percentage of her pay she wants to contribute to the plan), and the company then automatically buys the stock for the employee at the end of the purchase period. Unlike some 401(k) plans (see, e.g., Madrian and Shea (2001)), none of the ESPPs that we consider automatically enroll employees in the plan. However, if an employee signs up once and does not take any action to opt out, the employee remains enrolled in the plan and contributes the previously specified percentage of pay.

## **A. Firm-Level Data**

We hand collected firm-level data on employee stock purchase plans from 10-K forms for all firms in the S&P 500 index, NASDAQ 100 index, and the S&P 400 Midcap index for the fiscal years from 1998 through 2009. If the company has an ESPP, we also obtained a detailed ESPP contract; such contracts are typically located in previous SEC filings. We restrict our attention to ESPPs that are open to all employees, which includes all tax-qualified plans and non-qualified plans that explicitly specify that eligibility extends to everyone in the firm.<sup>7</sup> Among these, we have sufficient information to calculate the ESPP participation rates for 321 firms. In most of this analysis, we do not consider plans that require employees to hold the stock after they purchase it. Additionally, to ensure that the benefits of ESPP participation are sufficiently high, we consider only plans with discount rates greater than 5%. These requirements result in a final sample

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<sup>7</sup>Tax-qualified plans exclude executives who own more than 5% of their firm's stock. In addition, a company is allowed (but not required) to exclude employees with less than two years of tenure, employees who work fewer than 20 hours per week, and "highly compensated employees," as defined in section 414(q) of the Code.



of 239 firms. The number of firms after each step of applying the sample selection criteria is shown in Table I.

Since the maximum contribution cap is often set as a percentage of an employee's annual compensation, we also obtain employee salary data from the website Glassdoor.com and adjust them for the average national wage growth.<sup>8</sup> These data are anonymously reported by firm employees (segregated by job title in each firm). A disadvantage of these data is that the average number of respondents is only 421 people per firm, and we have a single cross section of salaries. We therefore also obtain salary data from the Compustat "staff expense" item that has been used in the prior literature as a proxy for employee salaries (e.g., Hanka (1998)). However, these data often overestimate employee salaries since they can include non-salary items, such as expenses associated with pension plans, and are available for only a small portion of our sample (less than 15%). For firms that do not report staff expense data, we use the median value within its industry (defined by the two-digit SIC code) for that year.<sup>9</sup> Overall, we believe that the survey salary (salaries reported by employees) is a more accurate measure and use the Compustat salary mainly for robustness checks. We also obtain data on employee stock option grants and exercises, which are available through the RiskMetrics database.

The contract features of stock purchase plans are given in Table II. On average, firms adopted an ESPP more than nine years earlier and allow a maximum annual contribution of \$9,911. The typical explicit discount of the plan is 15% and translates into a return of 17.6%. The average purchase period is 6.3 months, with most plans having periodic (typically biweekly) payroll contributions and 11.2% of plans allowing lump-sum contributions. In addition to the discount, 80.6% of ESPPs that we consider have a lookback feature that adds, in expectation, 16.4% in returns for the average

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<sup>8</sup>Our results are very similar if we do not adjust the wages or adjust them for inflation.

<sup>9</sup>For the sub-sample where the data on staff expense is available, the correlation between the Compustat salary and the survey salary is 63%, and the survey salary has a lower mean, consistent with Compustat staff expense overestimating annual salaries.

plan.<sup>10</sup>

The majority of plans (90.5%) allow employees to withdraw the contributed funds up to the date of the actual purchase.<sup>11</sup> Thus, if employees are unexpectedly hit by a liquidity shock during the purchase period, they almost always can get their accumulated contributions back. The table also shows that most of the plans allow employees to sign up starting from the first day of their employment, with a few plans requiring a minimum period of employment (typically 30 to 90 days).

Finally, Panel B displays the summary statistics for firm characteristics, such as average employee salary, option grants and exercises, employee turnover, CEO rating, average 401(k) participation, and whether the firm is one of the 100 best companies to work for. Following Cohen (2009) and Benartzi (2001), we collect the data on 401(k) contributions from the annual 11-K filings. To reduce data collection effort, we only obtain these data only for firms that have an ESPP. We omit the 11-K forms filed for employee stock ownership plans and focus on the largest pension plan during the year in firms with multiple plans. As pointed out by Benartzi (2001), not all 401(k) plans are required to file these annual reports. Specifically, the plans that buy shares on the open market (instead of issuing them) are exempt from this requirement and are thus not represented in our sample.<sup>12</sup> We calculate employee 401(k) participation as the combined employee contributions during the year divided by the product of the number of employees and the average survey salary. The average 401(k) participation for firms in our sample is 4.4% of salary.

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<sup>10</sup>The expected value of the lookback option can be calculated as the value of a European call option with maturity equal to the length of the purchase period and the strike price equal to the stock price at the beginning of the purchase period. We use the Black-Scholes formula adjusted for dividend payout to calculate this value.

<sup>11</sup>It is possible that the fraction of plans with withdrawal option is even higher, since some firms which allow employees to withdraw funds from an ESPP may not disclose this information in the public filings.

<sup>12</sup>Benartzi estimates that approximately a third of all 401(k) plans fall into this category.

## B. Individual-Level Data

Our second data set on ESPPs comes from a survey of employees at fourteen companies, conducted in 2004–2005 as part of the NBER’s Shared Capitalism Research Project (Kruse, Freeman, and Blasi (2010)). Surveys with 80–100 questions were administered either online or on paper to employees of fourteen firms in 323 work sites. Typically, companies surveyed had broad-based ownership programs, and employees were given a small monetary incentive to participate in the survey. The survey methodology and the selection of companies are described in more detail by Kruse, Freeman, and Blasi (2010). Five of the fourteen companies had an ESPP plan and one of those companies was not publicly traded. Therefore we restrict our analysis to four companies, which we label A, B, C, and D.

The main benefit of this data set is that it has detailed information about individual employees, including their salaries, wealth, investments in the equity market, and 401(k) plans. A disadvantage of these data, however, is that they only provide information on whether an employee *ever* participated in a company ESPP, and thus cannot be used to infer whether the employee participates currently or contributes up to the allowed limit. In all four firms, the employees are allowed to sell the stock immediately following the purchase.

Panel A of Table III gives summary statistics for the four companies. Company A is a large multinational company in the high-tech industry with more than 30,000 employees. Company B is a mid-sized firm that produces food products, with all of its employees located in the United States. Company C is a large financial firm employing over 5,000 people. Company D is a small high-tech firm with 55.2% of its employees working outside the United States. Since there may be minor differences in plans for employees working in different countries, we use country fixed effects in the regressions and only include countries in which at least one employee participated in the firm’s ESPP.<sup>13</sup> Our results are robust to including only U.S. employees in the dataset.

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<sup>13</sup>The reason for this restriction is to account for the possibility that some country-specific laws may

Panel B presents the demographics of employees working in each of the four firms. Employees at company A are highly educated (83.6% have a college degree) and earn higher salaries than employees at the other firms. Employees at company B are the least well paid and report the lowest household wealth. Company C has an average salary of \$46,335 and has the highest proportion of females (66.2%) and the lowest proportion of whites (8.2%) in the sample. Employees at company D have relatively high pay (the average salary is \$86,188) and are well educated.

We also report the employee participation rates in 401(k) plans and the average fraction of employees who frequently buy and sell securities on the open market, which we use as a proxy for equity market participation. Measured in this way, equity market participation is likely to be underestimated because some people may passively hold the stocks without engaging in trading (e.g., through assets in a 401(k) plan). Firm B has the smallest fraction of employees participating in the equity market, 7.6%, and Firm A has the highest fraction of equity market participants, 18.3%.

Finally, Panel B provides the average values of our measures of financial literacy. In the survey of firm A, several additional questions that asked about the valuation of employee stock options can be related to financial literacy. Specifically, employees were asked for the least number of shares of stock they would accept in exchange for 10 out-of-the-money stock options. In this firm over 99% of employees received stock options during their tenure at the firm. Interestingly, the survey shows that 5.1% of surveyed employees consider such stock options completely worthless and would exchange them for 0 shares of stock. At the other extreme, there are people who would not be willing to exchange 10 underwater stock options for anything less than 10 shares of stock, with frequently suggested numbers in the range of 11–20 shares. We find that, overall, 15.0% of all surveyed employees grossly overvalue stock options. Note that this overvaluation does not just capture their expectations about future stock performance, since they are overvaluing the options in terms of shares of stock.

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not allow individuals to participate in an ESPP. The two countries that do not have any employees participating in ESPPs in our sample are Hungary and Romania.

## II. ESPP Non-Participation and Employee Losses

In this section, we document the extent of participation in ESPPs and calculate employee losses from non-participation. We showed in Table II that a typical ESPP presents an attractive investment opportunity. In a perfect world with no costs of participation, we would expect 100% participation. We next examine the actual employee participation in these plans.

We define two measures of ESPP participation. The first is equal to the contributions to the ESPP per employee normalized by the maximum allowed contribution per year, where the latter is the lower of the maximum annual dollar contribution specified by the firm and the maximum percentage of compensation employees can contribute to the plan multiplied by the average survey salary. The second measure is similar, but uses the salaries imputed from Compustat. Since we use the average employee salary at the firm level, rather than each individual employee's salary, to calculate the participation rate, it is possible that this leads to a biased estimate of the participation rate. However, as we show in the appendix, the participation rate will be overestimated by our procedure if the individual participation in ESPP is positively correlated with the individual's salary. From the individual data, we estimate that the correlation between ESPP participation and salary is significantly positive (average correlation of 23.6% across four firms). Hence, the true rate of participation in ESPPs is even lower than what we report here.

The summary statistics for participation rates are presented in Table IV. The average participation rate is 23.8% when we use the survey salary and 30.4% when we estimate salaries from Compustat.<sup>14</sup> Figure 1 shows that the distribution of partic-

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<sup>14</sup>For a sample of firms we were able to obtain employee-level ESPP participation data from the plan administrator. In this sample, 41 firms have an ESPP that allows immediate resale of acquired stock and has a discount greater than 5%. The ratio of participating employees to total number of eligible employees varies from 2.4% to 77.5%. The average headcount-based participation rate is 30%. This number is not directly comparable to our estimates, since some of the participating employees do not contribute to the full extent allowed. Therefore, headcount-based participation rates should be higher than contribution-based participation rates. Nevertheless, it is interesting that this estimate is similar to our average participation rate. This is perhaps attributable in part to the fact that our estimates of participation rates are likely biased upward due to a positive correlation between salary

icipation rates has a strong right skew, with very few firm-years having participation rates higher than 80%. Since none of the firms in this sample require employees to hold the stock, not participating in the ESPP is equivalent to leaving money on the table since investment is both riskless and profitable. In Figure 2, we plot the average participation rates over time and observe that they vary from 19.5% in 2008 to 32.1% in 1998.

We next quantify the amount of money (in dollar terms) employees forfeit by not signing up for the plan. When the maximum allowed dollar contribution is  $C$ , employees can buy a number of shares equal to the  $C/\text{Discounted Price}$ , and earn on each purchased share the spread between the current market price and the discounted price. If the discount is  $d$  and there is no lookback option, the discounted price is equal to  $1 - d$  multiplied by the market price. The average annual loss to the non-participating employee is

$$\text{Loss} = C \frac{(\text{Market Price} - \text{Discounted Price})}{\text{Discounted Price}} = \frac{Cd}{1 - d}. \quad (1)$$

With a lookback option, the discounted price is obtained from the lower of the prices at the time of purchase and at the beginning of the contribution period. Let  $P_T$  be the price at the time of purchase and  $P_0$  the price at the beginning of the purchase period. If  $C$  dollars are spent in buying shares at a cost of  $(1 - d)\text{Min}[P_T, P_0]$ , then a total of  $\frac{C}{(1-d)\text{Min}[P_T, P_0]}$  shares can be acquired. Selling these shares immediately at market price  $P_T$  results in a profit of  $\frac{CP_T}{(1-d)\text{Min}[P_T, P_0]} - C$ . Simplifying, we obtain the loss from non-participation in the ESPP as

$$\text{Loss} = \frac{Cd}{1 - d} + \frac{C}{1 - d} \frac{1}{P_0} \text{Max}[P_T - P_0, 0], \quad (2)$$

where the expectation of the second term can be calculated using the Black-Scholes formula for the value of a call option.

We now illustrate the calculation of the expected loss from non-participation in a  


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and participation rates among employees within the same firm.

typical ESPP. Suppose that the average annual limit on contributions is \$9,911 (the sample average) and the discount rate is 15%. The loss from non participation is

$$\text{Loss} = \frac{\$9911 \times 0.15}{0.85} + \frac{\$9911}{0.85} \frac{1}{P_0} \text{Max}(P_T - P_0, 0), \quad (3)$$

Assuming a purchase period of 6.3 months (the sample average), a stock return volatility of 47% (the sample average), a continuously compounded risk-free rate of 4%, and no dividends, we can calculate the expected loss as

$$\begin{aligned} \text{Loss} &= \frac{\$9911 \times 0.15}{0.85} + \frac{\$9911}{0.85} \frac{1}{P_0} (P_0 N(d_1) - P_0 e^{-rT} N(d_2)) \\ &= \$1749 + \frac{\$9911}{0.85} \left( N \left( \frac{\left( r + \frac{\sigma^2}{2} \right) \sqrt{T}}{\sigma} \right) - e^{-rT} N \left( \frac{\left( r - \frac{\sigma^2}{2} \right) \sqrt{T}}{\sigma} \right) \right) \\ &= \$3428. \end{aligned} \quad (4)$$

Part of this value (\$1,749) is guaranteed because the stock plan provides a fixed discount, whereas the rest of the value (\$1,679) comes from the lookback option. The ex-post value of the lookback option cannot be negative but depends on the stock returns over the purchase period. We do a similar calculation for each firm-year in our sample and report the summary statistics in Table IV. It can be seen from the table that the average expected loss from non-participation is \$3,446, which is very close to the loss for a typical plan of \$3,428.

To better assess the real employee losses, we also account for transaction costs, likelihood of employee separation from the firm, and tax. Essentially, we calculate the fixed salary that gives an individual the same expected wealth as participation in the ESPP, net of all costs. The details are in Appendix B. We set the individual tax rate at 28%, the tax rate for individuals with a combined annual income of more than \$69,000 and less than \$144,000 (as of the year 2003).<sup>15</sup> Transaction costs are assumed to be

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<sup>15</sup>The tax treatment of ESPP sales is somewhat complicated, with different tax rates for disqualifying and qualifying dispositions. In general, however, the effective tax rate goes down if employee holds the stock longer. For our purposes, we are interested in the amount of tax that would be triggered if

\$40 per participation period. In most cases, firms open brokerage accounts for their employees and pay for at least part of the expenses associated with purchasing stock through an ESPP. The employee is only responsible for the brokerage fees associated with stock sale and some stamp duties. To estimate expenses associated with trading ESPP stock, we assume that employees sell the stock at the end of each purchase period (e.g., four times a year if the purchase period is three months) and assume an average brokerage fee of \$20 for each buy or sale transaction (although fees associated with purchase are frequently covered by the firm).

We estimate the likelihood of employee separation from the firm using stock option forfeiture rates. When it is not possible to obtain an estimate, we assume that the probability of separation is 10% per year. Since firms allow employees to withdraw their contributions in the event of separation from the firm, we assume that the employee withdraws funds just before leaving the company. In reality, it is likely that employees anticipate the change of employment and withdraw funds from the plan earlier, which leads to lower losses arising from the possibility of separation. Other parameters, such as stock return volatility, a cap on ESPP contributions, and features of the plan (discount rate, presence of a lookback option, and purchase period) are estimated from the data.

On average, non-participating employees leave on the table a salary-equivalent value of \$3,079 each year. It can also be seen from Figure 3 that losses are sizable for a large fraction of employees. The product of the salary-equivalent loss and the actual non-participation rate for a given firm-year provides an estimate of the total loss for a firm-year. We aggregate these numbers across all firm-years to obtain an estimate of \$84 billion in losses across firms in our sample during the period 1998–2009, or approximately \$7 billion per year. Note that since our sample covers only 239 firms with ESPPs, the aggregate losses due to ESPP non-participation across all U.S. firms are likely to be an order of magnitude higher. If we make the extreme assumption that

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the employee engages in a same-day sale. In this case, the tax treatment is simple since there is no capital gain and all income that the employee earns on the ESPP is taxed as ordinary income.



all employees are cash-constrained and need to borrow on their credit cards at a 14% APR (estimate based on Telyukova (2012)) to participate in the ESPP, we still obtain substantial salary-equivalent losses, with an average estimate of \$2,877 per employee annually.

We also use individual employee survey data from the four public firms to study ESPP participation. Panel B of Table IV documents that the participation rates range from 40.9% to 92.3%. Although these numbers are considerably higher than the averages from our firm-level data, ESPP participation is measured differently here since it is based on whether an employee *ever* participated in an ESPP to *any extent*. Additionally, firm selection for the survey may be non-random. For example, firm A, which is also part of our broad firm sample, turns out to have the highest ESPP participation rate among all firms in the S&P 500 and Midcap 400.

The average annual loss per non-participant is \$3,758 in firm A, or \$3,362 if we calculate the salary-equivalent loss. Over the employee's tenure with the firm, these losses add up to \$13,713. Similarly, non-participating employees at firm D forfeit on average \$2,783 in salary-equivalent losses annually. The employee dollar losses are somewhat lower at the two other firms, in part because of their lower average salaries and also because firm C had an annual limit of \$5,000 on ESPP contributions. However, they still amount, on average, to 2.7% and 5.8% of annual salary in firms B and C, respectively.

In all four firms, employees are allowed to sell the stock immediately after purchasing it. Nevertheless, we see that many employees who participate in ESPPs never sell the stock over their tenure. The percentage of employees who never sell the ESPP stock varies across firms, from 39.5% to 58.5%. This is particularly striking since employees of the four firms already have substantial holdings in their firm's stock through employee stock options. For example, employees of firm D report an average intrinsic value of currently owned stock options of over \$140,000. Finding that many employees do not sell the stock resonates with evidence that employees invest a significant fraction of

their retirement portfolios in company stock (Benartzi (2001)). This is also consistent with evidence of inertia in the context of such decisions. Madrian and Shea (2001) find that many employees who were automatically enrolled in a 401(k) plan do not change either the default contribution rate or their allocation.

We next present univariate comparisons of ESPP participation rates among employees with different salaries, education, and age. Figure 4 shows that the relation between employee pay and participation is monotonic, with highly paid employees more likely to join an ESPP. In Figure 5, we see that participation rates also tend to increase with employee education, with particularly large differences observed between the groups with and without a bachelor's degree. Figure 6 plots the participation rate as a function of employee age. As can be seen from the graph, the relation has an inverted U-shape, with both young and old individuals showing a relatively lower propensity to participate.

Finally, we explore whether the employees who take advantage of ESPP are also more likely to participate in the general equity market and make contributions to a 401(k) plan. Figure 7 shows that indeed equity market participation rates are consistently higher among employees who sign up for an ESPP. For example, in firm A only 10.1% of employees who ignore the ESPP plan trade on the market, whereas this number is 19.0% for ESPP participants. Similarly, Figure 8 shows that there is a positive relation between 401(k) contributions and ESPP participation rates.

### **III. Determinants of ESPP Participation**

#### **A. Factors That Affect ESPP Participation**

In this section, we discuss factors that can affect ESPP participation, and relate them to participation rates in a multivariate regression setup. We start with factors that should matter if employees strictly maximize their wealth, have the ability to understand and weigh multiple options, have perfect self-control, can forecast the consequences of each

option, and choose rationally. In particular, we consider plan attractiveness, transaction costs and the opportunity costs of time, and employee liquidity constraints. We then move on to factors that can be important if employees are boundedly rational or are local thinkers, as defined in Gennaioli and Shleifer (2010). For example, employees may have limits to processing information or use only information that readily comes to their mind. In this context, we consider such factors as awareness of the plan, familiarity with trading stocks, financial literacy, experience and cognitive aging, trust in the firm, loyalty of employees, and past individual experiences in the stock market. Our discussion below leads to a number of hypotheses on the relation between empirical proxies for these factors and ESPP participation rates. These are summarized in Table V.

### **A.1. Benefits and Costs of the Plan**

It is expected that employees are more likely to participate in plans that are more attractive financially. Therefore, we examine whether participation rates are higher in firms with more generous plans by focusing on the two most important characteristics of the plan: the discount and the value of a lookback option. These two components are considered separately because the discount provided by the plan represents a risk-free benefit that participating employees receive if they immediately sell the stock. In contrast, while the value of the lookback option cannot be negative, it depends on the stock price movement during the offering period. If employees are considerably risk-averse and value only the certain benefits provided by the plan, the participation rate should be more sensitive to the discount rate than to the value of the lookback option. Additionally, employees might not completely understand how to value the lookback feature causing them to undervalue this feature. In this case, their valuations should become more accurate over time, and the sensitivity of participation to lookback value should go up with the number of years that the plan is in existence. Alternatively, employees may place a higher value on the lottery-like features of the plan. For exam-

ple, Kumar (2009) presents evidence that some investors (particularly those with low income) tend to overweight lottery-type stocks.

An interesting question is whether employees participate in an ESPP out of short-term or long-term profit motives. Some ESPPs require employees to hold on to their shares for a minimum period of time. If most employees want to invest in an ESPP for a short term, then this requirement imposes an additional cost by exposing employees to firm-specific risk. Since it is likely that at least some employees invest in ESPP out of short-term motives, we expect ESPPs with holdup requirements to have lower participation rates.

For most firms the annual cap on contributions to the ESPP is specified as a fraction of employee salary (e.g., 10%), resulting in higher dollar benefits from participation for employees with higher salaries. Assuming that there are some fixed costs of participation, such as studying the terms of the plan or understanding ESPP tax treatment, a higher salary should then be associated with higher participation.

It is plausible that employees are reluctant to participate in an ESPP if they think that the likelihood of separation from the firm is high. However, since almost all firms allow employees to withdraw their contributions at any time, employees can participate knowing that they can withdraw as soon as they know that they will be leaving the firm. Therefore, we hypothesize that the likelihood of job turnover is unlikely to have a significant effect on participation rates.

## **A.2. Transaction Costs and Opportunity Costs of Time**

A second possible explanation for widespread ESPP non-participation is related to transaction costs and the opportunity costs of time. According to our reading of company plans, many employers who specify how the transaction costs are to be handled pay for the ESPP account maintenance and cover at least part of the brokerage costs associated with purchases of ESPP stock. However, the fees charged for stock sales are almost always paid by the employee. As argued in the previous section, transaction

costs are typically very small relative to the possible gain from participation. Another possible cost is the opportunity cost of time needed to manage the sales of stock and filing of tax (note that purchases are automatically taken care of by the company). If each sale of stock takes one hour of employee time and tax filing at the end of the year takes two hours, then the value of the time it takes an employee to manage the ESPP would amount to approximately \$186 per year on average. These estimates are considerably smaller than losses from not participating in the ESPP.

Of course, for an employee who is unfamiliar with such plans, more time may be required to understand the absence of risk and to figure out the tax treatment of sales associated with an ESPP. However, it should be noted that such costs are incurred only once. Once the employee figures out how the plan works, these costs do not have to be incurred in subsequent years. Nevertheless, costs emanating from lack of familiarity with ESPPs can matter for the participation decision, and we discuss them later in conjunction with the effect of familiarity in dealing with stocks and awareness of the plan.

### **A.3. Liquidity Constraints**

The next explanation that we consider is related to the liquidity constraints faced by employees. Campbell (2006) argues that binding borrowing constraints are a defining characteristic of households. In the previous section, we estimated the salary-equivalent losses if employees had to borrow using their credit cards to purchase stock in the ESPP; we found that liquidity constraints can significantly reduce the value of ESPP participation (from \$3,079 to \$2,877 per year on average). In our empirical analysis at the firm level, we proxy for the tightness of liquidity constraints using average employee salary and the value realized from option exercises during the year. We also consider the length of the purchase period, since a longer purchase period requires employees to invest their contribution for a longer period of time. At the individual level, employee salary proxies for the tightness of liquidity constraints.

A related factor that could be relevant for participation is the possibility of future liquidity shocks. For example, an employee may be reluctant to contribute to an ESPP if she anticipates unexpected liquidity needs during the purchase period. Telyukova (2012) argues that this can be a motivation for households to maintain credit card debt and to hold cash at the same time. However, since almost all plans allow employees to withdraw their accumulated contributions at any point of time during the purchase period, it is unlikely that unexpected liquidity needs would deter employees from ESPP participation.

#### **A.4. Education and Financial Literacy**

Another potential reason for leaving money on the table is employees' lack of education, financial illiteracy, or perception of being financially unsophisticated. For example, Graham, Harvey, and Huang (2005) find that investors who are more comfortable with their ability to understand investment products tend to trade more frequently. The literature also documents that individuals who lack financial literacy are much less likely to plan for retirement, participate in the stock market, diversify their investments, and rebalance their portfolios (Kimball and Shumway (2010); Calvet, Campbell, and Sodini (2007)).

Employees working in the finance industry should have a higher level of financial sophistication and better understanding of the benefits of ESPP participation. Using the firm-level data, we examine whether participation rates are higher in the financial industry. In the individual-level data, we use dummy variables for irrational overvaluation or undervaluation by employees of their out-of-the-money stock options as proxies for financial illiteracy, and an indicator for whether the employee has a bachelor's degree as a proxy for employee education level.

### **A.5. Awareness and Familiarity**

A related explanation for low participation is a lack of awareness of the significant benefits of ESPP participation. For example, in the context of stock market participation, Guiso and Jappelli (2005) find that over 35 percent of Italian households were simply unaware of stocks in the late 1990s. To proxy for awareness of the ESPP at the firm level, we use the number of years since the plan was adopted, presuming that, over time, employees have more opportunities to learn about the plan's existence. We expect a concave relation with years since adoption, since the additional need to learn would diminish with time since the plan was adopted. We also use the value of stock option grants per employee to proxy for familiarity with the ESPP. The rationale for this variable is that employees who receive stock options are more likely to be familiar with shares in general. They should have a better understanding of how to sell shares, how to file taxes, etc.

At the individual level, we look at whether an employee ever received stock options and whether she frequently trades other securities. These are proxies for familiarity with dealing with stocks in general and should be positively related to ESPP participation. We might expect the familiarity effect to be stronger for employees with a lower level of education, since well-educated employees should be able to more easily overcome a lack of experience in dealing with stocks.

### **A.6. Individual Past Experiences**

We also consider the possibility that an employee's personal experience with stock market fluctuations affects her decision to buy her firm's stock through an ESPP. Malmendier and Nagel (2011) provide evidence that experiencing lower stock returns over the course of one's life lowers an individual's willingness to invest in the stock market. Relatedly, Odean, Strahilevitz, and Barber (2010) find evidence that investors repeat actions that previously resulted in pleasure and avoid those that led to pain.

It is important to point out that, in our setting, employees do not need to be exposed

to price risk since they are allowed to sell the stock immediately after purchasing it. Nevertheless, people who experienced negative stock returns and saw, for example, large declines in the value of their employee stock options or retirement accounts, may avoid all kinds of investments related to stocks. If such an effect exists, it ought to be weaker for employees who are well educated, since we expect them to better understand the irrelevance of past stock market experience to the ESPP participation decision. In the individual-level tests, we use a measure of weighted past stock returns of the firm over the course of employee tenure, calculated as

$$\text{Stock Return Experience} = \sum_{k=1}^{\text{tenure}_{it}-1} \frac{(\text{tenure}_{it} - k)^\lambda}{\sum_{j=1}^{\text{tenure}_{it}-1} (\text{tenure}_{it} - j)^\lambda} R_{t-k}, \quad (5)$$

where we take  $\lambda = 1.5$  as estimated by Malmendier and Nagel (2011) and  $R_{t-k}$  is the raw stock return  $k$  years ago relative to the current year. At the firm level, we test for the influence of past experiences on the decision to enrol in the plan by using the contemporaneous firm's stock returns and the buy-and-hold stock returns over the previous three years. Alternatively, it is possible that employees' perceptions are affected by performance of the overall stock market and that they are reluctant to participate after recessions.

### **A.7. Trust and Loyalty**

Finally, we test for two other explanations for non-participation. The literature has suggested that trust may be an important element needed for an individual to invest in stocks (Guiso, Sapienza, and Zingales (2008)). It is an interesting empirical question whether trust remains an important factor when an individual can earn riskless profit on an investment. It is possible that lack of trust is relevant only in conjunction with having to accept some downside risk. On the other hand, someone who lacks trust may not trust that there really is no downside risk. To proxy for trust at the employee



level, we rely on survey questions that ask employees to evaluate whether the company keeps its promises and whether the company is fair to its employees. We also look for interaction effects between trust and employee education, since it is possible that trust has a larger effect if employees lack the level of education needed to understand the details of the plan.

Another possibility is that some employees may not participate in an ESPP because they do not like being associated with the company. For example, Cohen (2009) shows, in the context of 401(k) plans, the importance of employee loyalty in pension contribution decisions. At the firm level, we proxy for loyalty using the dummy variable for whether the firm makes a list of 100 best companies to work for and the average approval rating of the firm's CEO by employees. At the individual level, we rely on survey questions that ask employees whether they feel loyal to the firm and whether they have a sense of sharing a common purpose with their employer.

#### **A.8. Effect of Age through Experience and Cognitive Ability**

Previous research has documented the lifecycle patterns in financial mistakes by individuals. For example, Agarwal et al. (2009) study different types of individual credit behavior and conclude that middle-aged adults are less likely to make mistakes. They argue that young people lack the experience necessary to make the right choices, whereas very old individuals can have lower cognitive ability. Similarly, Korniotis and Kumar (2011) examine individual investments in the general equity market and document an inverted U-shaped age-skill pattern. We expect to see a similar inverted U-shaped pattern in ESPP participation with age. To see this effect, we include in the individual-level regressions dummy variables for different employee age categories.

### **B. Firm-Level Results**

Table VI presents the results of multivariate regressions, where the dependent variable is the level of ESPP participation at the firm level. In all specifications at the firm

level, we control for such firm characteristics as the amount of research and development normalized by the firm’s assets, size of the firm (logarithm of book value of assets), and Tobin’s Q. We also include the average salary of the firm’s employees, the discount value, the value of the lookback option, and the number of years since the plan was adopted. Controlling for firm size can be important if firms of different sizes have different human resources policies. Using the amount of research and development can identify firms with more educated employees, and average Q proxies for firms’ growth opportunities. We also include year and industry fixed effects (Fama-French 17 industries) and report the t-statistics based on standard errors clustered at the firm level. All of these variables explain approximately 48% of the variation in participation rates. Note also that, when discussing our empirical results, we sometimes interpret them only in the context of the causal story that motivated the regression. However, the reader should keep in mind that the results from the regressions can be reliably interpreted only as correlations and that there may be alternative explanations consistent with the observed patterns.

We find that participation rates tend to respond positively to plan benefits. For example, an additional 1% of return arising from the discount offered by the plan increases the participation rate by approximately 0.8%. Consistent with employees assigning smaller value to the lookback option, we observe that 1% of lookback value increases participation by a smaller amount (approximately 0.3%). In unreported tests, we find that the difference in these two coefficients is statistically significant. This can indicate either employee risk aversion or employees’ inability to understand the value provided by the more complex plan terms.<sup>16</sup> If the latter explanation is indeed important, the extent of the employees’ lack of understanding of the value due to lookback should diminish over time. In support of this explanation, we find a positive coefficient on the interaction between years since plan adoption and the lookback value

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<sup>16</sup>In unreported results, we also considered whether participation rates are affected by other terms of the plan, such as the option to withdraw contributions, the option to increase and decrease contributions, and whether employees can contribute in the form of lump-sum payments. Among these, we found only a weak positive effect of the option to increase contributions (significant at the 10% level).

(column 2).

The effects of a holdup requirement and employee turnover are consistent with our hypotheses in sub-section A.1. Specifically, plans with a holdup requirement have a 4.7% lower participation rate (column 3). This result suggests that some employees participate in the ESPP out of short-term profit motives rather than a desire to hold on to the shares for a long time. While a higher likelihood of turnover can potentially decrease the benefit from participation, as we have argued earlier, the effect of this on participation rate is likely to be small. Accordingly, we find that the level of turnover, measured using cancelled options, is not significantly related to participation.

We find that average salary is positively related to participation. This is consistent with existence of some fixed costs of participation, which become less important when the salary and hence the dollar benefit from participation is larger. This result could also be interpreted as a negative effect of lower liquidity constraints on participation.

In general, liquidity constraints appear to be moderately important for employee enrollment in an ESPP. Option exercises tend to ease liquidity constraints. Participation rates are positively related to the value obtained by employees from their option exercises. A one standard deviation increase in value from option exercises increases the participation rate by 3.5% when the average participation rate is 23.8%.<sup>17</sup> Additionally, we find that the length of the contribution period is negatively related to participation. However the effect is not very large, with a one standard deviation increase in the purchase period increasing participation by 1.5%. Even in firms where ESPP purchases can be made monthly (where liquidity constraints should play a smaller role), the average participation rate is quite low: 13.7%.

There is some evidence that awareness of the plan decreases non-participation. As each additional year passes after plan adoption, the participation rate increases by approximately 0.6%. If we include both the number of years since adoption and the

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<sup>17</sup>However, option exercises may not always capture the easing of liquidity constraints if employees exercise their option to hold the stock rather than to realize taxable capital gain. Further, in cases where stock options awards are not broad-based, option exercises may not be a good proxy for the easing of liquidity constraints across all employees.

square of the number of years since adoption squared (column 5), we observe that the coefficient on the first variable is positive and the coefficient on the second variable is negative. This suggests that the pace of learning slows down after the plan has been in place for a number of years. Firms that make larger option grants tend to have higher participation rates (column 7), perhaps because their stock programs are more broad-based and employees are more familiar with dealing with stock.

Employees of financial firms are likely to have a higher level of financial literacy and should find it easier to understand the benefits of participating in an ESPP. In column 8, we find that participation rate is 8.2% higher for firms in the financial industry. Note that in this specification we drop industry fixed effects in order to identify the effect of financial industry relative to all other industries.

We examine whether employees' decision to enroll in a plan is determined by their past experiences in the stock market. We find that when we control for the firm's market-to-book ratio, past returns are not related to participation rates (column 11). However, market-to-book might be capturing the long-run stock return experience from the past. We note that the coefficient on the market-to-book is positive and significant in all specifications. If it is dropped from the set of control variables, contemporaneous stock returns as well as stock returns over the previous three years show up as being significantly positively related to participation rates. Thus, based on firm-level data, our results on the importance of past stock return experience are mixed.

We next examine whether participation is affected by the business cycle. A recession could affect participation rates because a negative performance of the aggregate stock market could affect perceptions of the attractiveness of all stock-based investments, including ESPPs. Alternatively, a recession could affect household financial constraints through a decline in the value of investments, real estate, or unexpected unemployment of a spouse. In Figure 2, we see that participation rates in the years 2002 and 2008 show a downward blip relative to the adjacent years. This is suggestive of a negative effect of recession on ESPP participation. To examine the effect of recession in a multivariate

regression setting, we define a recession dummy as 1 if at least 6 months of the fiscal year fall within the NBER-identified recession period (March 1, 2001–November 20, 2001, or December 1, 2007–June, 30, 2009). We drop year fixed effects as controls for this test. Column 13 shows that the participation rate is indeed lower during recessions than in other years.

We find some support for the employee loyalty explanation. Specifically, we find that being a “best employer” is associated with an approximately 12.9% higher participation rate.<sup>18</sup> We observe similar effects on participation if we use employees’ CEO approval ratings.<sup>19</sup> However, a caveat is that CEO ratings are available only on a single date and can be endogenous. For example, participating in an ESPP may make employees more satisfied with their jobs and more approving of their CEO.

Finally we relate the ESPP participation decision to another decision that requires employees to use a portion of their salaries to purchase financial assets: the decision to participate in a 401(k) plan. We expect 401(k) participation to be positively related to ESPP participation since the same employee characteristics are likely to drive both decisions – e.g., employee familiarity and comfort in dealing with company stock. As expected, we find that, at the firm level, ESPP participation is strongly positively related to 401(k) participation. Interestingly, this relation is weaker for ESPPs with holdup requirements. This is suggestive of an additional substitution effect between 401(k) plans and those ESPP plans that require holding on to the stock. This is reasonable since from an economic perspective ESPPs with holdup are more similar to pension plans in that they are more in the nature of a longer-term investment.

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<sup>18</sup>To rule out reverse causality, we verified that the best companies are not screened in or out based on whether they have ESPPs or for the level of ESPP participation. We thank Amy Lyman of the Great Place to Work Institute for sharing this information with us.

<sup>19</sup>Other measures of loyalty that we considered are employee satisfaction with their jobs and the number of analysts covering the stock. Both of these variables are positively correlated with ESPP participation.

## C. Individual-Level Results

We next turn to ESPP participation at the individual level. An advantage of these data is that they allow us to link employee demographic information to participation rates. In all specifications, we include country and firm fixed effects. Country fixed effects are intended to capture the effects of distance, language, culture, and any unobserved differences in the treatment of ESPP plans (e.g., different individual taxes).<sup>20</sup> Firm fixed effects capture the variation due to differences in plan design and human resources policies across firms.

Following other studies, we include employee gender and marital status as control variables in all our specifications. It is known that women participate less in the stock market (Van Rooij, Lusardi, and Alessie (2011)) and trade less than men do (Barber and Odean (2001)), possibly because they are less overconfident and more risk-averse (Holt and Laury (2002)). Neither of these should be important factors in their decision whether to participate in an ESPP since the stock can be immediately sold. Haliassos and Bertaut (1995) report that marriage tends to increase stock market participation. Married individuals can potentially benefit from economies of scale in their analysis of financial decisions and are sometimes less financially constrained. The results in Table VII show no significant effect of gender or marital status on ESPP participation.

The two largest racial groups represented in our sample are whites and Asians. Oyserman and Sakamoto (1997) argue that interdependence and group connectedness are cultural hallmarks of Asian cultures. Small initial differences in the propensity to participate (perhaps due to higher levels of education and numeracy) can translate into a much larger actual participation rate due to the multiplier effect operating through stronger social connections (Hong, Kubik, and Stein (2004)). In our sample, we do observe that Asian employees have a higher level of education (94% of Asians have a bachelor's degree as compared to the sample average of 75%). Additionally, Benjamin,

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<sup>20</sup> Additionally, we run all specifications for the sample of U.S. employees only and find similar results.

Choi, and Strickland (2010) show experimentally that Asian identity is associated with greater patience. Since ESPP participation involves making salary contributions over the purchase period and pays off only when the employee sells the stock at the end of the purchase period, participation requires patience on the part of the employee. We therefore hypothesize that employees who classify themselves as Asian participate more in their companies' ESPP.<sup>21</sup> We find that Asian employees have on average a 4.9% higher participation rate.<sup>22</sup>

We also include employee tenure at the firm and the number of promotions as control variables. Longer tenure can be associated with greater experience and familiarity with the firm's benefit plans. It can also measure the firm-specific human capital of the individual, which can be relevant if individuals plan to hold the stock. The number of promotions an employee has received could capture the cognitive ability of the employee beyond that captured by education. Both employee tenure and number of promotions are positively related to participation rates in the data.

We find that participation is higher among people with higher salaries. This could be because of higher dollar benefits from participation (since the permitted maximum contribution amount goes up with salary) making participation more attractive and because employees with higher salaries could have lower liquidity constraints.

Our evidence also points to the importance of familiarity in dealing with stocks. For example, we find that people who have experience trading other securities are more likely to participate in an ESPP. Similarly, individuals who report having ever received stock options have higher participation rates. These results could be interpreted as evidence that there are fixed costs associated with ESPP participation, such as figuring out plan details, tax treatment, and opening a brokerage account, that can affect the

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<sup>21</sup>Ethnic identity is based on the self-classification of the survey respondents. It can sometimes be difficult to classify people, e.g., someone living in Dallas whose father is from Jakarta and mother from Edmonton. In such cases, self-classification seems most appropriate since it reflects the ethnic group with which respondent identifies most closely.

<sup>22</sup>In unreported results, we find that no other race/ethnicity variables are significantly related to plan participation. This could be because other ethnic groups are not well represented in our sample and tests lack the power to uncover any effects.

decision to participate in an ESPP. We expect these learning-related and psychological costs to be higher for individuals with a lower level of education. Indeed, we find that education attenuates the relation between familiarity in dealing with stocks and ESPP participation. Another implication of interpreting greater familiarity with stocks as lowering the fixed cost to participation is that the effect of familiarity should be reduced when the dollar benefits from participation are large. Since the dollar benefits from participation increase with salary, we examine whether the positive effect of comfort in dealing with stocks decreases with higher salary. Columns 9 and 10 show that this is indeed the case. We also find a negative interaction effect between salary and education (column 8), which can be interpreted in a similar fashion.

We find that education also has a large direct effect on participation. Individuals with a bachelor's degree are approximately 4% more likely to participate in the plan. We test whether people who make mistakes in the valuation of stock options are more likely to miss out on ESPP benefits. The results are shown in column 3. We find that indeed employees who grossly overvalue or undervalue underwater stock options are less likely to enroll in their company's ESPP. These results underscore the importance of financial literacy in making sound financial decisions.

Participation is also related to the experience of the individual with the company stock. An individual's past experience is measured by the weighted firm stock returns over the employee's tenure. We find that a one standard deviation increase in annual stock return over the course of an employee's tenure increases the probability of participation in an ESPP by 4.8%. For a rational individual, past returns should not matter for participation, because they are not reliable predictors of future returns, and moreover, because the stock obtained through an ESPP can be sold immediately. We expect that more educated individuals are more likely to understand this irrelevance. We do find that the effect of past stock returns is significantly stronger for individuals without a bachelor's degree (column 7).

We next explore explanations for non-participation such as lack of trust in and



loyalty to the firm. Overall, we find a weak relation between employee loyalty to the firm and the likelihood of participation in the firm's ESPP. A similar result is observed for employee trust, as proxied by the responses to questions about whether the company keeps its promises and whether it is fair to its employees. Interestingly, when we interact the trust variable with employee education, we find that trust is an important determinant of participation only for less-educated employees. Our interpretation is that people without a bachelor's degree find it more difficult to study the terms of the plan and perhaps cannot determine whether it is indeed a good deal. If such individuals implicitly trust their employer, they are more likely to invest in the ESPP.

We also find a strong non-linear effect of age on the decision to sign up for the plan. This is evident from negative coefficients on dummy variables for people younger than 25 and those 55 and older. The inverted U-shape age-skill pattern we find in the context of ESPP participation is similar to results found by Korniotis and Kumar (2011) on individual investments in the broader equity market.

Overall, from our analysis of individual-level data we find that employee participation rates are strongly related to proxies for familiarity with dealing with stock. We also find a robust relationship with proxies for education and financial literacy. Further, education helps mitigate the effect of lack of familiarity with dealing with stocks on propensity to participate in an ESPP. As seen in other contexts related to making financial mistakes, non-participation is highest among very young and very old employees.

## **IV. Failing to Sell the ESPP Stock**

We next examine whether employees quickly sell the stock acquired through ESPPs. It is commonly argued that employees in the U.S. invest too large a share of their personal wealth in their company's stock (see, e.g., Benartzi (2001); Poterba (2003); and Cohen (2009)). For example, Meulbroek (2005) estimates that on a risk-adjusted

basis the value of company stock is only 50% to undiversified employees. However, a decision not to sell the stock may be justified if employees have favorable information about future returns or wish to reduce their tax bill. Overall, given the large cost of a lack of diversification, an employee's decision not to sell any company stock during her tenure is likely suboptimal. Additionally, we find in unreported results that people who report not selling their ESPP stock also report a lower profit from the ESPP.

Here we investigate the determinants of an employee's failure to sell the company stock. Since only employees who enroll in an ESPP in the first place can decide whether to keep or sell the stock, we estimate the model using the Heckman two-stage sample selection method. We use the same dependent variables for the selection equation (ESPP participation) as for the outcome variable (a decision not to sell the stock), so that our identification comes from the non-linearity in the Mills ratio term. Table VIII reports our results for the outcome equation, where the dependent variable is equal to 1 if an employee indicates that she has never sold the company stock acquired through the ESPP; otherwise the dependent variable is equal to 0.

We find that females are 10.7% more likely to hold the stock than men, consistent with the findings by Barber and Odean (2001) that women trade less. This result could also be attributed to the fact that women tend to be less selfish than men and have a higher sense of reciprocity (see, e.g., Croson and Buchan (2008) and Eckel and Grossman (1998) for experimental evidence). For example, they could think that the company has been generous to them by allowing them to invest in the ESPP and that in exchange they should hold the stock for some time. Alternatively, it could be that women are more busy than men with raising children and other household responsibilities and simply do not find time to manage stock sales.

Our results indicate that married individuals are less likely to never sell the stock than are single people, which could be attributed to economies of scale in their analysis of financial decisions. Similarly we find that people who received a larger number of promotions and earn higher salaries are more likely to sell their stock, presumably

because they have higher cognitive ability. Employees with longer tenure sell the stock faster, which is consistent with an argument by DeGeorge, Jenter, Moel, and Tufano (2004) that employees with longer tenure have more firm-specific human capital and therefore are subject to higher risk from holding the firm stock. However, the effect of tenure in our context is small and not statistically significant.

We argued in the previous section that Asian ethnicity could be associated with greater patience, which could translate into willingness to hold on to stock for a longer time. On the other hand, if selling the stock soon after the purchase is optimal for the majority of employees, higher group connectedness among Asians and propagation of this knowledge could result in shorter holding periods. We do not find any significant difference among Asians in their propensity to sell the firm's stock.

An unexpected pattern we find is that people with college degrees tend to hold the company stock longer. One possible interpretation of this result is that highly educated people become overconfident and hold the stock in hopes of reaping high rewards. Alternatively, highly educated people could have less firm-specific human capital or be less risk-averse, making them more willing to take the risk of holding on to equity in the firm.<sup>23</sup>

Since some people may not know how to sell the stock through a broker, we test whether previous exposure to trading is associated with more dispositions of stock acquired through ESPPs. Indeed, we find that people who report trading frequently in the stock market are more likely to dispose of their ESPP stock. We also find evidence that financial illiteracy, as proxied by over- and undervaluation of underwater stock options, is associated with a lower propensity to sell the stock. This is especially interesting since people who place no value on out-of-the money stock options must have low expectations for the future stock price, yet they tend to hold the ESPP stock

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<sup>23</sup>Another possible explanation is that highly educated individuals may earn higher salaries and be subject to higher marginal tax rates, thus benefiting more from holding on to the stock. Note, however, that we control for income in the regression specifications. Also, since our variable captures whether the employee *ever* sold stock obtained through participation in an ESPP, tax treatment cannot provide a complete explanation.

longer. This result strongly suggests that this variable captures the effect of financial illiteracy. Table VIII also shows how employees' loyalty and trust affect their decisions to sell their stock. Perhaps unsurprisingly, we find that employees who are more loyal to the firm and more trusting tend not to dispose of the stock. Thus while loyalty and trust may guide employees to invest in an ESPP, those sentiments can also hurt employees by leaving them exposed to risk of their firm's stock.

## V. Discussion

Our analysis so far has focused on the reasons employees may or may not participate in the firm's ESPP plans. We now turn to a discussion of why firms set up such plans in the first place.

In their public filings, many firms mention that creating incentives for employees and increasing their stock ownership are the primary reasons for having an ESPP. For example, firms often use phrases such as “we want to *motivate employees, encourage equity ownership, and increase employee interest in the company's success.*” Companies may also be motivated by a desire to place their stock in friendly hands as a form of takeover defense (Rauh (2006)) and need to raise capital for investment. Note, however, that if setting up an ESPP were motivated by these considerations alone, it could be easier for a firm to grant stock or options to employees without requiring active individual decisions to sign up.

There can also be reasons for a firm to offer an ESPP even if it expects a relatively low participation rate. For example, a firm might be able to use its ESPP as a non-overt tool for providing unequal compensation. This could be important if paying different salaries to employees with similar job descriptions creates tension among coworkers and reduces employee cooperation. Since an ESPP is offered to all employees in the firm, workers should not view it as providing an unfair benefit to some. Yet only the smarter employees (who are likely to have better opportunities for employment elsewhere) are

more likely to figure out that an ESPP presents an excellent investment opportunities decide to participate. It may even be possible for firms to explicitly point out the benefits of participating in an ESPP to only a select group of individuals, thereby increasing their effective compensation.

Similarly, if employees systematically assume that they will participate in an ESPPs at the time they are hired, firms could benefit by including such plans in compensation packages. The stated compensation presented by a firm to a potential new hire could be based on the assumption that the employee will participate in the ESPP, making the compensation seem more generous. Finally, offering an ESPP can be one way for firms to portray the image of an employee-friendly company that encourages employee ownership. It is possible that such an image influences the equity investment choices of some investors.

## **VI. Conclusion**

In this paper, we document that the majority of employees in large public U.S. firms do not take advantage of the riskless and profitable investment opportunities provided by employee stock purchase plans. Individual losses associated with this behavior are non-trivial, with the average employee forfeiting \$3,079 per year by not signing up for the plan.

Our results suggest that non-participation is at least partially attributable to employee financial illiteracy and lack of familiarity in dealing with stocks. Using individual survey data, we document that non-participation is higher among employees who are less familiar with dealing with stocks, less educated, and more likely to incorrectly value financial securities. Employees who fail to take advantage of riskless investment through an ESPP are also less likely to enroll in a 401(k) plan or to participate in the broader equity market. Although ESPPs allow employees to sell the company stock immediately after purchasing it, over 45% of individuals never sell the stock over

their tenure and maintain highly undiversified portfolios. These findings suggest that individuals are making mistakes that substantially affects their welfare.

This analysis points to several potential avenues for future research. For example, left unanswered is the question why so many firms in the U.S. offer discounted stock purchase plans to employees that allow the immediate sale of the stock. Do these firms provide employees with an incentive for value creation and hope that the employees will not bother to sell the stock? Are they trying to use employees as a source of financing? Or are they trying to create a pay structure that rewards the smartest employees who are able to figure out that ESPP participation is a good deal? We hope that future research will provide answers to these intriguing questions.

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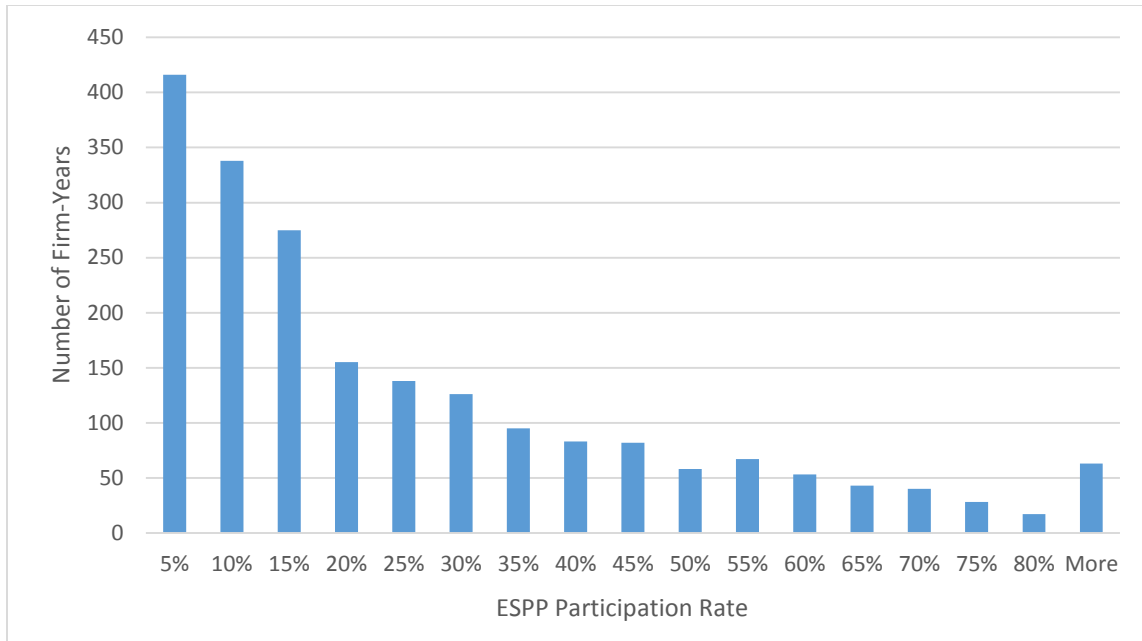
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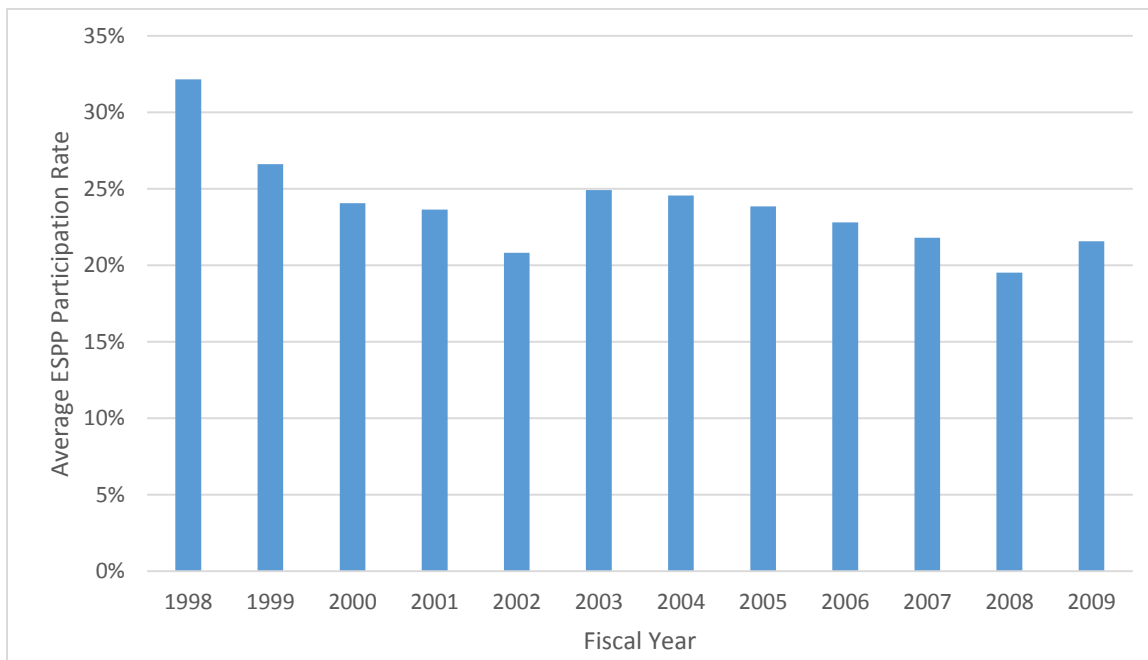
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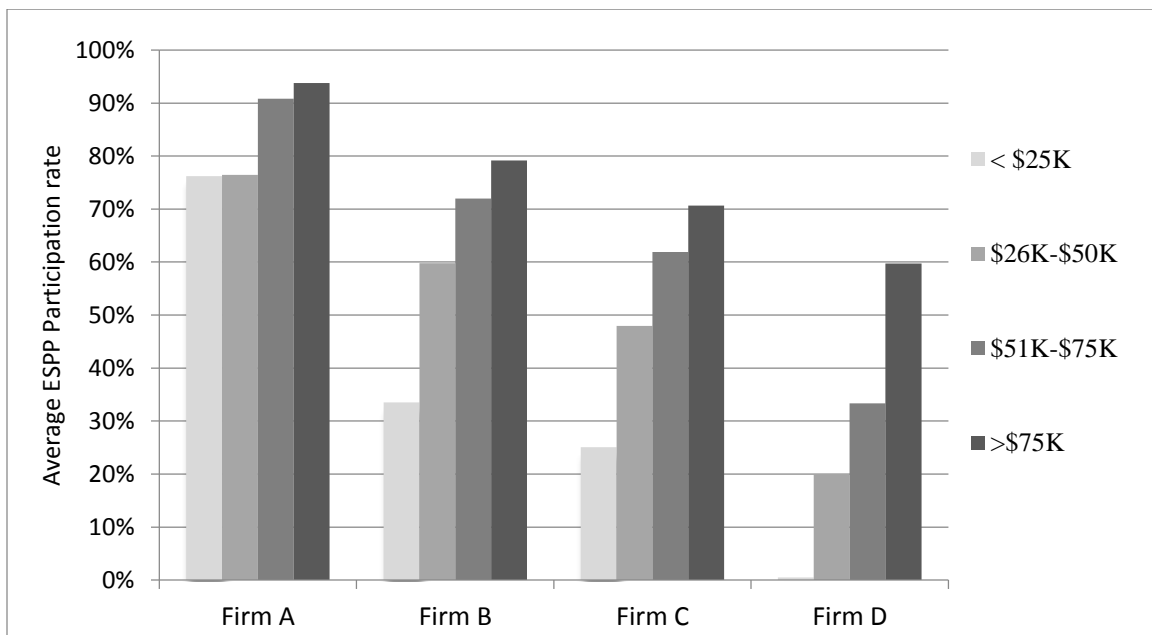
**Figure 1.** Distribution of ESPP participation rates, calculated for 2,077 firm-years. ESPP participation rate is the dollar ESPP contributions per employee normalized by the lower of (1) the annual dollar limit, and (2) the maximum percentage of compensation multiplied by the survey salary. The sample consists of 239 firms during the 1998-2009 period as described in Table I.



**Figure 2.** Distribution of average ESPP participation rates over time. ESPP participation rate is the dollar ESPP contributions per employee normalized by the lower of (1) the annual dollar limit, and (2) the maximum percent of compensation multiplied by the survey salary. The sample consists of 239 firms during the 1998-2009 period as described in Table I.



**Figure 3.** Distribution of annual salary-equivalent employee losses from ESPP non-participation, calculated for 2,077 firm-years. Salary-equivalent annual loss is the amount of additional salary that would give an employee the same value as participation in an ESPP taking into account transaction costs, tax, forgone interest, and the probability of employee separation from the firm (see Appendix B). The sample consists of 239 firms during the 1998-2009 period as described in Table I.



**Figure 4.** Relation between employee salary and average ESPP participation rate in four survey firms.

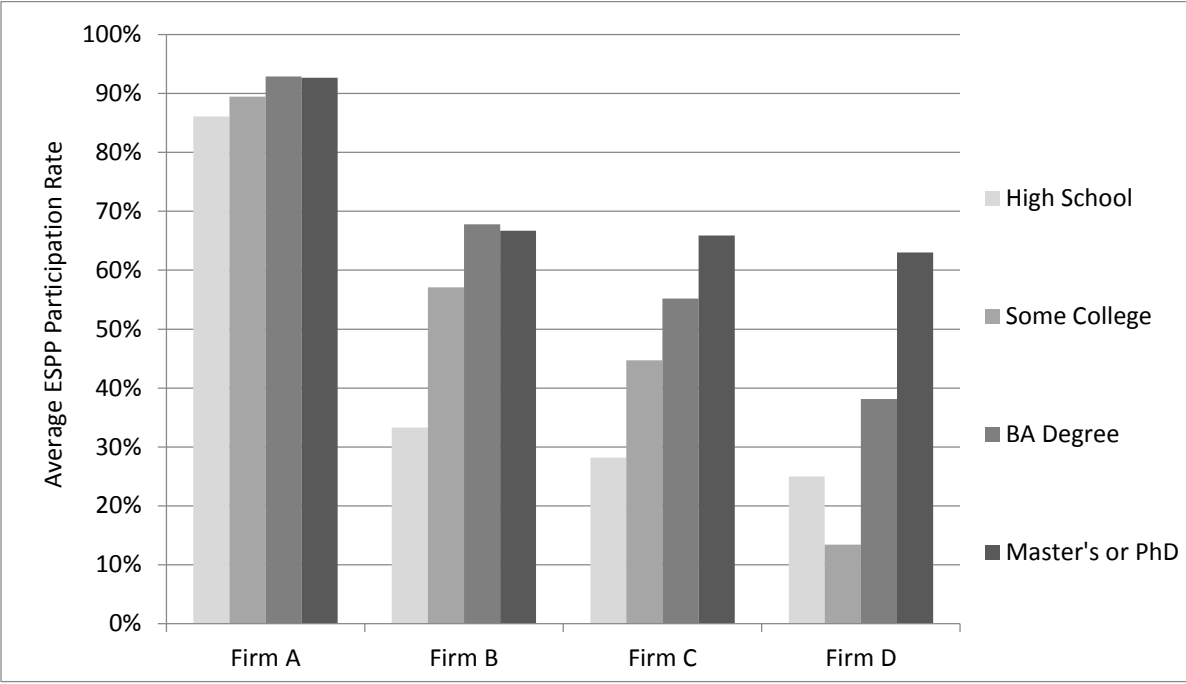


Figure 5. Relation between employee education and average ESPP participation rate in four survey firms.

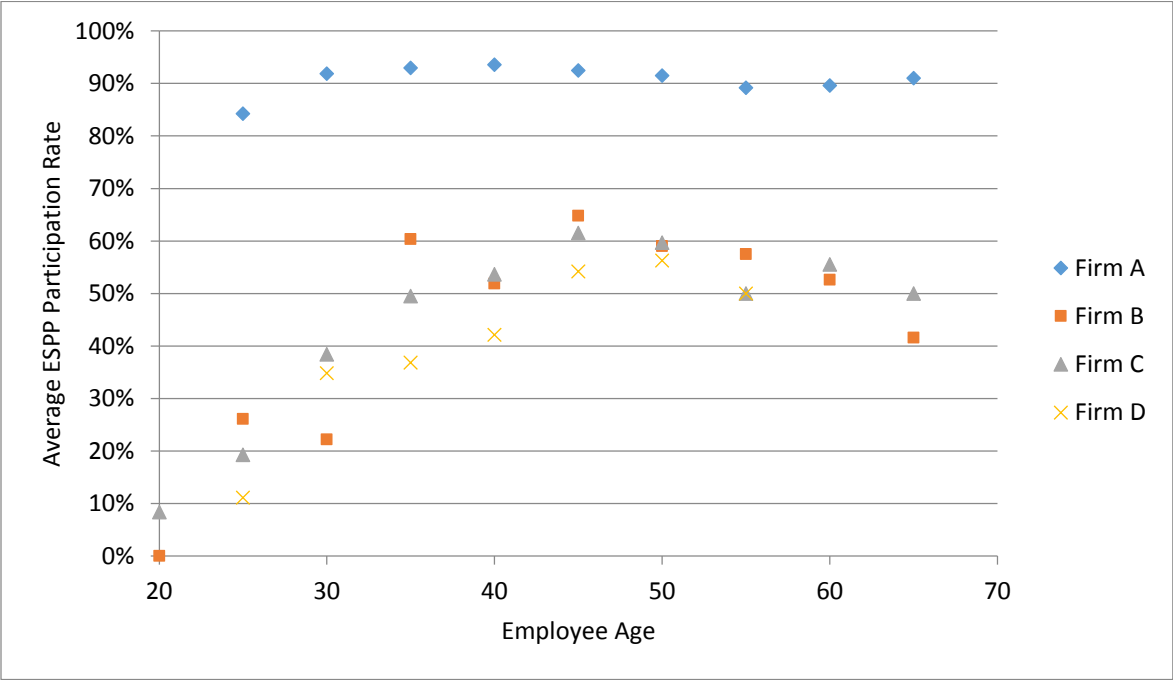
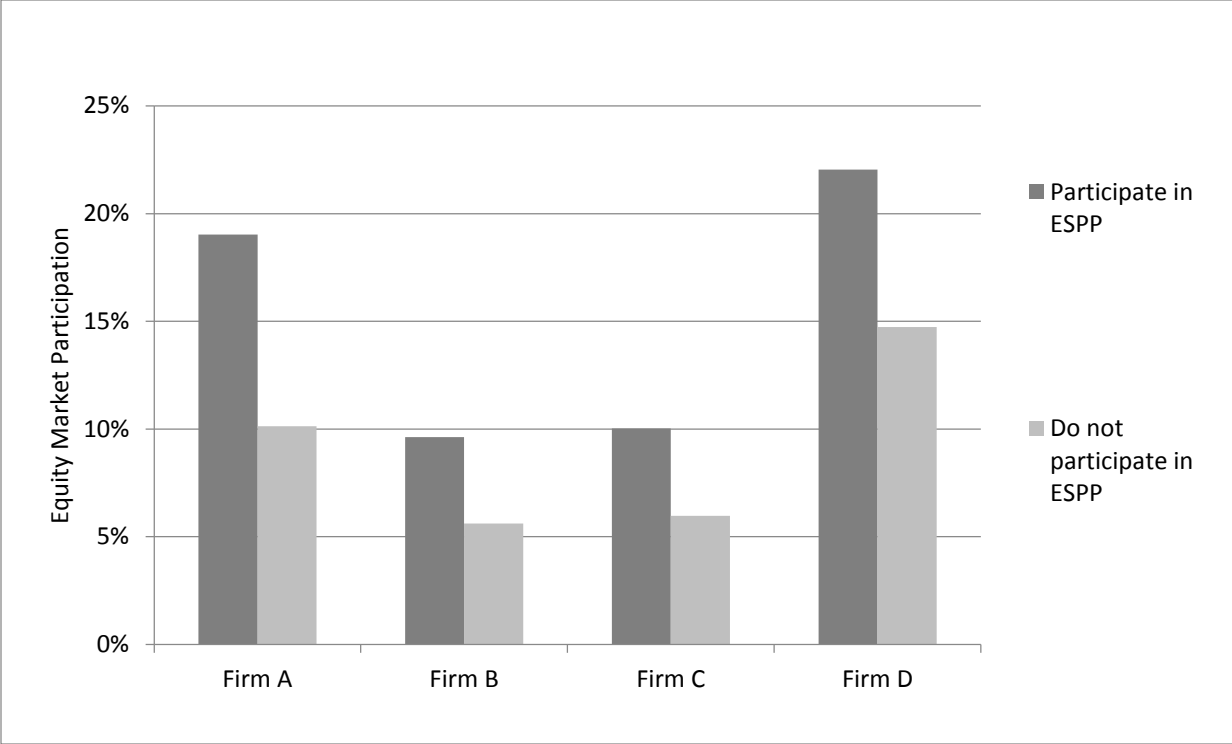
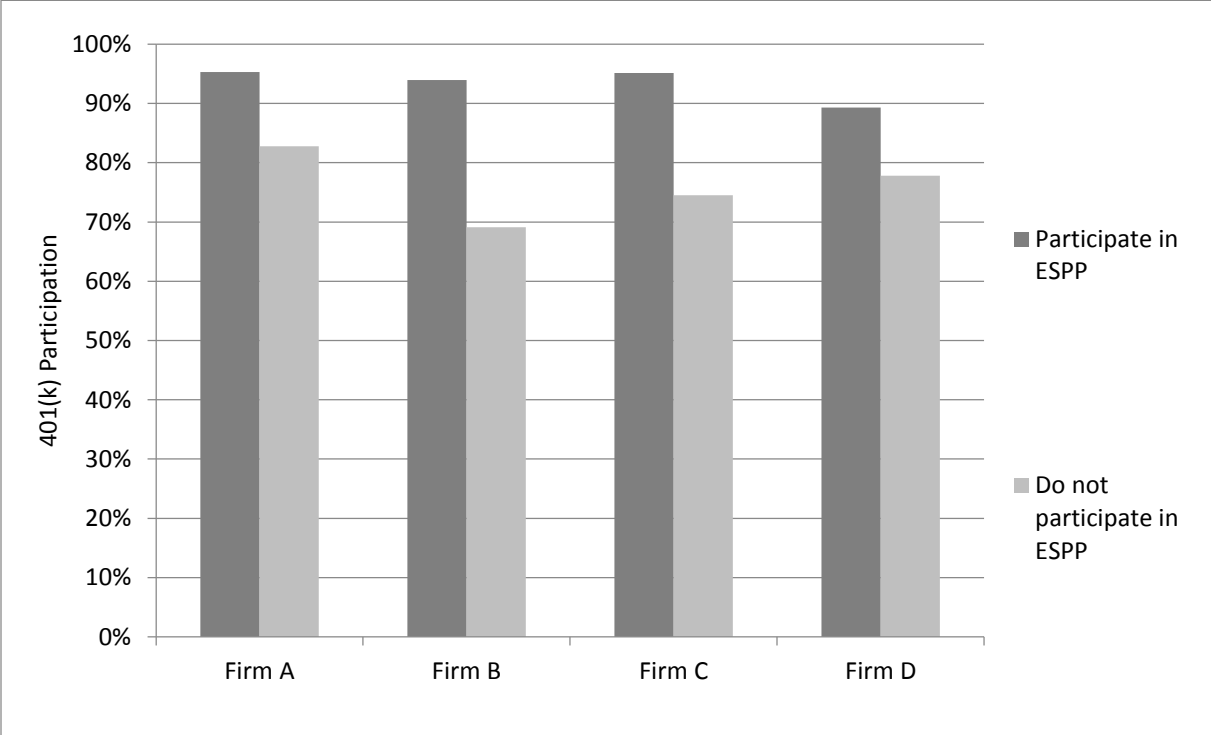


Figure 6. Relation between employee age and average ESPP participation rate in four survey firms.



**Figure 7.** Relation between equity market participation and ESPP participation.



**Figure 8.** Relation between participation in 401(k) plans and participation in an ESPP in four survey firms.

## Appendix A. Bias in the Estimation of ESPP Participation Using Average Salary Data

Let the random variable  $\tilde{P}$  denote the ESPP participation rate, the contribution of an employee divided by the contribution cap and variable  $\tilde{S}$  denote salary of an employee. We would like to measure the average participation rate in each firm,  $E(\tilde{P})$ . However, because we can observe only the average employee salary per firm instead of a set of individual salaries, we are measuring

$$\frac{E(\tilde{P} \cdot \tilde{S})}{E(\tilde{S})}.$$

To see whether we over- or underestimate the true average participation rate in each firm, we have to sign the difference between the two measures

$$\frac{E(\tilde{P} \cdot \tilde{S})}{E(\tilde{S})} - E(\tilde{P}).$$

Multiplying the equation by  $E(\tilde{S})$  and using the definition of covariance, we obtain

$$E(\tilde{P} \cdot \tilde{S}) - E(\tilde{P})E(\tilde{S}) = Cov(\tilde{P}, \tilde{S}).$$

Thus if the correlation between the individual employee salary and participation in the ESPP is positive, we will overestimate the participation rate.

## Appendix B. Salary Equivalent of ESPP Participation

We calculate the salary equivalent of ESPP participation, taking into account the following factors: (1) risk of employee separation from the job (we assume the employee's likelihood of separation is uncorrelated with the value of the company's stock); (2) individual taxes on ESPP profits; (3) transaction costs. We do a separate analysis for the case when an employee has to borrow money in order to invest in the ESPP.

Assuming that the employee is allowed to invest  $\bar{C}$  per year in the ESPP and the purchase period is  $T$  years, she can invest an amount  $C = \bar{C}T$  in every purchase period. We assume that she holds the rest of her wealth in Treasuries earning a risk-free rate. The employee's total wealth at the end of the purchase period is

$$W = w_{RF} + \max\left(\frac{CP_T}{(1-d)P_0}, \frac{CP_T}{(1-d)P_T}\right) - \tau \max\left(\frac{C(P_T - P_0(1-d))}{(1-d)P_0}, \frac{C(P_T - P_T(1-d))}{(1-d)P_T}\right) - \phi, \quad (6)$$

where  $P_T$  is the stock price at the end of the purchase period,  $d$  is the ESPP discount,  $\tau$  is the ordinary individual tax rate,  $\phi$  is the transaction cost, and  $w_{RF}$  is dollar amount invested by the employee in Treasuries plus the accumulated after-tax interest

$$w_{RF} = w - C + (1 - \tau) \left( w \left[ (1 + r_f)^T - 1 \right] - C \left[ (1 + r_f)^{T/2} - 1 \right] \right). \quad (7)$$

Note that since the employee contributes money to an ESPP over the course of the purchase period, the forgone interest on ESPP contributions is cumulated over half of the period. The remaining terms in (6) capture the after-tax proceeds from an ESPP sale less transaction costs. The employee buys a maximum number of  $\frac{C}{(1-d)P_0}$  and  $\frac{C}{(1-d)P_T}$  shares (because of a lookback feature) and sells them at the price  $P_T$ . The tax is levied at the rate  $\tau$  on the ESPP profit. The expected wealth of the employee is

$$EW = w_{RF} + \frac{C(1-\tau d)}{1-d} + \frac{C(1-\tau)}{(1-d)P_0} E(P_T - P_0)^+ - \phi, \quad (8)$$

For ESPPs without a lookback, the end-of-purchase-period expected wealth is

$$EW = w_{RF} + \frac{C(1 - \tau d)}{1 - d} - \phi. \quad (9)$$

If the employee contributes to an ESPP and changes jobs during the purchase period, she is reimbursed for her contributions and her wealth is

$$W_{turn} = w_{RF} + C. \quad (10)$$

To obtain the salary equivalent of ESPP participation, consider the wealth of an employee who is given a fixed amount  $S$  in the form of a salary

$$EW_S = w + w(1 - \tau) \left( (1 + r_f)^T - 1 \right) + S(1 - \tau). \quad (11)$$

The salary equivalent can then be obtained from the following equation

$$EW_S = (1 - p)EW + pEW_{turn}. \quad (12)$$

where  $p$  is the probability of turnover during the purchase period. Solving this equation for  $S$  yields

$$S = (1 - p) \left( \frac{Cd}{1 - d} + \frac{Cl}{(1 - d)P_0} E(P_T - P_0)^+ - \frac{\phi}{1 - \tau} \right) - C \left( (1 + r_f)^{T/2} - 1 \right), \quad (13)$$

where  $l$  equals 1 for firms with a lookback, and zero otherwise. Note that the expected value  $E(P_T - P_0)^+$  can be calculated using the Black-Scholes formula.

If, in addition, the employee does not have any savings to invest in an ESPP and has to borrow the amount  $C$  at the interest rate of  $b$  per year, the salary equivalent becomes

$$S = (1 - p) \left( \frac{Cd}{1 - d} + \frac{Cl}{1 - d} \frac{1}{P_0} E(P_T - P_0)^+ - \frac{\phi}{1 - \tau} \right) - C \left( (1 + b)^{T/2} - 1 \right). \quad (14)$$



**Table I. Sample Selection Criteria.**

The table describes the sample selection criteria and the remaining number of firms. The sample includes S&P 500, S&P 400 Midcap, and NASDAQ 100 firms that sponsored at least one employee stock purchase plan over the period 1998–2009 with the following features: (1) the plan is broad-based, (2) sufficient data are available to calculate the participation rate in the ESPP, (3) the plan allows employees to sell the stock immediately after the purchase and provides substantial value (discount is greater than 5%).

Selection Criteria	Remaining Firms
Unique firms in S&P 500, S&P 400, and NASDAQ 100	925
Non-foreign firms that filed 10K forms	918
Firms offer an ESPP plan	473
ESPP plan is broad-based	393
Sufficient data are available to calculate participation rate	321
ESPP plan allows for immediate stock resale and has a discount greater than 5%	239

## Table II. Descriptive Statistics of ESPP Plan Characteristics and Other Variables (Firm Level).

The sample consists of S&P 500, S&P 400 Midcap, and NASDAQ 100 firms with ESPPs that satisfy all the criteria in Table I (239 firms). *Years since adoption* is the number of years since the plan was disclosed in SEC filings; *maximum percent of compensation* is the maximum percentage of compensation an employee can contribute to the ESPP; *annual dollar limit on contributions* is the dollar cap on participation, which is calculated as the lowest of the various participation caps specified by the company; *purchase period* is the period over which payroll deductions are made prior to stock purchase; *discount* is the percentage discount at which an employee can buy stock; *lookback option* is equal to 1 if the price at which employees can buy the stock is the lower of the prices at the beginning and the end of the purchase period minus the specified discount. *Discount value* is equal to  $d/(1 - d)$ , where  $d$  is the discount. *Lookback value* is calculated as the Black-Scholes value of a call option with time-to-maturity equal to the purchase period and strike price equal to the price at the beginning of the purchase period. *Total value* is the sum of discount value and the lookback value. *Withdraw option* is equal to 1 if the firm allows employees to withdraw contributions during the purchase period; *increase (decrease) contribution option* is equal to 1 if the firm allows employees to increase (decrease) their contributions during the purchase period; *minimum employment* is the minimum number of months of employment needed to qualify for the plan; *lump-sum contributions allowed* is equal to 1 if the plan does not require periodic payroll contributions and allows for lump-sum contributions at the end of the purchase period; *survey salary* is the average wage as self-reported by employees on Glassdoor.com; *Compustat salary* is equal to the staff expense (from Compustat) normalized by the number of employees; whenever this item is missing, it is set to the median value within the industry (defined by the two-digit SIC code); *option grants/employee* is the Black-Scholes value of granted employee stock options, normalized by the number of employees; *option exercises/employee* is the number of options exercised by employees multiplied by the difference between the stock price and the weighted average exercise price, normalized by the number of employees; *401(k) participation* is equal to the combined employee contributions during the year divided by the number of employees and the average survey salary; *CEO approval by employees* is the percentage of employees that approve of the firm's CEO (Glassdoor.com); *100 best company* is equal to 1 if the firm is listed in the year as one of the 100 best companies to work for by Fortune magazine, and is 0 otherwise; *Finance industry* is the 16th industry out of 17 industries defined by Fama and French; and *employee turnover* is the number of forfeited employee stock options in the previous year divided by the total number of outstanding stock options.

<i>Panel A: ESPP Plan Characteristics</i>						
	Obs.	Mean	SD	10%	50%	90%
Years since adoption	2,077	9.2	6.1	2	8	17
Maximum percent of compensation (%)	2,077	17.0	20.4	10	10	20
Annual dollar limit on contributions (\$)	2,077	9,911	4,769	5,000	8,962	15,512
Purchase period (months)	2,065	6.3	4.2	3	6	12
Discount (%)	2,077	14.9	4.0	15	15	15
Lookback option (%)	2,077	80.6	39.6	0	1	1
Discount value (%)	2,077	17.4	4.2	17.6	17.6	17.6
Lookback value (%)	2,077	16.4	12.4	0	15.3	33.2
Total value (%)	2,077	33.3	12.5	17.6	32.8	49.6
Withdraw option (%)	2,026	90.5	29.3	0	1	1
Increase contribution option (%)	1,979	45.2	49.8	0	0	1
Decrease contribution option (%)	1,973	65.2	47.6	0	1	1
Lump-sum contributions allowed (%)	2,052	11.2	31.6	0	0	1
Minimum employment (months)	2,052	3.5	6.7	0	0	12

<i>Panel B: Other Variables</i>						
	Obs.	Mean	SD	10%	50%	90%
Survey salary (\$)	2,077	63,083	19,392	33,332	64,325	87,160
Compustat salary (\$)	1,955	58,379	26,224	35,687	54,478	85,073
Option grants/employee (\$)	1,862	18,900	37,754	213	3,725	52,478
Option exercises/employee (\$)	1,869	17,672	38,523	59	2,902	50,866
401(k) participation (%)	740	4.4	2.4	1.2	4.4	7.6
CEO approval by employees (%)	1,797	62.6	21.9	33	64	89
100 best company (%)	2,077	7.9	27.0	0	0	0
Finance industry	2,077	0.08	0.276	0	0	0
Employee turnover (%)	1,745	9.0	11.0	1.4	5.5	18.2

**Table III. Firm and Employee Characteristics at Four Firms (Individual Level).**

Panel A gives the broad firm characteristics and Panel B presents the individual employee characteristics at four firms. *Number of promotions* is the number of promotions an employee has received over his/her tenure, where 3 or more promotions is coded as 3; *salary* is the employee's annual base pay (excluding any bonuses and commissions) before taxes and deductions; *wealth* is the employee's estimate of the value of her house minus the mortgage, plus the value of stocks, mutual funds, and bonds owned, cash, checking accounts, and value of retirement accounts including 401(k); *Ever received stock options* is equal to 1 if the employee has ever been granted employee stock options, and is equal to 0 otherwise. *Trade other securities* is equal to 1 if the employee reports that he/she frequently buys and sells securities in the market, and is equal to 0 otherwise. *Irrational ESO overvaluation* is equal to 1 if the employee would not exchange 10 underwater stock options for anything less than 10 shares. *Irrational ESO undervaluation* is equal to 1 if the employee would exchange 10 underwater stock options for 0 shares of stock.

<i>Panel A: Firm Characteristics</i>				
	Firm A	Firm B	Firm C	Firm D
Year of survey	2004	2005	2005	2005
Web or paper survey	Web	Paper	Web	Web
Response rate	19.1%	71.5%	63.4%	76.7%
Industry	High tech	Food services	Financial	High tech
Number of employees	Over 30,000	500-1,000	5,000-10,000	Under 500
US employees	84.5%	100%	100%	44.8%
<i>Panel B: Employee Characteristics</i>				
	Firm A	Firm B	Firm C	Firm D
Female (%)	22.0	44.7	66.2	24.5
Married (%)	82.0	61.3	62.0	73.1
White (%)	72.3	96.6	84.1	62.8
Asian (%)	18.6	1.0	3.2	32.1
BA degree (%)	83.6	26.1	43.7	75.0
Average age (years)	39.4	40.0	38.5	36.8
Average tenure (years)	4.4	5.5	6.1	2.2
Average number of promotions	1.3	1.1	1.5	0.5
Average salary	\$98,985	\$35,518	\$46,335	\$86,188
Average wealth	\$724,815	\$179,064	\$204,403	\$327,571
Ever received stock options (%)	99.8	77.7	89.2	84.7
Average intrinsic value of owned ESOs (\$)	320,174	7,133	36,617	141,177
Employees participate in 401(k) (%)	94.5	82.4	84.5	85.3
Trade other securities (%)	18.3	7.6	7.9	17.7
Irrational ESO overvaluation (%)	15.0	N/A	N/A	N/A
Irrational ESO undervaluation (%)	5.1	N/A	N/A	N/A

**Table IV. ESPP Non-Participation and Employee Losses.**

*ESPP participation* is the ESPP contributions per employee normalized by the lower of (1) the annual dollar limit, and (2) the maximum percentage of compensation multiplied by the survey salary; *ESPP participation (Compustat)* is the ESPP contributions per employee normalized by the lower of (1) the annual dollar limit, and (2) the maximum percentage of compensation multiplied by the Compustat salary; *expected annual loss* is the total expected dollar amount that an employee can earn from ESPP participation and the immediate sale of stock, calculated as total value multiplied by the annual dollar limit on contributions; *salary equivalent annual loss* is the amount of additional salary that would give an employee the same value as participation in an ESPP, taking into account transaction costs, tax, forgone interest, and the probability of employee separation from the firm (see Appendix B); *salary equivalent annual loss with credit card borrowing* is calculated in the same way, but assumes that the employee has no free cash to invest in the plan and has to borrow money on a credit card (see Appendix B). *Employees ever enrolled in ESPP* is the fraction of eligible employees in each firm who report having participated in the ESPP; *Employees ever enrolled in ESPP who never sold stock* is the fraction of employees who report having participated in the ESPP and never selling their acquired stock.

<i>Panel A: Firm Level Data</i>						
	Obs.	Mean	SD	10%	50%	90%
ESPP participation (%)	2,077	23.8	22.6	2.7	15.2	58.5
ESPP participation (Compustat) (%)	1,955	30.4	29.6	2.7	19.1	81.7
Expected annual loss (\$)	2,077	3,446	2,362	1,116	2,867	6,500
Expected annual loss as % of salary	2,077	5.4	3.3	2.2	4.7	9.3
Salary equivalent annual loss (\$)	2,065	3,079	2,305	857	2,555	6,042
Salary equivalent annual loss with credit card borrowing (\$)	2,065	2,877	2,252	736	2,349	5,721
<i>Panel B: Individual Level Data</i>						
	Firm A	Firm B	Firm C	Firm D		
Employees ever enrolled in ESPP (%)	92.3	52.3	47.8	40.9		
Expected annual loss, mean (\$)	3,758	984	1,934	3,127		
Salary equivalent annual loss, mean (\$)	3,362	811	1,693	2,783		
Salary equivalent annual loss with credit card borrowing, mean (\$)	3,115	738	1,599	2,582		
Salary equivalent loss over the employee tenure, mean (\$)	13,713	4,488	8,547	5,932		
Salary equivalent loss as % of salary, mean (\$)	3.7	2.7	5.8	3.9		
Employees ever enrolled in ESPP who never sold stock (%)	39.5	44.8	58.5	38.0		

**Table V. Predictions for Level of Employee Participation in an ESPP.**

This table summarizes our main empirical hypotheses for the level of employee participation in an ESPP.

Firm-Level Variable	Comments	Individual-Level Variable	Comments
<i>Plan Costs and Benefits</i>			
Discount value	+	Log(salary)	+
Lookback value	+		
			Increases with years since adoption
Discount-lookback value	+/-		Ambiguous effect
Holdup	-		
Employee turnover	-/0		Weak negative effect
Survey salary	+		
<i>Liquidity Constraints</i>			
Survey salary	+	Log(salary)	+
Option exercises/employee	+		
Purchase period	-		
<i>Familiarity/Awareness</i>			
Option grants/employee	+	Ever received stock options	+ Weaker for more educated employees
Years since adoption	+	Trade other securities	+ Weaker for more educated employees
<i>Education and Financial Literacy</i>			
Finance industry	+	BA degree	+
		Irrational ESO overvaluation	-
		Irrational ESO undervaluation	-
<i>Experience in the Stock Market</i>			
Past stock return	+	Positive stock return experience	+ Weaker for more educated employees
Recession	-		
<i>Employee Trust and Loyalty</i>			
100 best company	+	Employee loyalty	+
CEO approval by employees	+	Employee trust	- Weaker for more educated employees

**Table VI. Employee Participation in an ESPP (Firm Level).**

The dependent variable is *ESPP participation*. *RD/assets* is research and development expenses normalized by the book value of assets; *firm size* is the natural logarithm of the book value of assets; *Tobin's Q* is the sum of market value of equity and book value of debt normalized by the book value of assets; other variables are defined in the header of Table II. The estimation includes year and industry fixed effects (Fama-French 17), unless specified otherwise. *t*-statistics based on robust standard errors clustered by firm are listed in parentheses. The numbers below the *t*-statistics indicate by how much the participation rate increases for a one standard deviation increase in the independent variable.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Survey salary	0.18*** (2.90) 3.5%	0.18*** (2.97) 3.5%	0.16*** (3.44) 3.1%	0.20*** (3.11) 3.9%	0.18*** (2.93) 3.5%	0.17** (2.55) 3.3%	0.16** (2.55) 3.1%
Years since adoption	0.61*** (3.57) 3.7%	0.29 (1.33) 1.8%	0.60*** (4.24) 3.7%	0.62*** (3.78) 3.8%	1.28*** (3.30) 7.8%	0.70*** (4.00) 4.3%	0.71*** (4.13) 4.3%
Years since adoption* lookback value		2.02** (2.07)					
Holdup			-4.70*** (-2.73)				
Plan 423			2.76 (0.93)				
Purchase period			-0.35* (-1.76)				
Employee turnover				-0.91 (-0.18)			
Years since adoption <sup>2</sup>					-0.03* (-1.85)		
Option exercises /employee						0.09*** (3.16) 3.5%	
Option grants /employee							0.11*** (3.94) 4.2%
Discount value	78.87*** (9.05)	76.25*** (9.18)	70.18*** (7.92)	55.53*** (5.89)	75.97*** (8.95)	56.54*** (6.59)	58.26*** (7.13)
Lookback value	34.44*** (4.74)	17.32 (1.62)	41.89*** (6.00)	34.42*** (4.63)	34.11*** (4.71)	31.33*** (4.29)	28.67** (4.01)
RD/assets	112.9*** (6.10)	108.6*** (5.90)	104.0*** (6.53)	106.0*** (5.61)	109.5*** (5.89)	107.7*** (5.74)	102.1*** (5.50)
Firm size	1.80** (2.26)	1.86** (2.37)	1.73*** (2.74)	2.16*** (2.80)	1.89** (2.40)	1.60** (2.07)	1.64** (2.18)
Tobin's Q	3.57*** (6.72)	3.64*** (6.84)	3.48*** (7.63)	3.52*** (6.40)	3.52*** (6.61)	2.22*** (3.64)	2.24*** (4.40)
Years/industries	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
Adjusted- $R^2$	0.483	0.487	0.496	0.497	0.486	0.498	0.506
Observations	2,059	2,059	2,706	1,733	2,059	1,854	1,848

	(8)	(9)	(10)	(11)	(12)	(13)
Survey salary	0.22*** (4.61) 4.3%	0.18*** (2.93) 3.5%	0.17*** (2.68) 3.3%	0.21*** (3.21) 4.1%	0.11** (2.03) 2.1%	0.10 (1.56) 1.9%
Years since adoption	0.58*** (3.57) 3.5%	0.63*** (3.85) 3.8%	0.57*** (3.29) 3.5%	0.66*** (3.69) 4.0%	0.54*** (3.56) 3.3%	0.65*** (4.05) 4.0%
Finance industry	8.20** (2.00) 2.3%					
100 best company		12.93*** (4.10) 3.5%				
CEO approval by employees			0.11** (2.30) 2.4%			
Contemporaneous stock return				0.06 (0.07)		
Past stock return				0.20 (0.11)		
Recession					-3.24*** (-4.63) -1.3%	
Holdup						6.99*** (3.09)
401(k) participation						3.58*** (7.81)
401(k) participation* holdup						-2.44*** (-4.53)
Discount value	79.63*** (10.49)	75.94*** (9.54)	82.41** (2.47)	68.42*** (8.33)	77.45*** (9.03)	54.62*** (4.15)
Lookback value	34.34*** (4.67)	36.52*** (5.23)	33.30*** (4.33)	33.28*** (4.41)	36.76*** (5.45)	34.83*** (3.82)
RD/assets	111.5*** (6.31)	103.4*** (5.53)	112.5*** (5.64)	104.4*** (5.38)	121.8*** (6.71)	70.17*** (2.92)
Firm size	2.14*** (2.82)	0.94 (1.31)	1.87** (2.08)	1.82** (2.21)	1.70** (2.14)	2.25*** (2.99)
Tobin's Q	3.35*** (6.62)	3.15*** (6.35)	3.42*** (6.08)	3.64*** (5.21)	3.75*** (7.19)	3.42*** (5.72)
Years/industries	Yes/No	Yes/Yes	Yes/Yes	Yes/Yes	No/Yes	Yes/Yes
Adjusted- $R^2$	0.472	0.503	0.507	0.489	0.474	0.585
Observations	2,059	2,059	1,779	1,882	2,059	1,121



**Table VII. ESPP Participation and Employee Characteristics (Individual Level).**

The dependent variable is equal to 1 if an employee ever participated in the firm's ESPP, and is equal to 0 otherwise. The model is estimated by probit with firm fixed effects and country fixed effects. *Positive stock return experience* is past stock returns of the firm weighted over the employee tenure, with more recent years carrying a larger weight. *Employee loyalty* is the sum of how loyal the employee feels to the firm on a scale of 1 to 4 and whether the employee feels she shares a common purpose with the firm on a scale of 1 to 4. *Employee trust* is the sum of whether the employee feels the company is fair to its employees on a scale of 1 to 4 and whether the company keeps its promises. The omitted age category is the dummy for  $35 \leq \text{Age} < 45$ . Other variables are described in the header of Table III. Each cell shows the coefficient, *t*-statistic (in parentheses), and the economic magnitude, measured as the average marginal effect multiplied by the standard deviation of the independent variable (if continuous) or by 1 (if a dummy). The marginal effects and *t*-statistics for the interaction effects are calculated using the procedure developed by Ai and Norton (2003).

	(1)	(2)	(3)	(4)
Female	-0.02 (-0.33) -0.3%	-0.01 (-0.24) -0.2%	0.09 (1.24) 1.1%	-0.02 (-0.33) -0.3%
Married	0.06 (1.29) 1.1%	0.05 (1.03) 0.9%	-0.02 (-0.31) -0.3%	0.06 (1.31) 1.1%
Asian	0.27*** (3.82) 4.9%	0.26*** (3.59) 4.5%	0.24*** (2.79) 3.0%	0.27*** (3.77) 4.9%
BA degree	0.24*** (4.89) 4.3%	0.25*** (5.02) 4.4%	0.12 (1.58) 1.4%	0.57*** (2.76) 10.2%
Age < 25	-0.50*** (-3.80) -9.0%	-0.38*** (-2.82) -6.8%	-0.35 (-1.11) -4.3%	-0.48*** (-3.66) -8.7%
25 ≤ Age < 35	-0.08 (-1.59) -1.5%	-0.07 (-1.33) -1.2%	-0.04 (-0.62) -0.5%	-0.08 (-1.48) -1.4%
45 ≤ Age < 55	-0.07 (-1.31) -1.3%	-0.07 (-1.30) -1.3%	-0.09 (-1.27) -1.2%	-0.07 (-1.28) -1.3%
Age ≥ 55	-0.23*** (-2.74) -4.2%	-0.26*** (-2.99) -4.6%	-0.24** (-2.01) -2.9%	-0.24*** (-2.79) -4.3%
Log(tenure)	0.13*** (4.91) 2.4%	0.15*** (4.15) 2.6%	0.09** (2.47) 1.1%	0.14*** (5.08) 2.5%
Number of promotions	0.17*** (8.66) 3.0%	0.14*** (6.97) 2.5%	0.18*** (6.25) 2.2%	0.17*** (8.58) 3.0%
Log(salary)	0.29*** (5.81) 5.2%	0.23*** (4.46) 4.0%	0.08 (0.98) 0.9%	0.29*** (5.82) 5.3%
Irrational ESO overvaluation			-0.29*** (-3.88) 3.5%	
Irrational ESO undervaluation			-0.56*** (-5.54) 6.8%	
Ever received stock options		0.82*** (6.51) 14.5%		
Trade other securities		0.30*** (4.62) 5.3%		
Positive stock return experience		0.27** (2.30) 4.8%		
Employee loyalty		0.02 (1.63) 0.4%		
Employee trust				0.03* (1.90) 0.6%
Employee trust*				-0.04* (-1.75) 0.8%
BA degree				
Pseudo-R <sup>2</sup>	0.268	0.281	0.096	0.269
Firms included	All	All	A	All
Observations	7,537	7,453	5,206	7,453

	(5)	(6)	(7)	(8)	(9)	(10)
BA degree	0.61*** (2.61)	0.27*** (5.21)	0.38*** (3.65)	2.74*** (3.20)	0.24*** (4.94)	0.24*** (4.93)
Log(salary)	10.7% 0.22*** (4.37)	4.7% 0.23*** (4.43)	6.8% 0.22*** (4.34)	48.2% 0.37*** (5.20)	4.3% 0.90*** (4.18)	4.3% 0.27*** (5.11)
Ever received stock options	3.9% 1.00*** (5.75)	4.0% 0.82*** (6.52)	3.9% 0.82*** (6.52)	6.5% 0.81*** (6.43)	15.9% 8.15*** (3.58)	4.8% 0.82*** (6.46)
Trade other securities	17.6% 0.30*** (4.65)	14.5% 0.46*** (3.49)	14.5% 0.30*** (4.61)	14.3% 0.30*** (4.70)	143.6% 0.30*** (4.67)	14.4% 3.87*** (3.31)
Positive stock return experience	5.3% 0.26** (2.19)	8.1% 0.27** (2.27)	5.3% 0.45*** (2.65)	5.4% 0.26** (2.15)	5.3% 0.24** (2.06)	68.1% 0.27** (2.29)
Employee loyalty	4.6% 0.02* (1.65)	4.8% 0.02 (1.63)	8.0% 0.02* (1.65)	4.5% 0.02* (1.66)	4.4% 0.02* (1.69)	4.8% 0.02* (1.70)
BA degree*Ever received stock options	0.4% -0.37* (-1.91)	0.4% -0.37* (-1.91)	0.4% -0.37* (-1.91)	0.4% -0.37* (-1.91)	0.4% -0.37* (-1.91)	0.4% -0.37* (-1.91)
BA degree*Trade other securities	0.4% -0.21** (-2.11)	0.4% -0.21** (-2.11)	0.4% -0.21** (-2.11)	0.4% -0.21** (-2.11)	0.4% -0.21** (-2.11)	0.4% -0.21** (-2.11)
Positive stock return experience*BA degree	0.4% -0.27* (-1.79)	0.4% -0.27* (-1.79)	0.4% -0.27* (-1.79)	0.4% -0.27* (-1.79)	0.4% -0.27* (-1.79)	0.4% -0.27* (-1.79)
Log(salary)*BA degree	0.4% -0.23*** (-3.50)	0.4% -0.23*** (-3.50)	0.4% -0.23*** (-3.50)	0.4% -0.23*** (-3.50)	0.4% -0.23*** (-3.50)	0.4% -0.23*** (-3.50)
Log(salary)*Ever received stock options	0.4% -0.70*** (-3.14)	0.4% -0.70*** (-3.14)	0.4% -0.70*** (-3.14)	0.4% -0.70*** (-3.14)	0.4% -0.70*** (-3.14)	0.4% -0.70*** (-3.14)
Log(salary)*Trade other securities	0.4% -0.32*** (-3.40)	0.4% -0.32*** (-3.40)	0.4% -0.32*** (-3.40)	0.4% -0.32*** (-3.40)	0.4% -0.32*** (-3.40)	0.4% -0.32*** (-3.40)
Pseudo-R <sup>2</sup>	0.281	0.281	0.281	0.282	0.283	0.282
Firms included	All	All	All	All	All	All
Observations	7,453	7,453	7,453	7,453	7,453	7,453

**Table VIII. Not Selling Stock Purchased through an ESPP and Employee Characteristics (Individual Level).**

The dependent variable is equal to 1 if the employee participated in an ESPP but never sold the stock, and is equal to 0 if the employee participated in an ESPP and sold the stock sometime in the past. The model is estimated by the two-stage Heckman selection model with firm and country fixed effects. The selection equation (whether an employee chooses to participate) uses the same dependent variables as the outcome equation (whether an employee holds the stock). *Employee loyalty* is the sum of how loyal the employee feels to the firm on a scale of 1 to 4 and whether the employee feels she shares a common purpose with the firm on a scale of 1 to 4. *Employee trust* is the sum of whether employee feels the company is fair to its employees on a scale of 1 to 4 and whether the company keeps its promises. The omitted age category is the dummy for  $35 \leq \text{Age} < 45$ . Other variables are described in the header of Table III. Each cell shows the coefficient, t-statistic (in parentheses), and the economic magnitude, measured as the average marginal effect multiplied by the standard deviation of the independent variable (if continuous) or by 1 (if a dummy). Significance at the 1%, 5%, and 10% level is denoted by \*\*\*, \*\*, and \*, respectively.

	(1)	(2)	(3)	(4)
Female	0.29*** (7.54) 10.7%	0.27*** (7.08) 9.9%	0.25*** (3.18) 9.3%	0.30*** (7.68) 10.9%
Married	-0.07* (-1.69) -2.6%	-0.07* (-1.73) -2.6%	-0.11** (-2.00) -4.0%	-0.07* (-1.69) -2.6%
Asian	-0.03 (-0.73) -1.2%	-0.01 (-0.24) -0.4%	-0.10 (-1.33) -3.7%	-0.01 (-0.25) -0.4%
BA degree	0.21*** (4.58) 7.4%	0.22*** (5.08) 8.0%	0.15* (1.68) 5.7%	0.21*** (4.59) 7.4%
Age < 25	0.18 (0.90) 6.6%	0.10 (0.52) 3.5%	0.11 (0.40) 3.9%	0.15 (0.77) 5.6%
25 ≤ Age < 35	0.02 (0.44) 0.7%	0.02 (0.45) 0.6%	-0.02 (-0.49) -0.8%	0.02 (0.49) 0.7%
45 ≤ Age < 55	0.11*** (2.66) 4.1%	0.12*** (2.78) 4.2%	0.13*** (2.67) 4.9%	0.11*** (2.74) 4.3%
Age ≥ 55	0.17** (2.16) 6.0%	0.16** (2.16) 5.8%	0.26*** (2.96) 9.5%	0.16** (2.02) 5.6%
Log(tenure)	-0.01 (-0.39) -0.3%	-0.01 (-0.52) -0.4%	-0.00 (-0.03) -0.0%	-0.01 (-0.43) -0.3%
Number of promotions	-0.14*** (-7.72) -5.2%	-0.14*** (-8.33) -5.0%	-0.16*** (-5.21) -6.0%	-0.15*** (-7.95) -5.3%
Log(salary)	-0.17*** (-3.38) -6.2%	-0.16*** (-3.31) -5.7%	-0.23*** (-3.78) -8.4%	-0.18*** (-3.45) -6.3%
Ever received stock options		-0.05 (-0.21) -2.0%		
Trade other securities		-0.14*** (-3.19) -5.0%		
Employee loyalty		0.03** (2.48) 1.0%		
Irrational ESO overvaluation			0.14* (1.65) 5.3%	
Irrational ESO undervaluation			0.37** (2.21) 13.6%	
Employee trust				0.03*** (2.67) 0.9%
Inverse Mills ratio	0.64** (2.51)	0.99*** (3.67)	-0.65 (-0.34)	0.72*** (2.74)
Firms included	All	All	A	All
Observations	7,501	7,418	5,192	7,418