Equity Illusions

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Abstract

Although equity compensation grants for rank-and-file employees are common among venture-backed startups and are considered an ingrained part of their business culture, extremely little is known about how employees approach startup equity compensation. The authors begin filling this gap by examining employees' financial literacy regarding equity-based compensation and their willingness to forego cash compensation for startup equity. Using a survey and a combination of natural language processing and machine learning techniques with conventional regression modeling, the authors find that employees commonly respond to economically irrelevant signals and misinterpret other important financial signals. The findings also suggest that employees harbor a range of "market illusions" regarding startup equity that can lead to inefficiencies in the labor market, which sophisticated employers can legally exploit. The study's results raise serious questions about the protection of employees in their investor capacity in a market in which highly sophisticated repeat players—namely, venture capital and other private equity investors—interact with unorganized and uninformed retail investors.

Venture-backed startups rely heavily on equity compensation, including stock options and restricted stock units, to attract, retain and motivate employees (Tayan, Larcker, and Watts 2018; Blasi, Freeman, and Kruse 2013; Geczy et al. 2017; Aran 2018). Employees who earn equity compensation typically receive a cash salary as well as options, shares, or units of their employer's stock. This form of compensation was

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traditionally reserved for executives, who are often well versed in both financial instruments and their firm's finances. It served to reduce agency costs and to encourage executives to maximize the value of their companies. The practice, however, has been extended to rank-and-file employees, who are less familiar with financial instruments and less knowledgeable about their employers' finances.

Assessing the value of equity compensation at a private company is challenging because absent liquidity, the securities do not have a clear market price. Moreover, the securities regulation regime in the United States does not require private issuers to disclose their capital structure and fair market value to their employees. Startups offer equity compensation under Rule 701 of the Securities Act of 1933, which is a federal exemption that allows private companies to avoid registering compensatory offerings with the Securities and Exchange Commission (SEC) (Securities and Exchange Commission 2020). Since Rule 701 does not require employers to disclose the number of outstanding shares to employees, prospective employees are usually offered a number of securities (options, shares, or units), but they are not informed about their corresponding ownership stake (Paul 2015; Aran 2019). Moreover, most of the available information, such as Regulation D filings and media reports regarding the startup's valuation in the latest financing round, can lead to inaccurate and potentially misleading estimates of the value of employees' equity, since employees are compensated with common stock and its derivatives, whereas investors receive preferred stock, which is considerably more valuable (Gornall and Strebulaev 2020).[2] Thus, incomplete data, complex capital structures, and an illiquid capital market compromise startup employees' ability to evaluate their equity compensation in a well-informed way (Aran 2019).

Despite the widespread use of equity compensation by startups, little is known about how startup employees evaluate equity compensation offers. Previous studies of financial literacy have extensively tested Americans' knowledge of basic financial

[2] Typically, venture-backed startups issue stock in multiple classes: Investors purchase preferred shares, while employees are offered equity compensation in options to purchase common shares. Reg D filings only disclose information on the offering amount and price paid by investors, so they do not provide information on the value of the company's common shares. Previous studies demonstrate empirically that a sizable gap can exist between the value of preferred and common shares. For example, Gornall and Strebulaev (2020) estimate that, on average, if an employee uses information about the value of preferred stock as a proxy for understanding the value of common stock, that employee would overestimate the value of their shares by an average of 56%. The company's "409A valuation" may provide more relevant information about the fair value of the company's common stock, but this valuation is meant to serve the reporting obligation of the company towards the relevant tax authorities, not to its employees.

concepts (Lusardi and Mitchell 2011). These works documented widespread financial illiteracy among segments of Americans, which has practical implications that include inadequate decision-making regarding debt (Lusardi and Tufano 2015), planning for retirement (Lusardi and Mitchelli 2007), and stock market participation (van Rooij, Lusardi, and Alessie 2011). Industry surveys of startup workers demonstrate similar challenges in understanding equity. For example, a recent survey of over 1,000 Israeli startup workers, who operate under roughly similar equity compensation policies as their American counterparts, indicated that even though 95% negotiated their annual cash compensation, only 43% negotiated their equity compensation with nearly half (47%) citing insufficient understanding of stock options as their primary reason for not doing so (EquityBee 2021). And yet, to our knowledge, no previous works have attempted to measure financial literacy about startup equity compensation (Cable 2017; Hand 2008). Additionally, few previous studies have examined whether low financial literacy may negatively affect the decision-making of workers who are offered equity compensation. As startup equity prices are not provided by the market, employees may develop incorrect expectations about their securities' value (Cable 2017; Gornall and Strebulaev 2020; Aran 2019; Alon-Beck 2019), and form investment decisions based on their own intuition and knowledge, which could be prone to manipulation (Pollman 2020).

In this paper, we examine how well employees understand some of the factors that influence the value of equity compensation at venture-backed private firms, and how well they can navigate decisions regarding equity compensation. To do so, we developed a set of questions to measure study participants' understanding of startup equity compensation. The test presents choice tasks regarding different aspects of startup equity grants and asks participants to select the most advantageous alternative for employees. We administered this test to more than 3,000 American employees with at least a college-level STEM[3] degree, the primary target group for startup recruitment and the most likely to receive startup equity grants with their job offers.

Overall, we find that employees do not understand how startup equity compensation arrangements work or what drives the value of startup equity. Only 36.4% of the respondents demonstrated understanding of what a stock option is, and only 28.3%

[3] Science, technology, engineering, and math.

recognized the different risk levels of stock options and restricted shares. Furthermore, only a small fraction (18.3%) of the respondents understood the basic characteristic of venture capital finance as convertible preferred stock. Even more disturbing is respondents' unawareness to their own limitations: respondents were 67.3% more likely to be wrong than right when responding to questions about equity compensation, but they did not realize that they did not know the correct answers.

To determine if low equity compensation literacy might be associated with employees making systematic errors when evaluating equity compensation offers from startups, we also administered an experiment. Our goal with the experiment was to test if prospective employees of startups might be swayed by irrelevant information. Specifically, we test if study participants are enticed by equity offers with larger numbers of shares when holding the total ownership stake conferred by those shares the same. Behavioral economics studies on intermediary instruments that do not have exact face value—such as mileage or loyalty points—have demonstrated that a medium's inclusion can generate an illusion of advantage to an otherwise less advantageous alternative (Hsee et al. 2003). Anecdotal evidence suggests that this also applies to securities offerings to employees and naive investors. For example, the literature on stock splits suggests that "investors with a limited amount of investment funds would prefer to receive more stock shares than fewer, even though the amount invested would be the same" (Griffin 2010). Similarly, in the venture capital domain, the conventional wisdom suggests that startups often authorize the issuance of hundreds of millions of shares due to the psychological advantage of using a large number of securities in employee equity compensation offers (Bartus 2022).[4]

In our experiment, study participants were asked to choose between a cash-only salary and a compensation package that included (less) cash along with an equity grant. Study participants were randomly assigned to view different numbers of shares and amounts of cash compensation to test the effects of these variables on their preferences. Critically, however, none of the equity compensation offers changed the total ownership

[4] According to a venture capitalist interviewed for this research: "Most people think in nominal share numbers, and a hundred thousand seems like a great number of shares." See Interview by Yifat Aran with "VC02", venture capital investor, Sand Hill Rd., Palo Alto. (December 20, 2017) (transcript on file with author).

stake in the company. Basically, the equity grants were similar, but they appeared different because we divided the company's equity into more shares.

The results of the experiment show that economically irrelevant information can affect employees' investment decisions and preferences regarding equity-based compensation. Considering that all equity compensation packages offered to study participants guaranteed the same ownership stake, participants should have chosen these equity packages at similar rates. Instead, respondents were more willing to give up cash compensation in exchange for equity offers that included a greater number of shares. The pattern is particularly prominent among study participants who work outside the northeast of the United States, are less experienced, and even more so, among female respondents. Notably, we find that general financial literacy does not mitigate this effect, suggesting that startup equity compensation involves more specialized financial knowledge, which is rarely possessed by even sophisticated employees. We do find, however, that financial literacy specifically related to equity compensation does moderate this fallacy.

Finally, in order to understand why the study participants acted in this manner, we explore employees' attitudes and mindsets toward startup equity compensation. The regulatory justification for the exclusion of startup equity compensation from the registration requirement of the Securities Act is based on the premise that "the nature of the transaction is essentially compensatory, to provide benefits to the employee, rather than investment-oriented" (Securities and Exchange Commission 1985, p. 27). There is, however, no evidence that employees view the transaction in this manner. By examining the language used by survey respondents, we found that most tech employees are optimistic and bullish about this form of compensation and report that they are willing to forego some of their cash compensation to obtain it. We also find that, contrary to the SEC's rationale for deregulating equity compensation, most employees view this compensation as an investment and not merely a benefit. The less employees understand startup equity compensation, the more likely they are to view it as an investment or savings plan. More sophisticated employees are more likely to view startup equity grants as a lottery ticket than as an investment, so they may exhibit risk-seeking behaviors without reviewing the details.

We conclude by discussing the current legal framework governing startup equity compensation and evaluating some of the proposed changes to this legal framework.

1. Contributions to the Literature

This study adds to extensive literature on employees' investment choices by exploring tech workers' willingness to forego cash compensation for startup equity, a common practice among early-stage startups.

Such equity grants are common in venture-backed startups for a host of reasons. By offering equity compensation, startups can compete for talent with the more established public companies without draining their precious cash resources (Bankman 1994; Booth 2006; Haltiwanger et al. 2012; J. D. Kim 2018; Hand 2008; Aran 2019; Roach and Sauermann 2022). Equity grants also allow companies to attract risk-seeking employees who believe in the startup's prospects (Bergman and Jenter 2007; Oyer and Schaefer 2005; Hall and Murphy 2003). Equity compensation may spur motivation and increase employee productivity, especially in small companies where free-riding is less likely to occur (E. H. Kim and Ouimet 2014; Ittner, Lambert, and Larcker 2003; Yael V. Hochberg and Laura Lindsey 2010). More importantly, it allows firms to retain talent by implementing vesting schedules that provide incentives to stay for long periods of time (Tayan, Larcker, and Watts 2018; Blasi, Freeman, and Kruse 2013; Geczy et al. 2017; Aran 2018). Furthermore, equity compensation can serve as "golden handcuffs" that limit the mobility of employees of successful startups until a liquidity event (sale or IPO), thereby slowing the outflow of human capital and intellectual property and aligning the interests of private market investors and employees (Booth 2006; Aran 2018; Ittner, Lambert, and Larcker 2003; Hand 2008). The reason for this is that incentive stock option plans typically require employees leaving the company to exercise their stock options within 90 days of their departure. Exercising employee stock options can be expensive due to the exercise price and possible tax liability, and when the employer is a private company, selling some shares to cover these expenses may prove difficult or impossible (Aran 2018; Alon-Beck 2019).

While equity compensation is already in widespread use by startups, companies are increasingly compensating employees with these grants and allowing employees limited access to relevant information. Due to a regulatory reform introduced by the Jumpstart Our Business Startups Act of 2012, mature startups, often with thousands of employees, can reward their workforce with equity grants without assuming the reporting obligations of a public company (Cable 2017). As a result, the technological

workforce is increasingly exposed to a private companies' equity compensation plans. In general, younger employees are more likely to rely heavily on equity compensation (Charles Schwab 2019). Moreover, the SEC, which determines the conditions under which private firms can issue equity compensation, has proposed allowing gig workers to be compensated in equity (Securities and Exchange Commission 2020). Therefore, understanding how employees respond to equity compensation offers, and the potential of these arrangements for misuse is of increasing importance.

Since data on equity compensation arrangements is scarce, it is not surprising that research on employees' investment decisions has primarily focused on decisions by public company employees and has not addressed the pre-employment equity-compensation negotiation stage (Hand 2008).

Researchers have found that most employees decide whether to join employee stock ownership plans based on heuristics and prior experience rather than gathering information and making deliberate decisions (Benartzi 2001; Aubert and Rapp 2010; Pendleton 2010). In particular, prospect theory-based models have provided a compelling explanation for the pattern of employees' compensation choices. Core and Guay (2001) documented risk-aversion and reference point bias, while Spalt (2013) and Bahaji (2018) show that prospect theory's biased weighting of probabilities explains how and why employees exercise stock options. Hallock and Olson (2006) show that most employees value their options at a value greater than their Black-Scholes value. Devers, Wiseman, and Holmes (2007) document a similar overvaluation pattern and demonstrate that employees are affected by the endowment effect. Overall, based on observational data, these studies indicate that employees tend to overvalue equity grants when appraising them.

According to another body of literature, which focuses on CEO compensation, it is common for firms to grant the same number of options each year, regardless of changes in value, a phenomenon known as "number rigidity" (Choi et al. 2019; Athanasakou, Ferreira, and Goh 2022). The executive compensation literature suggests that many industry participants fail to understand or do not trust economic formulas, such as the Black-Scholes formula for option pricing, and instead turn to the number of securities offered as a proxy for the grant's value. The literature points out that this heuristic behavior is similar to thinking about money in nominal terms instead of real terms, also

known as "the money illusion" (Shue and Townsend 2017; Shafir, Diamond, and Tversky 1997).

In a different strand of literature that studies the financial decision making of the broader population, financial literacy scholars have documented that low financial literacy is correlated with a host of negative behaviors and outcomes, such as failing to plan for retirement, which, in turn, brings about a decrease in wealth (Lusardi and Mitchelli 2007); over-indebtedness (Lusardi and Tufano 2015); and adverse implications for stock market participation (van Rooij, Lusardi, and Alessie 2011). Lusardi and Mitchell (2011) document that financial illiteracy is widespread among older Americans, especially women, minorities, and the less educated. They also find that employees with low financial literacy are more likely to rely on the advice of informal information sources such as relatives or colleagues. Meanwhile, the relationship between financial literacy and preference for equity compensation has not been explored yet.

This study contributes to these fields by providing three contributions. First, it shows that employees of all ranks tend to think of equity compensation in number terms rather than in dollar or percentage terms. More specifically, our experimental setup indicates that prospective employees who have limited information regarding the proposal's value rely on the number of securities offered as a proxy for value. This heuristic behavior can lead employees to undercut their positions when negotiating their compensation. Consequently, our paper is the first to demonstrate that "equity illusions" may negatively affect employees' bargaining power in compensation negotiations when employers are not required to provide detailed information. Second, our research shows that equity compensation offered by startup companies presents an unusually difficult investment choice for potential employees because they often misunderstand the effects of relevant terms on grant value. This is especially true for entry-level employees and women, both of whom are less likely to possess specific financial literacy regarding startup equity. We find that general financial literacy is not enough to mitigate these market illusions. To overcome these misconceptions, one needs distinct financial literacy regarding startup equity.

Third, given the increasing economic importance of venture capital-backed startups, and these firms' tendency to attract talent with equity incentives, our results highlight the strategic importance of equity-based compensation as a means to attract talent. At the same time, they also raise questions regarding the protection of employees

in their investor capacity in a market where highly sophisticated repeat players (venture capital and other private equity investors) interact with unorganized and uninformed retail investors.

2. Experiment Design

2.1 Research Design

Our survey is structured in three sections. The first section, which we refer to as the Number of Shares Experiment, evaluates the effect of using a large number of securities in equity compensation offers. The second section, which we call the Equity Financial Literacy (EFL) Test, measures workers' financial literacy specifically about startup equity compensation. The third section collects information about the survey respondents that may provide alternative explanations to the results of the Number of Shares Experiment aside from financial illiteracy about equity compensation. This section includes questions from the Standard Financial Literacy (SFL) or "Big Three" Test, which measures respondents' general financial literacy, questions from the Cognitive Reflection Test (CRT), which measures if respondents are using intuition or more analytical processing when completing the survey, and questions about the respondents' demographic background and work histories.

The design of the EFL Test and the Number of Shares Experiment draws upon the previous literature on general financial literacy. In those papers, financial literacy is often defined by the knowledge of fundamental financial concepts, the ability to do simple calculations, and the ability to make informed decisions about financial instruments (Lusardi and Mitchell 2011; Mandell 2008). We designed our survey to test these three dimensions regarding equity compensation. The EFL Test asks questions requiring recognition and understanding of the fundamental concepts of equity compensation. These questions also require respondents to consider simple calculations regarding the value of equity. The Number of Shares Experiment investigates the degree to which respondents' make informed decisions with regard to equity compensation or if their preferences are influenced by economically irrelevant information.

We developed the exact questions for the EFL Test and Number of Shares Experiment based on interviews with experts and employees within the startup ecosystem. Specifically, we interviewed thirty individuals involved in startups. Between

June 2017 and April 2019, we interviewed ten startup employees regarding their experience with equity compensation. These employees were asked if there was anything they wish they had known regarding equity compensation when they first joined a startup. We also interviewed ten startup founders, as well as five lawyers and five venture capitalists with experience advising founders and employees regarding equity compensation. These individuals were asked to describe the most common mistakes that employees make regarding startup equity-based compensation. The interviews were primarily conducted in person as well as by phone and Skype. Whenever interviewees consented, the interview was recorded and transcribed, otherwise notes were taken.

To supplement these interviews, we analyzed ten blog posts written by lawyers, venture capitalists, and equity compensation specialists that describe common mistakes startup employees make when negotiating equity offers and compared those insights with our interviews.

Using the interview data and blog posts, we compiled a list of the most fundamental concepts regarding equity compensation, the most common calculations that startup employees might need to perform when offered equity shares, and the most frequent decisions and mistakes that startup employees make when negotiating equity compensation offers. We then designed three questions that would test for knowledge of these concepts and the ability to make simple calculations similar to those an employee would face in the real world.

To finalize the survey, we conducted a convenience sample of more than twenty startup employees, who were asked to complete the draft survey and provide feedback. Based on this feedback, we made changes to the format, style, and language of the survey questions. We then pretested five versions on small online samples (roughly 100 respondents in each pretest). Following these pretests, we conducted a smaller round of modifications, primarily language changes to avoid ambiguity, which eventually led to the final version of the survey.

2.2 The Number of Shares Experiment

The first section of the survey tested respondents' ability to make decisions with regard to equity compensation offers. We asked the study participants to state their preference between being compensated with a market-rate cash-only salary and a lower-

than-market-rate cash salary accompanied by an equity grant. Most important, despite using different hypothetical numbers of shares in different treatment groups, the proposal's economic value does not change: the shares conveyed a 0.5% ownership stake in a promising early-stage startup (with unknown valuation) under all treatment conditions. In the study, participants were unable to make inferences about the total number of shares available or compare offers with more shares to offers with fewer shares. Instead, they could only compare more cash to less cash with an accompanying number of shares. We randomized the study participants to see one of four different trade-offs between cash and cash with equity:[5]

- **Treatment A:[6] Small trade-off** in exchange for a **small number** of shares: $10,000 reduction in cash salary (from $110,000 to $100,000) in exchange for 1,000 shares.

- **Treatment B: Small trade-off** in exchange for a **large number** of shares: $10,000 reduction in cash salary (from $110,000 to $100,000) in exchange for 50,000 shares.

- **Treatment C: Large trade-off** in exchange for a **small number** of shares: $30,000 reduction in cash salary (from $130,000 to $100,000) in exchange for 1,000 shares.

- **Treatment D: Large trade-off** in exchange for a **large number** of shares: $30,000 reduction in cash salary (from $130,000 to $100,000) in exchange for 50,000 shares.

Each study participant was randomized across these four different trade-offs with equal probability.[7] The task prompt read as follows (the underlined numbers varied according to the treatment group): [8]

[5] A randomization check in Table 1 confirms that the four experimental groups were balanced across all observable covariates.

[6] Note that respondents were not told the name of which treatment they saw; it is only for reporting purposes that we have named them here as treatments *A, B, C,* or *D.*

[7] In this particular experiment, we did not stratify the randomization. The summary statistics table, Table 1, demonstrates that the study participants who viewed the different trade-offs were balanced on the vast majority of dimensions.

[8] The study was designed to reflect the limited information available to prospective employees of private startup companies who are considering compensation packages involving equity. Employees can also receive equity in the form of refreshment grants and bonuses. The conditions are different in those cases: the employee may have privileged information about the employer's operations, and the grant would not affect their cash salary. Differently designed experiments would be necessary in order to assess how current employees respond to equity refreshment grants and bonuses.

> Suppose you are seeking an entry-level position with a promising early-stage start-up. You get an offer letter asking you to choose between two compensation packages.
>
> Assume that the typical salary for this position in your area for someone with your qualifications is $110,000. Assume also that the equity offer represents a 0.5% ownership stake at the time of the offer and is subject to customary vesting conditions.
>
> Which package are you more likely to choose?
>
> - $110,000 in cash salary per year.
> - $100,000 in cash salary per year and 1,000 common shares.

The order of the two compensation alternatives in the question was also randomized to avoid a primacy effect. Following the choice task, subjects were asked "Why?" and provided their answers using an open-end text box.

Note that to simulate the real-life experience of startup equity compensation negotiation, where information is extremely limited, respondents did not receive details that would allow them to calculate the value of each share. Typically, the valuation of an early-stage startup is highly subjective due to limited historical data, little to no existing revenues, and a high level of market uncertainty. Therefore, the choice task does not have a "correct" answer; it is rather a matter of personal risk preference. Still, employees' risk preferences should not be responsive to information that has no economic meaning. Therefore, if study participants show a propensity towards higher numbers of shares despite a lack of difference in value, this would reveal a systematic fallacy.

After completing the study described above, we inserted a question checking for the participants' attentiveness. Specifically, we requested the participants restate their answer to the previous question. Subjects who failed to repeat their answer correctly were dropped from the study.

2.3 Equity Financial Literacy

In the second part of the study, we assess participants' knowledge of concepts and ability to perform simple calculations with regard to equity compensation, what we refer to as Equity Compensation Literacy (EFL). We asked subjects three questions concerning stock option value, liquidation preferences, and option leverage effect. These three concepts were chosen for two reasons. First, the questions reflect everyday decisions and trade-offs concerning equity-based compensation that startup employees face. Second, lawyers and venture capitalists interviewed when designing this survey identified these three concepts as fundamental to understanding equity compensation and as frequently misunderstood concepts that can affect prospective employees' ability to interpret compensation package offers.[9] The exact wording of the questions is as follows (the correct answers are marked in bold):

1. All else being equal, which is more valuable – a stock option with a high exercise price or a stock option of the same company with a low exercise price?
   - Stock option with a high exercise price.
   - **Stock option with a low exercise price**.
   - They are identically valuable.
   - Don't know.

2. All else being equal, including the companies' valuations and cash reserves, which equity-based compensation offer is more valuable – an offer from a start-up that has raised more money from venture capital investors or an offer from a start-up that has raised less?

   - Offer from a start-up that has raised more.
   - **Offer from a start-up that has raised less**.
   - They are identically valuable.
   - Don't know.

3. Ignoring tax considerations, an employee with low risk tolerance will prefer stock options over restricted stock.

   - True

[9] The questions asked reflected the areas that interviewees suggested are most frequently misunderstood by prospective employees. Alternative sets of questions were also considered. For example, as suggested by an anonymous referee, one could have asked, "Who is paid out first in the case of an exit?" With this version, however, the question already discloses the fact that investors and employees are not being paid together. Other areas of widespread misapprehension described by the interviewees but transcend the scope of this research relate to vesting schedules, post-employment exercise window, and taxation. We decided not to ask about taxation-related issues so that that the questions were equally applicable in different countries with different taxation policies.

- **False**
- Don't know

These questions cover three concepts that an employee would need to know to make a well-informed investment decision regarding startup equity compensation. The first question measures basic understanding of what a stock option is. The second question gauges knowledge regarding the hybrid nature of venture capital preferred stock financing—namely, realizing that investors are typically paid out first in the event of an exit. The third question measures an understanding of options leverage; it is a joint test of knowledge about "stock options" and "restricted stock" and of the risk levels each of these securities conveys. Because employees are often asked to choose between stock options and restricted stock units, it is important to ask questions about risk preference to assess whether employees understand the level of risk they opt into.

Similar to established financial literacy tests in the literature, we chose to use the nomenclature of equity compensation in our questions. The purpose of this test was to understand what prospective employees understand in a setting that mimics a real-life compensation negotiation. As with the standard financial literacy tests (Lusardi and Mitchell 2011), understanding of relevant terms is part of the challenge. We therefore used the common names of the relevant financial instruments in the questions. Study participants who were not familiar with these terms or did not feel confident that they knew the concepts could select the option, "Don't know."

Our EFL score for a study participant was the number of these questions for which he or she answered correctly.

2.4 Standard Financial Literacy

The third section of the study collected information about attributes of the respondents' that may be correlated with EFL and the ability to make informed decisions about equity compensation offers. We asked three standard questions commonly used to gauge general financial literacy. The questions, known as the "Big Three," were developed by Annamaria Lusardi and Olivia Mitchell to assess the understanding of three core financial concepts: compound interest, real rates of return, and risk

diversification (Lusardi and Mitchell 2011). For the precise wording of the questions please see Appendix A.

As with the established financial literacy literature, we define study participants' standard financial literacy (SFL) score as the number of questions from this section that they answered correctly.

2.5 Cognitive Reflection Test

The survey also collected information about variables that may provide alternative or complementary explanations for our experiment results, such as inattention while answering the survey. We asked three questions that are based on Frederick's three-item Cognitive Reflection Test (CRT) (Frederick 2005). The CRT measures subjects' ability to override an intuitive response alternative that is incorrect and to engage in deliberate analytic thinking that leads to the correct response. In other words, the CRT provides an insight into which mode of thought the subject is relying on—system 1 (intuitive and instinctive) or system 2 (reflective and critical). The CRT is a widely used measure in behavioral economics and is correlated with other cognitive ability measures and rational thinking. A subject's performance on the CRT also predicts performance on many heuristic behaviors and biases tasks (Frederick 2005). Due to the CRT's prevalent use in surveys, concerns were raised that survey respondents on internet platforms were familiar with the CRT questions. To address these concerns, we slightly modified the CRT questions in our study to change the details without modifying the difficulty level numeracy-wise (see Appendix A for exact wording). We conducted pre-tests to verify that no difference in difficulty levels resulted from changing the wording. Again, following the literature, we compute the CRT score as the number of questions in this section that the study participant answered correctly.

2.6 Demographics

The final questions on the survey included general demographic questions—such as age, gender, education level, primary academic field of study, industry, marital status, number of children, income, and zip code—as well as whether they or a spouse had previously faced a decision regarding equity compensation. We placed these questions

at the end of the study in order to avoid well-known findings regarding stereotype susceptibility (Shih, Pittinsky, and Ambady 1999).

2.7 Survey Implementation

This study was implemented using Qualtrics software, and study participants were solicited through Lucid, and online sampling platform that is regularly used in psychology and economics research studies (Coppock and McClellan 2019). We administered the experiment to 3,163 individuals. We required our study subjects to reside in the United States, have earned at least a college-level degree majoring in a STEM field, be between the ages of 20 and 60, and be working at least 20 hours per week. Overall, 1,578 respondents completed the survey. After dropping respondents who completed the survey but did not have a college-level degree (n = 14), were under 20 or over 60 years old (n = 125) or failed to correctly answer one of the two attention check items (n = 426), the sample size was 1,013.

In Table 1, we summarize the attributes of the study's sample participants. The average age of individuals in the study was just over 40 years, 48.7% of subjects identified as female, and 35% completed an advanced degree. Approximately 15.4% of the subjects indicated that they previously faced a decision regarding equity-based compensation offer in the past,[10] and 8.6% recalled participating in such a decision carried out by their spouse. The average annual pre-tax income from the subjects' individual salaries was $104,500 (for the individual respondent, not the household), which is more than double the national median.[11] The sample is more diverse in terms of gender, age, and geographical location than a startup's employee-only sample.

All of the study participants hold college degrees in technical fields, fields for which there is an ever-growing competition among technology companies. The high proportion of high earners in the sample increases confidence in the research's external validity because the experimental setup was realistic given the subjects' range of salaries and negotiation experiences. Still, as with other experiments, as we discuss in greater

[10] According to the 2018 General Social Survey (GSS) data, 20% of private-sector workers in the U.S. have some level of ownership in the companies they work for. See Loren Rodgers (2019).

[11] According to the Bureau of Labor Statistics (BLS), the median annual wage for workers in the United States in the fourth quarter of 2019 was $936 per week or $48,672 per year for a 40-hour workweek. See Bureau of Labor Statistics 2022.

detail in the limitations section, the study cannot recreate the cognitive load and consequences of real-life compensation negotiations.

The study participants hail from a range of geographic regions, including technology hubs where equity compensation is particularly common. In Figure 1 (a), we show what percentage of our sample is geographically located within each Core-based Statistical Area (CBSA) in the United States. And in Figure 1 (b), we show what percentage of our sample states that they or their spouse had previously earned equity compensation that reside in each CBSA. Noticeably, those who have experience with equity compensation are geographically dispersed and not exclusively in the coastal cities or traditional tech hubs.

In Table 1, we compare the randomized attributes of those participants who saw a trade-off with a large number of shares versus those who saw a smaller number of shares. The participants' mean attributes are not significantly different at the 5% level on almost all dimensions. Among those assigned to the small trade-off treatment, the participants who were randomized to see a large number of shares had higher incomes and general financial knowledge. Among those randomized into the large trade-off treatment, the participants who were randomized to see the small number of shares were more likely to be married and hold more senior managerial roles. Importantly, however, in both treatment arms, the participants' equity financial literacy (EFL) was statistically indistinguishable across the randomized treatments. Finally, in our regression analysis, we control all of these attributes to boost our estimates' precision.

3. Findings

3.1 Financial Literacy Regarding Equity Compensation

We begin by documenting the level of financial literacy regarding equity compensation among our study participants. Table 2 displays the rate that participants answered the questions about equity compensation literacy correctly. On the first question, which asked if one would prefer stock options with lower or higher exercise prices, 36.4% answered the questions correctly, while 31.3% responded that they did not know. For the question that asked if it was more advantageous to receive equity grant from a startup that has raised more or less venture capital funds when both startups have similar valuation and cash reserves, 18.3% answered correctly, and 16.0% responded that

they did not know. On the third question, assessing understanding of the relative risk levels of a restricted stock versus stock options, 28.3% answered correctly, and 30.8% responded that they did not know.

The answers reveal that tech workers have a relatively low degree of financial literacy regarding startup equity. A mere 5% of respondents correctly answered all three questions, whereas 43.7% did not answer any question correctly.[12] Furthermore, a large percentage of respondents answered each question incorrectly, suggesting that many tech workers are unaware that they have an incorrect understanding of the basics of equity compensation, a cognitive bias known as the Dunning–Kruger effect (Dunning 2011).[13]

The EFL scores provide different information than a traditional measure of general financial literacy, such as the SFL. While EFL and SFL are positively associated, the two scores have a Spearman rank correlation of a mere 0.244. In addition, in our sample, EFL scores are correlated with income level while the SFL scores are not. Figure 2 shows that the average income level of the tech workers in the sample is positively correlated with higher EFL scores.[14] In contrast, the SFL scores show little association with higher income. This demonstrates that specialized knowledge about equity-based compensation is associated with opportunities for outsized compensation, consistent with the literature on employees whose income is partly based on stock options or stock grants (Eisfeldt, Falato, and Xiaolan 2018).

The results of the EFL test are strongly linked to the way subjects conceptualize equity-based compensation. Prior to answering the EFL questions, study participants were asked how their friends and colleagues conceive of startup equity compensation. In Figure 3, the percentage of respondents within each EFL score level who answered each conceptualization range from a risky gamble to a savings plan. Of those with the lowest

[12] Responses to the three EFL questions are significantly positively correlated, meaning that those who answer one question correctly are more likely to get the other two correct (R(Q1-Q2) = 0.22, *p*-value < 0.0001; R(Q1-Q3) = 0.14, p-value < 0.0001; R(Q2-Q3) = 0.14, *p*-value <0.0001). Nevertheless, the correlations are not high, suggesting that each question measures a different aspect of financial knowledge (Cronbach's alpha = 0.37). Moreover, equity financial literacy was also significantly positively correlated with general financial literacy (R = 0.23, *p*-value <0.0001).

[13] This meta-ignorance (ignorance of one's ignorance) is known as the Dunning–Kruger: poor performers often show little insight into the shortcomings in their performance, because deficits in their knowledge prevent them from both producing correct responses and recognizing that they are wrong.

[14] This is partially due to the correlation with managerial experience; however, the positive relationship remains even after residualizing for work history, education, and geography.

EFL score (of 0), 28% viewed equity compensation as an investment or savings plan, and only 4% saw it as a lottery ticket. In contrast, of those with the highest EFL score (of 3), 31% viewed equity as a gamble, and only 10% saw it as an investment or savings plan. This result suggests that the employees most vulnerable to making poorly informed investment decisions regarding equity-based compensation are also the ones who tend to think that earning startup equity instead of cash salary is a smart way to save and prepare for the future.

While the average level of EFL is low across our sample, there is heterogeneity in understanding equity compensation across different subgroups. Table 3 displays the percentage of respondents from different demographic and experience backgrounds who answered the EFL questions correctly. Older respondents performed better than younger ones: 8.5% of subjects between 50 and 60 years old answered all three questions correctly, whereas only 3.8% of subjects between 20 and 29 years old did so. Master's graduates performed better than bachelor's graduates: 8.4% versus 3.5% answered the three questions correctly, respectively. Master's graduates also performed better than graduates of doctoral programs and professional degree programs (of the latter, 6.5% answered all three correctly).

Many of the differences that can be seen in answering the EFL questions correctly may be because of associations among the variable characteristics of the survey respondents. To understand which characteristics were most strongly associated with answering each EFL question correctly or incorrectly, we estimated a series of linear probability models. In Table 4, we regress the dependent variables for columns (1)-(6) as an indicator if each EFL sub-question is answered correctly or if the study participant responded that they did not know the answer on all the characteristics. Finally, in columns (7) and (8), we use the dependent variables of indicators if the study participant answered all three questions correctly or incorrectly.

Overall, the coefficients on age do not show consistent correlations with answering the questions correctly. The only age group that shows a strong correlation with answering a question correctly is the 50–60-year-old group, which had a 16-probability-point higher chance of answering the question about option value correctly. This age group, however, did not have a statistically significantly higher probability of answering either of the other questions correctly. Similarly, after controlling for all other attributes,

the coefficients on the level of education does not demonstrate a strong association between education and knowledge of equity compensation.

Consistent with a learning curve explanation, the strongest predictors of success in the EFL measure included previously facing a decision regarding equity-based compensation, managerial experience, and income. After controlling for other attributes, workers who are first-level and higher-level managers with this supervisory experience are 9 and 12 probability points more likely to answer the option value question correctly. In contrast, although these workers had a positive higher probability of answering the other questions correctly, it is not statistically significant. Senior managers performed better than first-level managers and entry-level employees (8.7%, 3.2%, and 2.9% answered all questions correctly, respectively). Most notably, respondents who had previously experienced a dilemma regarding equity-based compensation were more than four times more likely to answer all three EFL questions correctly than respondents who did not have such experience (14.1% vs. 3.4%). However, even these "experienced" employee-investors performed relatively poorly on the EFL measure (only 14.1% answered all three questions correctly).

Ironically, those working in the legal and financial sectors demonstrated particularly low equity financial literacy. They were more likely to incorrectly answer both the EFL questions about option value and liquidation preferences, possibly because these workers are more familiar with public company financing or because they are less likely to admit to not knowing the answers.

In addition, there is a large gender gap in equity financial literacy. Men performed better than women on the EFL questions: 6.5% of men answered the three questions correctly, whereas only 3.4% of women gained a similar result. Since male and female tech workers may come from different backgrounds, hold different positions, and work in different industries, it is important to control for these factors. And yet, even after controlling for those factors in a linear probability model predicting if a respondent answered the EFL questions correctly (see Table 4), the coefficients on gender are large in magnitude. The statistically significant coefficients for females answering the questions on option value (-0.08) and liquidation preferences (-0.05) imply that female respondents are 8 and 5 probability points less likely to answer correctly. For the final EFL question on leverage, the female coefficient is -0.02, although it is not statistically significant. Overall, the probability that a female survey respondent answered all three questions

correctly after controlling for other characteristics was 2 probability points lower, while the probability of getting all three questions incorrect was 6 probability points higher.

This gender gap in answering questions is even more striking given the large differences between how frequently female and male respondents chose to answer "Don't know." Female respondents were 19, 11, and 12 probability points more likely to respond "Don't know" to the equity option value, liquidation preference, and leverage questions, respectively.

The finding that female tech workers have lower equity financial literacy is consistent with the well-documented advantage that men have over women in financial literacy tests (Lusardi and Mitchelli 2007; Almenberg and Dreber 2015). While differences in education and work experience do not fully explain the gender gap, one possible reason why male respondents scored higher on EFL could be related to a more general gender gap in self-confidence or guessing that has been documented in previous papers (see Coffman 2014; Exley and Kessler 2019). Specifically, male participants may simply be guessing more frequently (Baldiga 2013). On each of the EFL questions, female respondents responded they did not know the answer at higher rates than male respondents. If female respondents had answered Question 1 at the same rate as their male counterparts by simply guessing across the three answers, we would expect 38.43% of female respondents to have answered correctly. This would have been qualitatively similar to the male rate of responding correctly of 42.7%. Similarly, for Question 2, such random guessing would have resulted in female respondents being correct 19.78% of the time versus 21% for male respondents. For Question 3, merely guessing at the same rate as male candidates who answered the question would have resulted in 34.35% of female respondents answering correctly versus 30.6% of male candidates. This demonstrates that the EFL score may provide different information about male versus female respondents' underlying financial literacy and confidence.[15] Regardless of the exact reason, the large gender gap in equity financial literacy may have significant implications for the gender gap in compensation among workers who receive equity.

While the results presented in this section suggest that those sampled have limited EFL, low EFL could be mitigated if subjects utilized professional guidance when

[15] Note that Table 3 shows summary statistics on the answers to each EFL question. Table 4 provides linear probability models that control for the characteristics and attributes of the respondents.

considering these offers. For example, we might expect that prospective employees considering an equity compensation package would research the potential employer, investigate how equity compensation works, or reach out to a professional for advice. Instead, we find that workers who faced an equity compensation offer did little research to bolster their decision-making. Among respondents who previously faced an investment decision regarding equity-based compensation, Figure 4 shows the percentage who sought financial advice from a professional adviser (financial consultant, lawyer, or other). The figure shows these percentages broken out by the EFL score of the respondent. Overall, fewer than 25% of respondents sought professional advice in considering an equity compensation package. Furthermore, seeking such guidance is unrelated to the employee's level of EFL. Employees who understand the relevant terms and employees who are entirely uninformed seek professional advice at the same rate. Nearly half of the relevant subjects reported not seeking advice or researching the topic at all.

Collectively, these results demonstrate that most tech employees have a limited understanding of startup equity compensation. Even employees who have previously been offered or accepted equity compensation do not necessarily understand how to evaluate such compensation arrangements. Even so, most of the respondents stated that they rely on their own knowledge and understanding when assessing an equity compensation package's value rather than seeking professional advice. Because of the complexity of evaluating equity compensation and the relatively limited financial literacy of potential employees, this raises the specter that job seekers could be misinterpreting equity compensation offers.

3.2 Misinterpretation of Large Numbers of Shares

Since financial literacy is low and information relevant to precisely assessing the value of equity compensation is complicated, potential employees may use heuristic behavior to make decisions. In this section, we present the results of an experiment testing whether job seekers misinterpret the number of shares being offered in a compensation package as an indicator of the offer's economic value.

First, study participants were asked about their willingness to trade-off a cash salary in exchange for an equity stake in a "promising early-stage startup." On average,

77.4% of the respondents were willing to trade $10,000 of a $110,000 salary in exchange for equity, and 59.9% of the respondents were willing to forgo $30,000 in exchange for equity (p-value < 0.0001). As expected, the results demonstrate negative price elasticity of demand for equity.

Next, we tested if the preference for equity grants was influenced not only by price (size of the cash trade-off) but also by irrelevant information, such as the number of shares offered in the treatment condition. While most real-world startups do not provide potential employees with information on the size of the employee's ownership stake, our experimental setting did disclose this information alongside the number of shares in the grant. As such, the study design is less opaque than many real-world negotiations.

In Figure 5, we show the proportion of respondents who chose the equity offer versus cash-only compensation in the different treatment groups. Under Treatment B, the small trade-off condition, 81.1% of the respondents preferred the equity grant of 50,000 shares, whereas only 73.9% chose this offer when the number of shares offered was 1,000 (Treatment A). Similarly, under the large trade-off conditions, 63.5% of respondents opted for equity compensation when offered 50,000 shares (Treatment D) whereas only 56.3% did so when offered 1,000 shares (Treatment C).[16] The higher proportion of respondents preferring equity when the number of shares was larger provides evidence that, whether consciously or not, respondents believe that the number of shares correlates with the compensation package's value.

It should be noted that each individual participant was offered only one cash salary versus one lower cash wage along with a specific number of shares. The given conversion ratios imply that 73.9% of the respondents in Treatment A were willing to forgo $1 of cash in exchange for .1 share of equity, while 81.1% of the respondents in Treatment B were willing to forgo $1 for 5 shares. Because the ownership stake offered was the same (.5%), the fact that more participants gave up cash wages when offered more shares demonstrates that the perceived value of startup equity grants is easily influenced by irrelevant information about the number of shares in the grant.

The finding that study respondents were more inclined towards Treatments B and D, the compensation packages containing higher numbers of shares, has implications for

[16] The difference in the proportion of participants opting for equity is significant for both scenarios at the 10% level.

employers and how they recruit. According to our study participants' responses, 7.2% would have accepted a $10,000 salary cut if offered 50,000 shares, but probably would not have made a similar choice if offered 1,000 shares, despite this difference making no change in actual ownership.[17] A similar percentage of respondents were willing to accept a $30,000 lower salary if offered 50,000 shares (Treatment D) but were likely to reject it for 1,000 shares (Treatment C). This demonstrates that employers could potentially entice job seekers to accept job offers at below-market salaries simply by issuing larger numbers of authorized shares and offering compensation packages that appear lucrative.

3.3 Predictors of Preference for Equity Compensation

What explains the preference for higher numbers of shares? In this section, we attempt to understand what attributes are associated with respondents demonstrating a preference for a higher number of shares in an equity compensation package when the ownership percentage remains unchanged.

Specifically, we regress an indicator for if a survey respondent preferred an equity compensation package over an all-cash package based on the number of shares included in the equity package offer and other controls.[18] If individuals prefer the equity packages with more shares—even though these packages had the same actual value—then the coefficient of number of shares will be positive. If, however, the respondents understood that the actual value of the compensation package is detached from the number of shares in that package then the coefficient on the number of shares should be statistically insignificant.

Table 5, Column (1) reiterates the finding from Figure 5 that those surveyed prefer compensation packages with larger numbers of shares. In this column, we show the estimated coefficients when the indicator for preferring the equity compensation package is regressed on the size of the all-cash offer as well as on the number of shares included in the equity package. When equity compensation was offered in exchange for $30,000 (as opposed to $10,000), the coefficient is -0.18 and significant. This means that

[17] We derive this percentage from the fact that 81.1% of the respondents accepted a $10,000 trade-off when offered 50,000 shares, but only 73.9% accepted such a trade-off for 1,000 shares (see Figure 5).

[18] We use linear probability models in the main text for ease of interpreting the interaction terms. In the Appendix we estimate these same models using logit regressions. The results are qualitatively similar.

respondents were 18 probability points less likely to choose the equity package with a $30,000 reduction than those who were offered only a $10,000 reduction.

More significantly, the coefficient on equity packages that included 50,000 shares (as opposed to 1,000 shares), is 0.07 and significant. That coefficient means that those who were offered 50,000 shares were 7 probability points more likely to choose the equity package even though the higher number of shares does not actually translate into higher real value for the respondent. Relative to the unconditional probability of showing a preference for equity, this is equivalent to a 10.29% higher rate of opting for the equity package.

While the positive coefficient on the number of shares demonstrates that respondents put a value on higher numbers of shares—a large-number illusion—it is possible that with more financial literacy an individual would be less reactive to being offered more shares. We test if this is the case by adding the respondents' EFL and SFL scores as controls to the linear probability model predicting the choice of the equity package. We include both EFL and SFL scores in these models because, as shown in the previous section, these measures capture distinct areas of knowledge.

Table 5, Column (2) shows the estimated coefficients from that model. The coefficients on SFL and EFL scores are both positive and significant. These demonstrate that individuals with higher levels of financial literacy—both general and equity-specific—are significantly more likely to choose the equity compensation package. More importantly, we find that the coefficient on the number of shares remains approximately 7 probability points and significant. This says that even after controlling for the level of financial literacy, individuals still show a preference for a higher number of shares.

Because the relationship with EFL might not be linear, in Appendix C we further investigate the correlation of EFL with the preference for equity compensation non-parametrically. To investigate this potential non-linearity, we regress if the respondent indicated a preference for equity based on interactions between the number of shares shown and the participant's EFL score.[19] In Appendix Figure 11, we plot the predicted probability of preferring equity within each EFL score. Study participants who scored the lowest on EFL were significantly more likely to choose equity with the larger number of

[19] See Appendix Table 7 for the coefficient estimates. The predicted probabilities are computed by adjusting the EFL score, while holding all other covariates constant at their means across all respondents.

shares: 57.65% indicated a preference for Treatment A equity when considering a trade-off with 1,000 shares, but 69.65% had that preference when considering Treatment B, 50,000 shares. Among the higher EFL scores, respondents consistently had a stronger preference for equity when viewing higher numbers of shares, however, the effects of the number of shares were not statistically significant. This result demonstrates that the primary difference in the preference for equity compensation by EFL score is between those with the lowest score and those who have at least minimal financial literacy and knowledge of equity.

While those with higher financial literacy are more likely to choose compensation packages with equity, the appeal of large numbers of shares may be less enticing for those with a better understanding of how equity is valued. We test for this in Table 5, Column (3), where we estimate the same linear probability model but add interaction terms between viewing 50,000 shares and an indicator for having gotten at least one of the financial literacy questions correct. If the interaction terms are positive, that would imply that those with financial literacy are even more drawn to large numbers of shares, while if the interaction is negative, it would imply that at least minimal financial literacy attenuates the draw of large numbers of shares.

Leveraging the result that those with some general and equity-specific financial literacy respond differently to equity compensation offers than those with no understanding of these matters, we investigate if these two groups respond differently to the large-share fallacy. We do this by adding interaction terms between an individual answering at least one SFL and EFL question correctly—an indicator of a minimal amount of general financial and equity-specific knowledge—and viewing a large number of shares. In Table 5, Column (3) coefficients on the financial literacy measures of SFL and EFL are 0.37 and 0.09, respectively, again demonstrating that general and equity-specifical financial literacy is associated with a higher probability of opting for equity compensation; however, the coefficients on the interaction terms, are negative: -0.27 for SFL and -0.09 for EFL. These estimates demonstrate that minimal financial literacy can help attenuate the large-number fallacy.

Finally, the EFL and SFL scores could be correlated with other aspects of individuals' work history and experience. While we randomized individuals across treatment groups, we can still increase the precision of our estimates of the impact of financial literacy by controlling for other demographic and work history factors. Table 5,

Column (4) includes controls for both the financial literacy scores as well as the attributes available of the study participants. As with the previous results, the coefficient on viewing 50,000 shares (Treatments B and D) remains positive, which implies that individuals are drawn to the high number of shares. Similarly, the coefficient on the interactions between financial literacy and seeing the large number of shares remains negative and of a similar magnitude to the previous models. This implies that differences in demographics and work history do not drive the finding that minimal financial literacy can help attenuate the large-number fallacy of equity compensation.

The results in Table 5, Column (4) also illuminate heterogeneity in the preference for equity compensation. The estimated coefficients demonstrate that some groups are more likely to be influenced by the higher number of shares in equity compensation offers than others.

Noticeably, male respondents are 7 probability points more likely than female respondents to opt for equity compensation, even after controlling for differences in education, work history, and both equity and general financial literacy. We explore this result further in Figure 9, where we show the predicted preference for equity while allowing for an interaction between viewing a larger number of shares and the respondent being female. The figure and associated regression reveal that when viewing a larger number of shares, female respondents prefer equity almost twice as much as male respondents. Specifically, female respondents increased the preference for equity by 9.81 percentage points, which is statistically significant at the $p<0.05$ level. In contrast, male candidates increased the preference for equity by 4.43 percentage points, which is not statistically significant. These findings mirror literature on risk-taking behavior that links entrepreneurship with immigration and with gender.[20] Given that many view equity compensation as a risky gamble, men may have a prior inclination towards equity over

[20] To learn more about the gender gap in entrepreneurship see, e.g., Bönte and Piegeler (2013) (attributing the gender gap in entrepreneurship to competitiveness); Caliendo et al. (2014) (attributing the gender gap in entrepreneurship to personality traits, and specifically risk preferences). For more on the high proportion of immigrants among startup founders, *see, e.g.*, Dheer (2018) ("findings of qualitative and quantitative studies suggest that a positive attitude towards risk taking also affects the startup of ventures by immigrants"); Wadhwa et al. (2008) (discussing the disproportionate share of highly skilled immigrants among founders of technology firms).

cash compensation. Thus, this result suggests that one possible reason for the gender equity gap is a gender difference in compensation preferences.[21]

In addition, non-native English speakers may be more drawn toward offers with a larger number of shares than native English speakers. The coefficient on native English speakers in Table 5, Column (4) shows that they are 15 probability points more likely to opt for the all-cash compensation. Other variables, including age, marital status, number of kids, education, income, managerial experience, and experience with receiving equity-based compensation, were not significantly associated with a preference toward equity-based compensation.

Finally, individuals living in specific geographies may have more or less awareness of the disconnect between the number of shares and actual ownership shares. In Figure 8, we show the predicted preference for equity by geographic region after controlling for other observables of the respondents. The figure reveals that those located in the Northeastern and Mid-Atlantic states of the United States tend to record that the value of the compensation package is unchanged by the number of shares. In contrast, those on the West coast, Mid-West, and South show a preference for higher numbers of shares. The contrast in preference for equity when the number of shares increases are statistically significant for the Midwest at $p<0.01$ and jointly at $p<0.1$. This could mean that tech workers outside of the northeast and mid-Atlantic may be more likely to mistakenly think that the number of shares will increase the value of an equity compensation offer.

3.4 The Employee-Investor Mindset

While many employers emphasize equity compensation as a means to align the incentives of employees with the employer (Astebro, Chen, and Thompson 2008; Braguinsky, Klepper, and Ohyama 2012; Hegde and Tumlinson 2021), Figure 3, somewhat surprisingly, reveals that most employees do not conceptualize equity compensation as an incentive or an incentive alignment device, nor do they view it as a benefit (as opposed to the SEC's rationale for deregulation). The way employees perceive

[21] Another reason is that women are underrepresented in R&D professions, where equity compensation composes a greater portion of the overall compensation package. To learn more about the gender gap in startups cap tables, see Emily Kramer, "Analyzing the gender equity gap," *Carta* (September 17, 2018), https://carta.com/blog/gap-table/ (: "Women make up 35% of equity-holding employees, but hold only 20% of employee equity").

equity compensation differs greatly depending on their level of EFL: the less they know about equity compensation, the more likely they are to view it as a savings plan or investment (10% of 3-EFL respondents and 28% of 0-EFT respondents). The more they know about it, the more likely they are to view it as a lottery ticket (4% of 0-EFT respondents, and 31% of 3-EFL respondents).

To gain further insight into the reasons that shape the subjects' preference for cash or equity compensation, after the respondents made their selection, we asked them why they chose that alternative. Using a machine-learning method, we generated a predictive model of subjects' preferences regarding cash and equity using individual words used in respondents' answers. Specifically, for each free-text response to why the respondent chose equity or cash, we parsed the sentences into individual words. We then removed stop words and words that appeared in fewer than 2% of the responses. We predicted if the respondent opted for equity using logistic regression with a ridge penalty. Finally, to reduce over-fitting of the predictive model, we used 5-fold cross-validation. The resulting β parameters of logistic regression represent the words' importance and direction as predictive features for the preference. Positive β values indicate that the word is predictive of equity compensation preference, whereas negative β values indicate that the word is predictive of cash preference.

Figure 6 shows the words associated with the largest magnitude βs are most predictive of the preference for or against equity compensation. The words used by those subjects who refused to forgo cash salary in exchange for equity compensation include *guaranteed*, *rather*, *cash*, *want, now, money*, and *invest*. Unsurprisingly, these words reflect risk aversion along with liquidity and diversification considerations. For example, a typical answer would read as follows: "I would rather invest my money myself."

In contrast, the words used by subjects who preferred a mix of cash and equity compensation include *opportunity, potential, future, growth, grow, chance, increase, run, believe, ownership,* and *investment*. These words convey an investment decision and expectation of profit. For example, a typical answer would read as follows: "In the long run, the shares could be worth way much more than salary lost."

Other reasons for choosing equity compensation included ownership as a goal in and of itself, risk-seeking preference, belief in one's ability to contribute to the stock performance, and tax incentives. Some subjects also explicitly mentioned the large

number of shares offered as a meaningful consideration, proving direct evidence of the manipulation's salience—for example:

- "50,000 common shares have a large potential to grow in value."
- "50k shares is a lot of stock; that would represent a purchase of $.20 per share."
- "50,000 shares will definitely be worth more than the $10,000."

Overall, subjects' responses shed light on the mindset of the employee-investor. They demonstrate that employees perceive equity compensation as a form of investment or as a high-return gamble, not merely a bonus or benefit.

4. Limitations

Some limitations of the present study should be mentioned. As with any lab experiment, a major concern is external validity. The external validity of a study might be threatened by the characteristics of the sample or the experimental measure itself. The population of interest for this study is workers who have or potentially could face decisions regarding startup equity compensation. We, therefore, sampled a group of workers who frequently work at private companies that offer equity compensation: U.S. workers with at least a college-level STEM degree. Because the most frequently analyzed and nationally representative surveys of workers, such as the Current Population Survey, do not ask respondents if they have received equity compensation, it is difficult to benchmark the representativeness of this sample. That said, our results are in line with those of two parallel unrelated studies about equity compensation, suggesting that our findings might be generalizable to the population of interest.[22]

Another limitation concerns the way we measured equity financial literacy levels. Comparing two compensation offers and asking participants to choose which would be more advantageous to employees in general might have resulted in information asymmetry. Specifically, the measured equity financial literacy levels might not exactly match what participants would do during actual compensation negotiations. For example, in real-world negotiations, employees might seek more information and consult with their peers and mentors before deciding between competing offers.

[22] The first is based on 1,000 interviews with employees who participate in equity compensation plans (Charles Schwab & Co 2019 Equity Compensation Participant survey), and the other is based on over 1,000 survey respondents who are Israeli startup employees (EquityBee Employee Stock Options Survey, 2021).

We address this limitation in two ways. First, researchers have demonstrated empirically that most employees use heuristics and prior experience to make decisions about equity programs rather than gathering information and engaging in deliberate decision-making (Benartzi 2001; Aubert and Rapp 2010; Pendleton 2010). Second, the experiment follows standard practice in the social sciences when it is infeasible to require subjects to make binding decisions that affect them in the real world. Thus, the experiment presents subjects with a hypothetical scenario that approximates the decision they would face in their careers. Still, as with other experiments, this one cannot recreate the cognitive load and consequences of real-life compensation negotiations. Third, our sample includes a subset of respondents who said they had faced a dilemma regarding equity-based compensation in the past. We asked these respondents what sources of information they relied on when making equity compensation-related choices. More than half of these respondents said they did not seek advice or do any research, about a quarter said they sought professional advice, and the rest said they used unprofessional advice or self-guided online research. While these findings don't eliminate the concern about employees' information sources, they do suggest that equity illusions are often left unaddressed. Finally, information asymmetry could also be reduced if employees receive verbal information along with the equity-based compensation offer.[23]

Lastly, our results indicate that the sample of tech workers who participated in our study have on average low relevant financial literacy based on our EFL Test questions. The possibility exists that some of the surveyed workers might simply be unfamiliar with the vocabulary of equity compensation rather than the underlying financial concepts. While this possibility exists, even those study participants who had previous experience with equity compensation, and thus likely had seen the basic terms of equity compensation, had low average scores on the EFL questions (1.22 out of 3). Finally, and most importantly, our results showed that scoring low on EFL test questions was associated with making costly mistakes regarding equity offers, such as believing that offers with higher numbers of shares are likely to be of high economic value.

[23] Based on our interviews and the data collected by EquityBee on over 1,000 Israeli startup workers, this seems not to be the prevailing practice. As per EquityBee's data, 66% of respondents did not know what percentage of the company their options grant represents, and 47% did not receive enough information to be able to assess the value of their options grant (Employee Stock Options Survey 2021).

5. Policy Implications

In recent years, legal and finance scholars have raised concerns that startup employees are misinformed regarding the value of their equity grants in a manner that could distort their employment and investment decisions. For example, Gornall and Strebulaev (2020) caution that the gap between the perceived value of startup equity grants and their fair value "can lead [employees] to dramatically overestimate their wealth" (Gornall and Strebulaev 2020, p. 123). Alon-Beck argues that "[s]tartup founders, investors and their lawyers have systematically abused equity award information asymmetry to their benefit" (Alon-Beck 2021, p. 1165). And yet, on November 24, 2020, the SEC voted to extend the federal regulation that allows startups to offer and sell equity incentives to their employees (Rule 701) to people who work with internet platform companies on a contract basis ("gig workers"). According to former SEC Chairman Jay Clayton, this amendment is desired "so that workers have the opportunity to share in the growth of the business" (Securities and Exchange Commission 2020).

The SEC's recent amendment proposal is the latest development in a deregulation process that began in 1988 with the promulgation of Rule 701. Over the last three decades, the SEC had significantly revised the rule and expanded its boundaries.[24] As a result of these amendments, Rule 701 releases the startup equity compensation market from nearly any regulatory oversight. Financial disclosure obligations are imposed only on private issuers that issue more than $10 million worth of equity-based compensation within 12 months—namely, large pre-IPO issuers. In addition, the JOBS Act of 2012 amended Section 12(g) of the Securities Exchange Act of 1934 to remove limitations on the number of employees and service provides that startups can compensate with equity while staying private.[25]

In theory, founders of top-quality companies can voluntarily disclose financial information to convince prospective employees that their securities are of greater value

[24] See Exempt Offerings Pursuant to Compensatory Arrangements, 64 Fed. Reg. 11,095 (Mar. 8, 1999) (to be codified at 17 C.F.R. pt. 230) (lifting Rule's $5 million volume ceiling and replacing it with an enhanced disclosure requirement). See also Exempt Offerings Pursuant to Compensatory Arrangements, 83 Fed. Reg. 34,940, 39,941 (July 24, 2018) (changing the threshold that triggers enhanced disclosure obligation from $5 million in 12-months sales to $10 million).

[25] Pub. L. No. 112-106, 126 Stat. 306 (2012) (the JOBS Act of 2012 amended Section 12(g) of the Securities Exchange Act of 1934 to exclude securities held by Rule 701 offerees from the shareholder headcount that triggers public company reporting obligations).

than the market baseline. Those companies will presumably enjoy a recruiting advantage, which will force other above-average companies to follow suit in a process of "unraveling" (Viscusi 1978; Grossman 1981; Milgrom 1981). However, in practice, very few companies adopt full transparency of cap table information (Aran 2019; Paul 2015). As the theory predicts, for unraveling to take place, the disclosure needs to be costless and credible. In practice, disclosure involves the costs of preparing and disseminating the information, and the cost of revealing sensitive information. Moreover, the credibility of voluntary disclosure is questionable due to the lack of verification and monitoring mechanisms, and the absence of a penalty for dishonesty (Gertner 1999; Shavell 1994; R. E. Verrecchia 1983; R. Verrecchia 2001). Litigation between startups and employees is rare, and reputational damage from false disclosures is negligible. Thus, the lack of mandatory disclosure may adversely affect the startup labor market.

The regulatory void in the startup equity domain is well recognized in the literature. For example, Gornall and Strebulaev (2020, p. 142) argue that "[b]etter reporting would benefit limited partners, employees with stock options, and the entire venture capital ecosystem." Similar calls for reform were made by securities law scholars who cautioned about the lack of sufficient disclosure requirements for mature private companies. Jennifer Fan (2016, p. 604) calls for enhanced disclosure requirements for unicorn companies and states that "the current disclosure regime is woefully inadequate." Alon-Beck (2019, p. 186) suggests that "[p]erhaps certain private companies, such as unicorns, should adhere to the same financial disclosure requirements as public companies."

Two popular targets for policy recommendations to tackle employees' lack of relevant financial knowledge are employer-sponsored financial literacy education programs and enhanced disclosure obligations for startup companies. However, these go-to policy prescriptions are helpful only to a certain degree.

Studies that assess financial education programs' effects on individuals' financial behavior show a decaying impact. Fernandes, Lynch, and Netemeyer (2014) conduct a meta-analysis of financial education's relationship to financial behaviors in 168 papers covering 201 prior studies. They find that interventions to improve financial literacy explain only 0.1% of the variance in financial behaviors studied. Similarly, Willis (2011) reviews the empirical literature and concludes that the evidence does not support a causal relationship between financial education to welfare-enhancing financial behavior.

As for enhanced disclosure, Ben-Shahar and Schneider (2014) review relevant empirical evidence and conclude that the quantity and complexity of information reduce the effectiveness of disclosures due to information overload. Bar-Gill (2012) similarly warns that information overload is an even bigger problem than lack of information. Therefore, leveling the playing field of startup equity will require more than just education or detailed and lengthy disclosure.

Joining management scholars in searching for solutions to this problem, law scholars have prescribed two possible approaches to confront the workers' informational disadvantage and lack of investment proficiency. Alon-Beck (2019) calls for mandating that "unicorn" employers provide employees with an independent purchaser representative's assistance. This proposal addresses employees' failure to consult with a professional adviser by imposing the costs of seeking and providing this service on the employer. Aran (2019) offers a different approach that relies on the ability of cap-table management software to summarize and simplify the disclosure of complicated financial data via visualization. Aran argues that if a startup issues over 10% of any class of shares to at least 100 employees, it should be required to disclose employees' individual payout across a range of possible exit values (known as waterfall analysis).[26] Aran's proposal avoids the need for a sophisticated understanding of venture capital finance terms by focusing on the impact of these terms on employees' individualized payout.

To fully appreciate the advantages and disadvantages of each of these approaches warrants further empirical investigation of startup employees' investment behavior.

6. Conclusion

The widespread and growing use of equity-based compensation has transformed high-skilled labor from a simple labor relationship into one that involves a significant investment component. This trend is particularly pronounced among venture capital-backed startups where a sizable portion of employees' pay is made in equity grants and there is no active liquid market to determine the securities' price. It is, therefore, crucial

[26] Exit waterfall analysis assumes that the company's equity is sold, and the proceeds are allocated in a "waterfall" down the different equity classes of shares, according to their respective liquidation preferences, until the common stockholders finally receive the residual claim, if any exist. A waterfall model can render a graph where for each possible "exit valuation" plotted on the x-axis, the employee's individualized payout is indicated on the y-axis.

to ascertain employees' expectations from, and understanding of, equity compensation with measures of financial literacy tailored to that setting.

Toward that end, this study devises questions that probe employees' understanding of fundamental concepts of equity compensation—including stock option value, liquidation preferences, and risk associated with the leverage effect of options—as well as ability to perform simple calculations with those concepts. Using these questions, the study gauges information about financial literacy beyond that which has been estimated with previous general financial literacy measures.

We find a troubling combination of high demand for startup equity grants among our sample of American tech employees—including a high willingness to forgo cash compensation in exchange for equity—and little understanding of basic concepts related to the value and risks associated with these investments. Only a small fraction of the respondents answered the questions about equity compensation correctly. Even study participants who reported previously facing equity compensation decisions demonstrated limited understanding of important equity compensation concepts. For the most part, the respondents also have not attempted to make up for their financial illiteracy by seeking professional advice.

The study demonstrates that lack of financial knowledge regarding equity-based compensation is linked to a susceptibility to misinterpret and make uninformed decisions regarding compensation offers. We find that study respondents based their evaluations of hypothetical equity compensation packages on the number of shares offered instead of the size of the ownership stake—an illusion caused by using equity as a medium.

Finally, we find that study respondents consider equity akin to an investment or a high-return gamble rather than a mere benefit or bonus. Employees display these attitudes despite the fact that the SEC's deregulatory policy was advocated on the grounds that "the transaction is essentially compensatory… rather than investment-oriented" (Securities and Exchange Commission 1985, p. 27). Our results demonstrate a very different mentality among tech workers. Low financial literacy regarding equity-based compensation does not suppress employees' willingness to trade off cash in exchange for equity, and employees with low levels of relevant financial knowledge are more likely to view startup equity awards as an investment or savings plan.

Taken together, these findings provide empirical support for the hypothesis that the fallacy of assessing an equity compensation offer according to the number of

securities offered instead of the size of the ownership stake is positively and nontrivially related to lack of financial literacy regarding equity-based compensation.[27] In real-world labor markets, a job seeker might make assumptions about the total number of outstanding shares a company has, guess the ownership percentage that a grant represents, and compare that with their prediction for the value of a share in order to rationalize opting for more equity. Additional data from the field would need to be collected to examine if job seekers perform such sophisticated research and predictions. In the setup of this study, the respondents were explicitly provided with the information they might try to collect. Specifically, participants were provided with the ownership stake that their shares conveyed. Therefore, our results indicate that job seekers opt for larger numbers of shares even when this number is not indicative of the economic value of the grant.

Equity compensation schemes involve multidimensional and intertemporal decisions—the kind of decisions that are most susceptible to cognitive errors. If employment decisions are affected by systematic misperceptions—as the results of this study suggest—startups may respond to employees' bounded rationality and financial illiteracy by designing compensation arrangements that prey on employees' fallacies. According to informal interviews with lawyers specializing in startup financing, the perceived value of "large" equity grants (in number of shares) is a well-known reason for startups to issue a large number of shares from the outset or to conduct stock splits later on. Media coverage of Silicon Valley startups' reverse stock splits and professional tutorials on the IPO process document the psychological effect of the reverse change on employee morale, despite having no impact on employees' ownership stake.[28] Further

[27] Such a preference for an irrelevant signal may be somewhat smaller among those actively considering an equity compensation offer, as some of these workers may do research or seek advice that boosts their equity financial literacy in the short-term. The results of our survey, shown in Figure 4, however, demonstrate that nearly half of the study participants who had faced an equity compensation offer did not perform additional research or seek professional advice.

[28] See, e.g., Pui-Wing Tam, "Before an IPO, Companies Look to Reverse Stock Splits," *The Wall Street Journal* (Sept. 30, 2010, 12:01 am ET): "Pre-IPO reverse stock splits have a downside: They can rub employees the wrong way. Although the combined value of the shares doesn't change in a reverse split, an employee who held 1,000 shares and ends up with 100 shares might feel cheated, says Patrick Pohlen, an attorney at Latham & Watkins who works with many Silicon Valley startups. "It's a difficult thing emotionally to explain to people," says Mr. Pohlen." See also Fenwick & West LLP, Legal Resource Guide for Startup Entrepreneurs (2015), at p 6: "Reverse stock splits reduce the number of shares held. On the other hand, forward stock splits add shares to holdings. Neither changes the percentage of ownership, but seeing the number of shares held decrease because of a reverse split is still hard on employee morale."

research is needed to test the hypothesis that companies are indeed using this fallacy to recruit talent with sub-par equity grants. It can be examined, for example, by comparing the size of same-tier employees hired right before and after stock splits.

With such dynamics at play, the so-called democratization of startup equity ownership via deregulation of equity compensation offerings may further aggravate the disparity between capital investors and employees, rather than alleviate it. This study's results should inform the public policy debate and inspire further empirical investigation of the role of equity-based compensation in startup companies' ability to attract talent and the power of proposed reforms to protect employees in their investor capacity.

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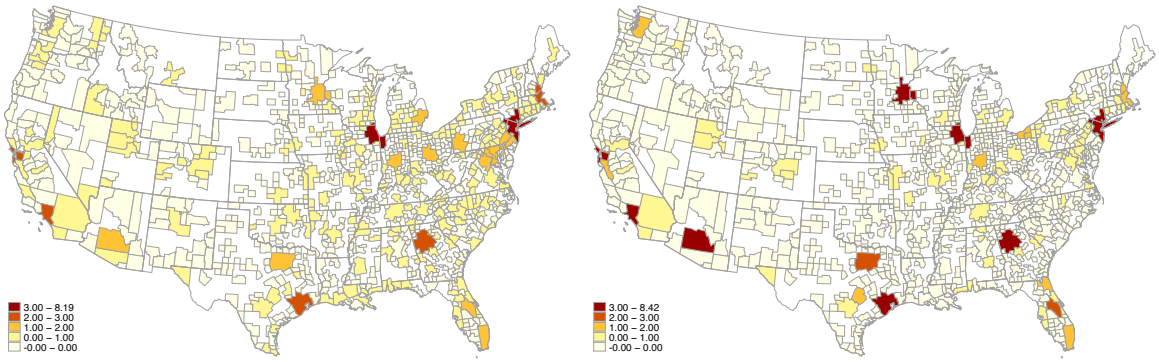
Tables and Figures

Figure 1 Location of Study Participants

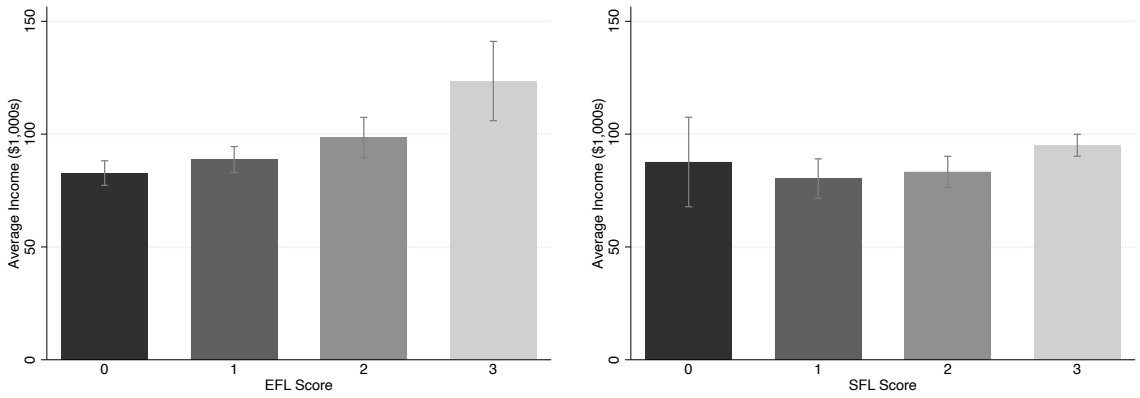
(a) (b)



Note: In the map on the left, we plot the percentage of the study participants in the sample who reside in each CBSA. In the map on the right, we plot the percentage of study participants with direct experience receiving equity compensation or whose spouse received equity compensation that live in each CBSA.

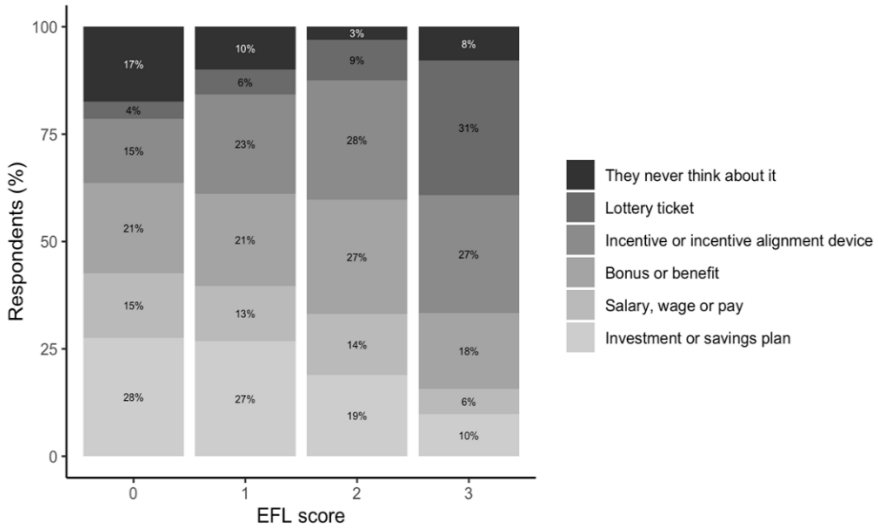
Figure 2 Association of Income, EFL, and SFL

(a) (b)



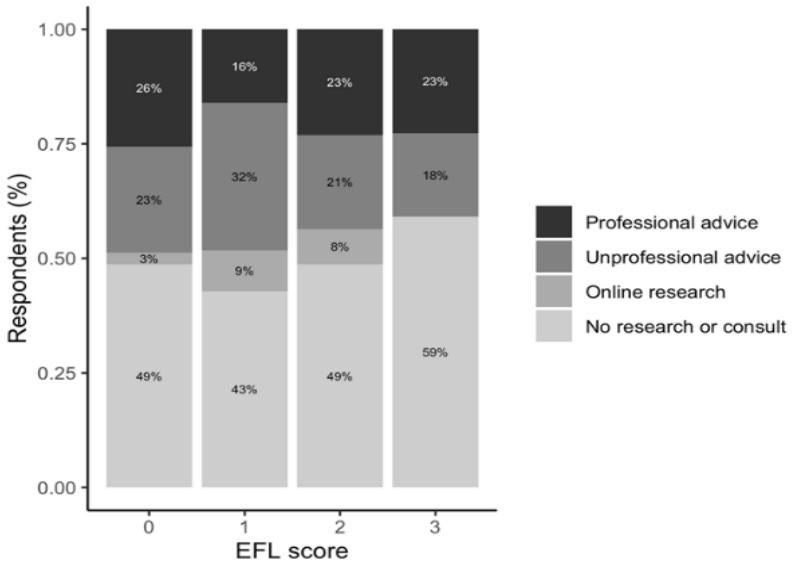
Note: In the figures above, we plot the average reported income against the EFL and SFL scores of the study participants. Income is collected by asking study participants which income brackets they currently fall in. For the above plots, we average over the lower end of the bracket.

Figure 3 Popular Conceptualization of Startup Equity



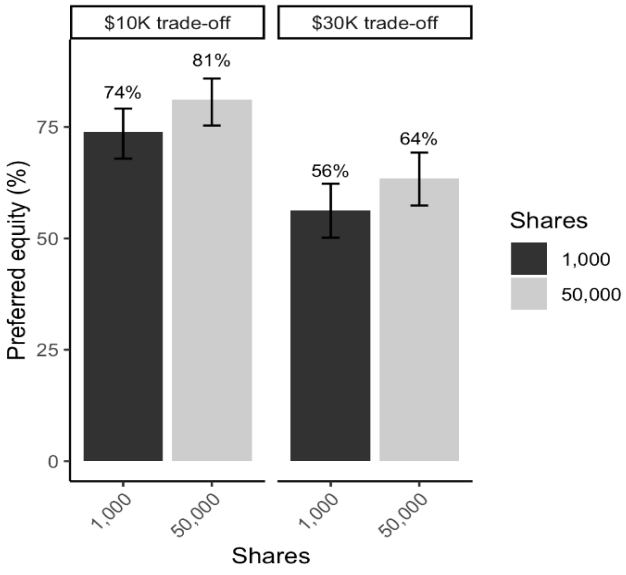
Note: The above figure shows the fraction of respondents who indicated that their friends and colleagues conceived of equity compensation in each way. The percentages are shown for subgroups of respondents based on the respondent's EFL score.

Figure 4 Seeking Advice Regarding Equity Compensation



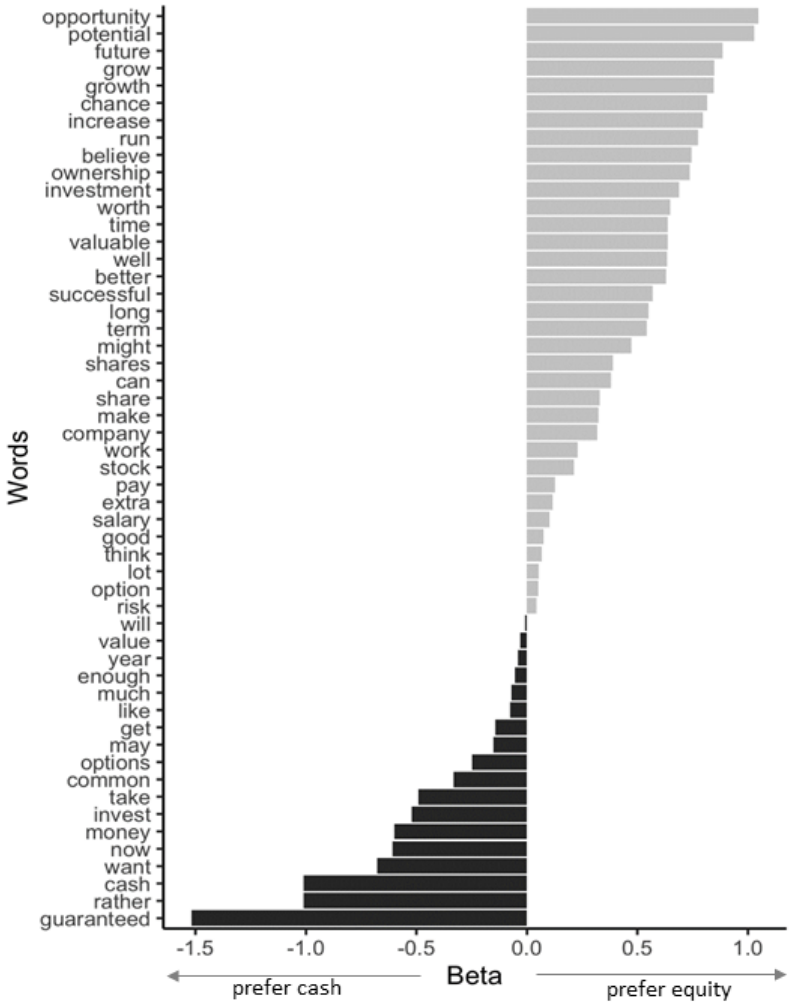
Note: The above figure shows the fraction of respondents who said that they would seek advice about equity compensation. The percentages are shown for subgroups of respondents based on the respondent's EFL score.

Figure 5. Percentage of Subjects Who Traded Off Cash Salary in Exchange for Equity by the Size of the Trade-Off and the Number of Shares Offered



Note: The above figure shows the percentage of study participants who said that they would prefer equity compensation. We show these percentages separately according to which trade-off and numbers of shares that the study participant viewed. Participants were randomized across the four different combinations of number of shares and trade-off size. The difference in preference for equity is significant at the 10% level for both the $10k and $30k trade-off scenarios.

Figure 6 Words Most Predictive of Preference for Cash vs. Preference for Equity

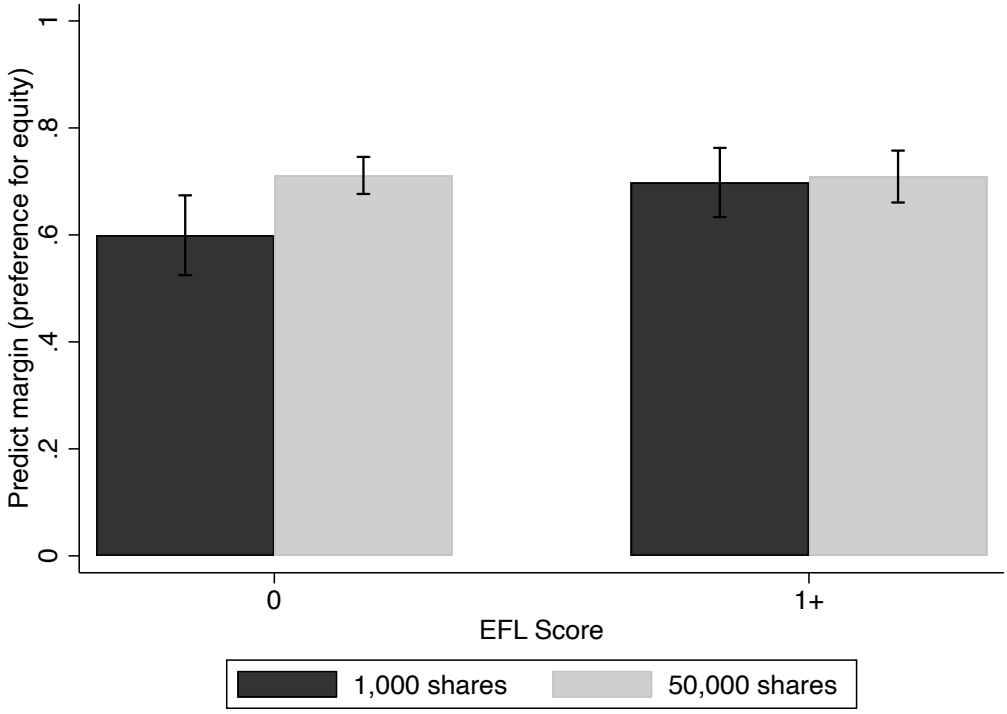


Note: Words were gleaned from common responses, including but not limited to:

- "Common shares can lose value whereas my salary is guaranteed."
- "[I] could use the extra $10,000 to invest the way I want."
- "That way I can take the extra money and put it into stocks or shares other than just the one listed."
- "I just prefer to have the money now as the market value fluctuates and I have greater immediate needs."
- "Money is good, and stock is better. Preparation for the future is on my mind."
- "Betting on earning a lower salary now against the chance of riches through an IPO in the future."
- "The potential for growth would allow me to gain even more money over time as I stay there."
- "The shares would provide steady income for retirement.
- "I would like to have ownership in the company."
- "Believing that I am a good fit in this company, I will help it succeed."
- "I want a vested interest in a company. I'm going to put forth more than my fair share of effort to increase the shareholder value of the stock in the organization."

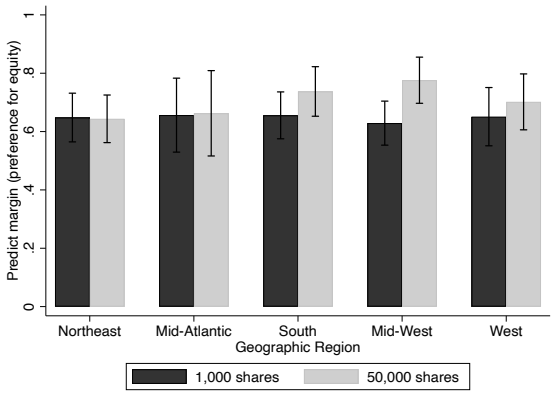
- "Saving for the long term is more important than immediate income. Taxes also play a role in my decision."
- "Young in my career, willing to gamble."

Figure 7 Predictive Margins of the Number-of-Shares Treatment



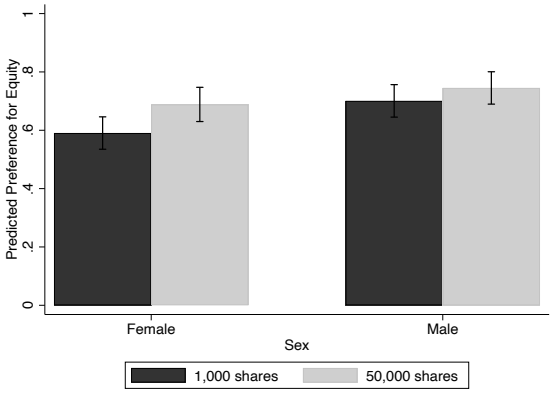
Note: The figure shows the predicted probability that a study participant indicated a preference for equity. These estimates are derived from the regression shown in Appendix Appendix Table 7. The predicted probabilities are computed by adjusting the EFL score, while holding all other covariates constant at their means across all respondents. The EFL score is binned to be either 0 or 1+.

Figure 8 Predictive Preference for Equity by Geographic Region



Note: The above figure shows the predicted probability for study participants who said that they would prefer equity compensation after residualizing by gender, native English speaker, age, marital status, number of children, income, and the size of the trade-off viewed. We show these probabilities separately according to the numbers of shares that the study participant viewed and the geographic region they live in. The difference in preference for equity by shares is significant at the 1% level for the Mid-West region and significant at the 10% level when tested across all regions.

Figure 9 Predictive Preference for Equity by Gender



Note: The above figure shows the predicted probability for study participants who said that they would prefer equity compensation after residualizing by gender, native English speaker, age, marital status, number of kids, income, and the size of the trade-off viewed. We show these probabilities separately according to the numbers of shares that the study participant viewed and the gender of the study participant. The difference in preference for equity by shares is significant at the 5% level for female respondents, but not significant for male respondents.

Table 1 Comparison of Characteristics of Study Participants in Experimental Conditions

	All	Small Trade-off			Large Trade-off		
		Small shares	Large shares		Small shares	Large shares	
	Mean	Mean	Mean	t-test	Mean	Mean	t-test
Gender [Male]	.51	.52	.5	0.700	.48	.55	0.100
Native English speaker [Yes]	.93	.94	.94	0.958	.93	.94	0.643
Age	40	40	41	0.071	41	40	0.331
Married [Yes]	.63	.61	.6	0.902	.71	.59	0.006
Number of children	1.2	1.1	1.3	0.079	1.2	1.2	0.379
Geographic Region							
-- Northeast	0.25	0.22	0.388	0.388	0.20	0.27	0.051
-- Mid-Atlantic	0.10	0.09	0.637	0.637	0.09	0.07	0.295
-- South	0.23	0.23	0.990	0.990	0.24	0.22	0.484
-- Midwest	0.29	0.30	0.822	0.822	0.26	0.23	0.435
-- West	0.12	0.16	0.238	0.238	0.20	0.21	0.828
Education (Highest degree)							
-- Bachelor's	.65	.71	.63	0.065	.64	.64	0.959
-- Master's	.27	.24	.29	0.160	.27	.28	0.839
-- Professional	.042	.028	.022	0.667	.063	.053	0.609
-- Doctoral	.034	.028	.057	0.116	.026	.026	0.977
Occupation Level							
-- Entry level	.37	.4	.39	0.872	.34	.37	0.448
-- First-level manager	.28	.27	.25	0.791	.26	.32	0.178
-- Higher-level manager	.35	.34	.36	0.682	.4	.32	0.042
Income	3	2.7	3	0.045	3.1	3.1	0.672
Earned equity compensation	.15	.14	.14	0.996	.15	.18	0.371
Spouse earned equity compensation	.086	.068	.11	0.151	.096	.075	0.384
CRT	1.1	1	1.1	0.770	1	1.2	0.148
SFL	2.3	2.2	2.5	0.003	2.2	2.3	0.596
EFL	.83	.79	.88	0.264	.8	.86	0.425
N	1,013	249	228		270	266	

Note: The above table shows the mean attributes of the study participants in our sample. The first column shows these means for all study participants. The second and third columns show the means for participants who were randomized into the small trade-off arm. The fourth column shows the p-values for two-sample *t*-tests of the difference in these means. The fifth and sixth columns show the mean

attributes of those randomized into the large trade-off arm. The final column shows the p-value for *t*-tests of difference in these means.

Table 2 Distribution of Responses to Equity Financial Literacy Questions

	Correct	**Incorrect**	**Don't know**
Stock option value	36.4%	32.3%	31.3%
Liquidation preference	18.3%	65.7%	16.0%
Leverage effect	28.3%	40.9%	30.8%

Note: The above table shows the percentage of study respondents who answered each EFL question correctly, incorrectly, or indicated that they did not know the answer. The rows of the table correspond to the three EFL questions.

Table 3 Distribution of Correct Answers to the EFL Questions Across Demographic Groups

			Q1: Option Value		Q2: Liquidation		Q3: Leverage		Overall	
		N	Correct	DK	Correct	DK	Correct	DK	Three correct	None correct
Age	20-29	157	28.7	40.8	18.5	20.4	25.5	38.2	3.8	51.6
	30-39	344	34.3	30.5	19.5	13.1	29.1	27	4.4	42.2
	40-49	301	33.9	29.6	14.6	15	27.2	32.6	4	46.5
	50-60	211	49.3	28	21.3	19	30.8	28.9	8.5	36.5
Gender	Female	493	29.8	44.6	15.4	22.7	26	39.4	3.4	49.3
	Male	520	42.7	18.7	21	9.6	30.6	22.7	6.5	38.5
Education	Bachelor's	663	34.7	34.4	17.3	17.8	27.5	32	3.5	45.2
	Master's	273	40.3	23.4	22	12.1	30	26.7	8.4	39.2
	Professional / Doctoral	77	37.7	32.5	13	14.3	29.9	35.1	6.5	46.8
Manager	Not manager	377	28.1	49.6	15.6	23.1	21.5	44.3	2.9	53.6
	First level	279	38.7	21.5	17.6	12.5	26.2	26.9	3.2	41.9
	Higher level	357	43.4	19.6	21.6	11.2	37.3	19.6	8.7	34.7
Industry	Biotech/Pharma	89	31.5	32.6	21.3	7.9	24.7	36	4.5	47.2
	IT	321	41.7	17.8	19.3	9	29.9	22.1	5.9	39.3
	Legal & finance	60	31.7	20	13.3	15	28.3	23.3	3.3	46.7
	Scientific & technical	120	31.7	40	20.8	20	35.8	27.5	7.5	42.5
	None of the above	307	31.6	43.6	15.3	25.7	24.8	41.4	4.2	51.1
Earned equity comp.	No	857	32.6	34.7	16.5	17	25.8	33	3.4	47.1
	Yes	156	57.7	12.8	28.2	10.3	42.3	18.6	14.1	25

Note: The above table shows the percentage of study participants who answered each question correctly, incorrectly, or indicated that they did not know the answer.

Table 4 Linear Probability Model Predicting Answers to Each EFL Question

	Q1: Option Value		Q2: Liquidation		Q3: Leverage		Overall	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Correct	DK	Correct	DK	Correct	DK	Three Correct	None Correct
Age: 30-39	0.01	-0.03	-0.00	-0.05*	0.01	-0.06	-0.01	-0.05
	(0.03)	(0.05)	(0.02)	(0.02)	(0.04)	(0.05)	(0.01)	(0.03)
Age: 40-49	-0.01	-0.03	-0.06*	-0.03	-0.01	-0.00	-0.02	0.00
	(0.03)	(0.03)	(0.03)	(0.02)	(0.05)	(0.03)	(0.01)	(0.03)
Age: 50-60	0.16*	-0.08*	0.01	-0.01	0.03	-0.06	0.03	-0.11**
	(0.06)	(0.03)	(0.01)	(0.03)	(0.04)	(0.06)	(0.02)	(0.03)
Female	-0.08**	0.19***	-0.05**	0.11***	-0.02	0.12**	-0.02*	0.06***
	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.03)	(0.01)	(0.01)
Education (Highest degree)								
Master's	0.02	-0.05	0.04	-0.03	0.00	-0.01	0.04*	-0.03
	(0.06)	(0.05)	(0.04)	(0.02)	(0.04)	(0.03)	(0.02)	(0.06)
Professional/Doctoral	0.03	-0.01	-0.06**	-0.02	0.02	0.04	0.03	0.03
	(0.04)	(0.04)	(0.02)	(0.06)	(0.04)	(0.04)	(0.02)	(0.04)
Occupation level								
First-level manager	0.09**	-0.24***	0.01	-0.08	0.04	-0.15***	-0.00	-0.10
	(0.03)	(0.04)	(0.02)	(0.04)	(0.03)	(0.02)	(0.01)	(0.05)
Senior leader	0.12***	-0.23***	0.04	-0.08**	0.13**	-0.19***	0.04*	-0.15***
	(0.02)	(0.04)	(0.04)	(0.02)	(0.04)	(0.03)	(0.02)	(0.02)
Industry: Biotech	-0.04	-0.11	0.05*	-0.16***	-0.02	-0.04	0.00	0.00
	(0.04)	(0.05)	(0.02)	(0.02)	(0.03)	(0.05)	(0.03)	(0.04)
Industry: IT	0.03	-0.14**	-0.00	-0.08***	0.01	-0.09	0.01	-0.02
	(0.02)	(0.03)	(0.02)	(0.01)	(0.04)	(0.05)	(0.02)	(0.01)
Industry: Legal/Finance	-0.07**	-0.15***	-0.05**	-0.05	-0.01	-0.10*	-0.02	0.04
	(0.02)	(0.03)	(0.02)	(0.03)	(0.06)	(0.05)	(0.03)	(0.09)
Industry: Science	-0.06**	0.04	0.03	-0.00	0.06	-0.06	0.02	-0.00
	(0.02)	(0.03)	(0.01)	(0.05)	(0.04)	(0.05)	(0.02)	(0.03)
Earned equity compensation	0.21**	-0.12***	0.09***	-0.02	0.14**	-0.08**	0.09**	-0.17***
	(0.05)	(0.03)	(0.01)	(0.02)	(0.05)	(0.02)	(0.02)	(0.03)
N	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012

Dep. Mean	0.36	0.31	0.18	0.16	0.28	0.31	0.05	0.44
Adj. R^2	0.07	0.18	0.02	0.06	0.03	0.09	0.04	0.05

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: In the above table, we show the results of estimating linear probability models. The dependent variables in models (1)-(6) are indicators for if the respondent answered correctly or don't know. The dependent variable in model (7) is an indicator for if the respondent answered all three questions correctly. The dependent variable in model (8) is an indicator for if the respondent answered all three incorrectly. The model is estimated via OLS. Bachelor's degree holders are the omitted group for highest education. The standard errors were clustered at the geographic region level.

Table 5. Linear Probability Model of Preference for Equity

	Prefers Equity over Cash			
	(1)	(2)	(3)	(4)
Trade-off size [$30,000]	-0.18***	-0.17***	-0.17***	-0.17***
	(0.02)	(0.02)	(0.02)	(0.02)
Number of shares [50,000]	0.07**	0.07*	0.37**	0.33***
	(0.03)	(0.03)	(0.13)	(0.11)
SFL		0.07***	0.09***	0.07***
		(0.01)	(0.01)	(0.01)
EFL		0.05**	0.07***	0.07***
		(0.01)	(0.02)	(0.01)
Number of shares [50,000] x Positive SFL			-0.27*	-0.23*
			(0.11)	(0.10)
Number of shares [50,000] x Positive EFL			-0.09**	-0.10**
			(0.04)	(0.03)
Gender [Male]				0.07*
				(0.03)
Native English speaker [Yes]				-0.15**
				(0.06)
Age				-0.00
				(0.00)
Married [Yes]				-0.06
				(0.05)
Number of children				0.02
				(0.02)
Level of education -- Master's Degree				-0.03

				(0.02)
-- Professional/Doctoral Degree				-0.10*
				(0.04)
Managerial experience				
-- First-level manager				0.01
				(0.04)
-- Higher-level manager				0.01
				(0.03)
Earned equity compensation				0.01
				(0.02)
Income				-0.00
				(0.01)
Constant	0.74***	0.54***	0.49***	0.68***
	(0.01)	(0.03)	(0.02)	(0.08)
Geographic Region FE	No	No	No	Yes
N	1,013	1,013	1,013	1,013
Dep. Mean	0.68	0.68	0.68	0.68
Adj. R^2	0.04	0.07	0.08	0.09

Standard errors clustered at the geographic region level shown in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: In the above table, we show the results of estimating linear probability models. The dependent variable in all models is an indicator for if the respondent indicated that they preferred the compensation package that included an equity grant versus an all-cash package. Covariates include the number of shares and the size of the trade-off viewed. In Column (4) we include an interaction between the number of shares viewed and the EFL score being 1 or greater. The model is estimated via OLS. Bachelor's degree holders are the omitted group for highest education. The standard errors were clustered at the geographic region level.

Appendices

Appendix A : Survey Questions

Appendix A.1 Equity Financial Literacy Questions

The correct answers are marked in bold:

1. All else being equal, which is more valuable – a stock option with a high exercise price or a stock option of the same company with a low exercise price?
    - Stock option with a high exercise price.
    - **Stock option with a low exercise price**.
    - They are identically valuable.
    - Don't know.

2. All else being equal, including the companies' valuations and cash reserves, which equity-based compensation offer is more valuable – an offer from a startup that has raised more money from venture capital investors or an offer from a startup that has raised less?

    - Offer from a startup that has raised more.
    - **Offer from a startup that has raised less**.
    - They are identically valuable.
    - Don't know.

3. Ignoring tax considerations, an employee with low risk tolerance will prefer stock options over restricted stock.

    - True
    - **False**
    - Don't know

Appendix A.2 Standard Financial Literacy

The exact wording of the survey questions are as follows:

1. Suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow?

    - More than $102
    - Exactly $102
    - Less than $102
    - Don't know

2. Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, with the money in this account, would you be able to buy…

- More than today
- Exactly the same as today
- Less than today
- Don't know

3. Do you think the following statement is true or false? Buying a single company stock usually provides a safer return than a stock mutual fund.

- True
- False
- Don't know

Appendix A.3 Cognitive Reflection Test Questions

In our survey, we asked study participants to answer questions based on Frederick's three-item "Cognitive Reflection Test" (CRT). Because the CRT is widely used in financial economics studies, we modified the questions slightly in order to ensure that study respondents carefully read and responded. The specific text of the questions used were as follows:

- A pencil and an eraser cost $1.10 in total. The pencil costs $1.00 more than the eraser. How much does the eraser cost?
- If it takes 10 machines 10 minutes to make 10 widgets, how long would it take 50 machines to make 50 widgets?
- A new company is hiring employees rapidly. Every day, the number of employees doubles in size. If it takes 40 days for the company to be at full capacity, how many days would it take for the company to be at half capacity?

Appendix B: Alternative Specifications

We utilized linear probability models in the main text of the analysis for ease of interpretation. In this appendix section, we reproduce the main specifications using logit regressions and display the marginal effects.

Appendix Table 6 Logit Regression with Marginal Effects Displayed

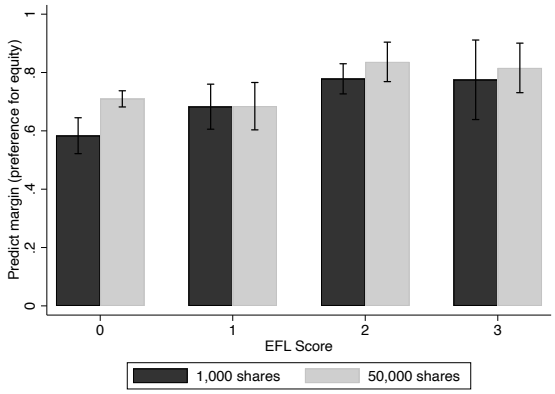
	Prefers Equity over Cash	
	(1)	(2)
Trade-off size [$30,000]	-0.17***	-0.17***

	(0.02)	(0.02)
Number of shares [50,000]	0.07**	0.07**
	(0.03)	(0.03)
Gender [Male]		0.08**
		(0.04)
Native English speaker [Yes]		-0.18***
		(0.07)
Age		-0.00
		(0.00)
Married [Yes]		-0.06
		(0.06)
Number of children		0.02
		(0.02)
Level of education		-0.04
		(0.02)
Managerial experience		0.00
		(0.02)
Earned equity compensation		0.04
		(0.04)
Income		-0.00
		(0.01)
EFL		0.07***
		(0.01)
Geographic Fixed Effects	No	Yes
N	1,013	1,013
Dep. Mean	0.68	0.68
Adj. R^2	0.03	0.07

Standard errors clustered at the geographic region level shown in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Note: In the above table, we should the results of estimating a logistic regression. The dependent variable in all models is an indicator for if the respondent indicated that they preferred the compensation package that included an equity grant versus an all-cash package. Covariates include the number of shares and the size of the

trade-off viewed. The model is estimated via logistic regression. The standard errors were clustered at the geographic region level.

Appendix Figure 10 Predictive Margins by EFL Score Using Logit Estimates



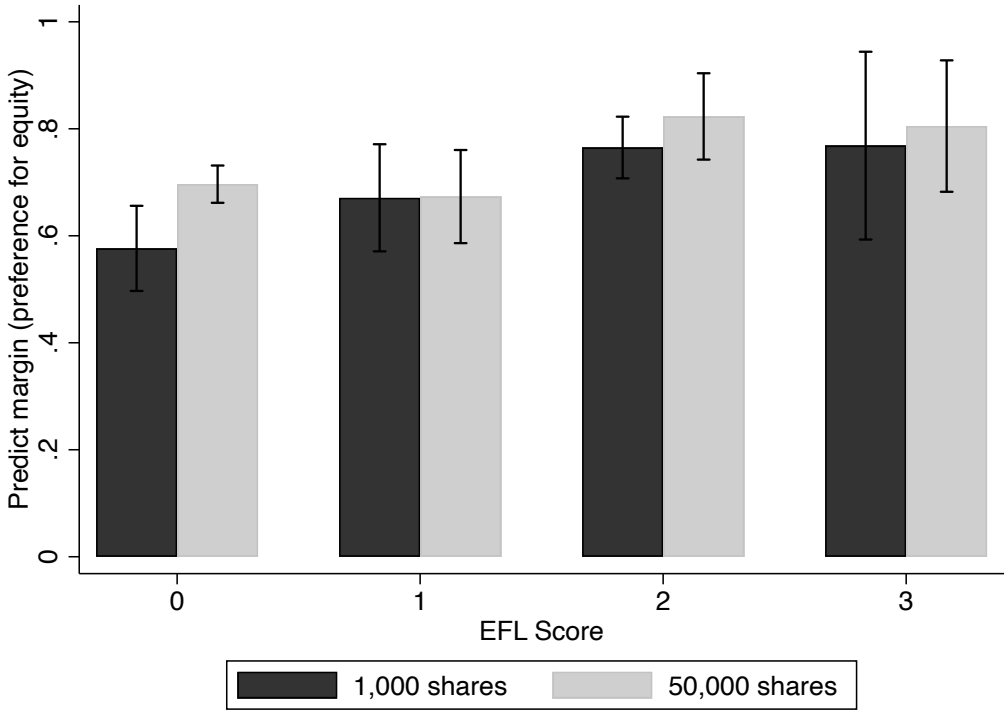
Note: The figure shows the predicted probability that a study participant indicated a preference for equity. These estimates are derived from the regression shown in Appendix Table 6. The predicted probabilities are computed by adjusting the EFL score, while holding all other covariates constant at their means across all respondents.

Appendix C: Non-Parametric Version of the EFL Score

The relationship between EFL scores and the preference for equity compensation may not be linear. Therefore, we examine the relationship using non-parametric analysis that allows for different effects from seeing higher numbers of shares at each level of EFL.

Appendix Figure 11 plots the predicted probability of preferring equity within each EFL score using interaction terms in a linear probability model.

Appendix Figure 11 Predictive Margins of the Number-of-Shares Treatment



Note: The figure shows the predicted probability that a study participant indicated a preference for equity. These estimates are derived from the regression shown in Appendix Appendix Table 7. The predicted probabilities are computed by adjusting the EFL score, while holding all other covariates constant at their means across all respondents.

Appendix Table 7 Estimates of the Effect of EFL on Preference for Equity

	Prefers Equity over Cash
EFL=1	0.05
	(0.06)
EFL=2	0.15**
	(0.05)
EFL=3	0.14
	(0.14)
Trade-off size [$30,000]=1	-0.21**
	(0.06)

EFL=1 x Trade-off size [$30,000]=1	0.08*
	(0.03)
EFL=2 x Trade-off size [$30,000]=1	0.08
	(0.06)
EFL=3 x Trade-off size [$30,000]=1	0.09
	(0.15)
Number of shares [50,000]=1	0.07
	(0.05)
EFL=1 x # of shares [50,000]=1	-0.02
	(0.08)
EFL=2 x # of shares [50,000]=1	0.04
	(0.06)
EFL=3 x # of shares [50,000]=1	-0.04
	(0.17)
Trade-off size [$30,000]=1 x Number of shares [50,000]=1	0.09
	(0.11)
EFL=1 x Trade-off size [$30,000]=1 x Number of shares [50,000]=1	-0.19*
	(0.08)
EFL=2 x Trade-off size [$30,000]=1 x Number of shares [50,000]=1	-0.18**
	(0.06)
EFL=3 x Trade-off size [$30,000]=1 x Number of shares [50,000]=1	-0.08
	(0.13)
Gender [Male]	0.08
	(0.04)
Native English speaker [Yes]	-0.16**
	(0.05)
Age	-0.00
	(0.00)
Married [Yes]	-0.06
	(0.05)
Number of children	0.02
	(0.02)
Earned equity compensation	0.01
	(0.02)
Master's	-0.03
	(0.02)

Professional/Doctoral	-0.08 (0.05)
First-level manager	-0.01 (0.04)
Senior leader	-0.01 (0.04)
Income	-0.00 (0.01)
Constant	0.84*** (0.07)
Geo Region	Yes
N	1,013.00
Dep. Mean	0.68
Adj. R^2	0.06

Standard errors are clustered at the geographic region level and shown in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

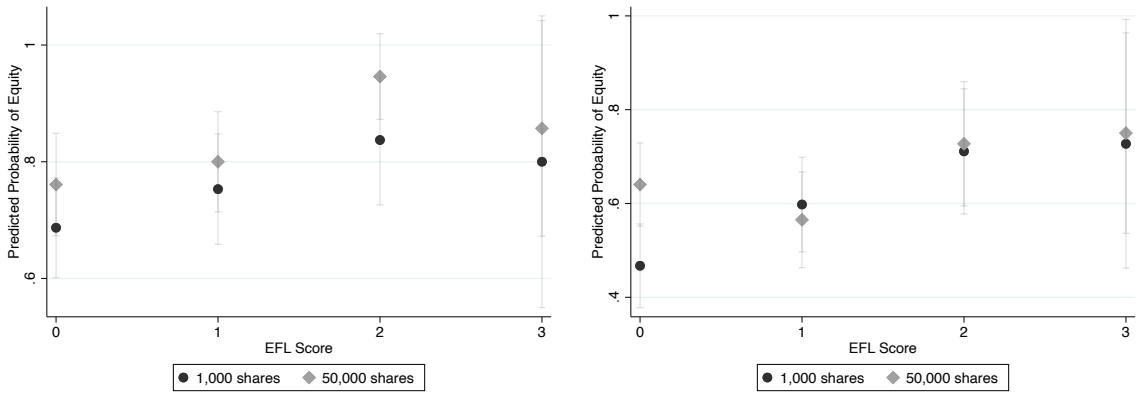
Note: In the above table, we show the results of estimating linear probability models. The dependent variable in the model is an indicator for if the respondent indicated that they preferred the compensation package that included an equity grant versus an all-cash package. Covariates include the number of shares and the size of the trade-off viewed. The model is estimated via OLS. The standard errors were clustered at the geographic region level.

In addition, we plot the effect of seeing higher numbers of shares separately for those who viewed a trade-off of $10,000 cash for equity and those who viewed a trade-off of $30,000 cash for equity. We plot this using the procedure developed by Cattaneo et al. (2019). The plot demonstrates that in almost every single bin of EFL, study participants showed more interest in equity when the number of shares offered was higher.

Appendix Figure 12 Effect of Larger Numbers of Shares on Preference for Equity

(a) $10,000 trade-off

(b) $30,000 trade-off

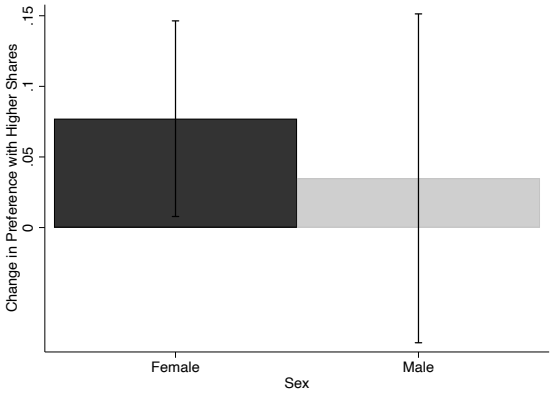


Note: The figures above show the predicted probability that a study participant indicated a preference for equity given their EFL score. The figure on the left shows this for study participants who viewed a $10,000 trade-off, while the figure on the right estimates using those who viewed a $30,000 trade-off.

Appendix D: Difference by Gender

Within our sample, female participants show greater change in preference for equity compensation when shown higher numbers of shares than the male respondents do. Using the main regression show in Table 5 column (4), we add interactions between the gender of the respondent, the number of shares shown, and the size of the trade-off considered. We find that female study participants opted for equity at a 9.81 probability point higher rate. That average increase is significant at the $p<0.05$ level. In contrast, male candidates only increased 4.43 probability points, a rate that is not significantly different from 0. We visualize that difference in the figure below.

Appendix Figure 13 Contrast in Predicted Preference for Equity by Gender



Note: The above figure is derived from a linear probability model shown in Table 5 column (4) with added interactions between the gender of the study participant, the size of the trade-off, and the number of shares displayed. The contrasting margins are then computed. Standard errors are computed with clustering at the geographic region level. Using F-tests, we find that the contrasting margins are significant for female respondents at the $p<0.05$ level, while the male contrast is not significant.