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Employee behavior in employee stock option plans: Why do some employees acquire company stock?

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Abstract

The article focuses on decisions to exercise and hold company stock at the maturity of a broad-based employee stock options plan. It investigates why some participants choose an uncertain and risky future reward when an immediate and certain increase in wealth could be secured at exercise. It draws on and expands the "mixed gambles" perspective in behavioral agency theory, utilizing a combination of stock price data and employee survey data from British companies with tax-approved stock option plans. It is found that the decision to take a gamble is influenced (negatively) by the extent of stock price lows (relative to prices at exercise) in the year prior to exercise, and by the risk preferences of the option holder. The findings contribute to further development of the "mixed gambles" perspective as an explanation of stock option behavior, showing that individual characteristics as well as some stock price movements affect behavior.

KEYWORDS
employee stock ownership, mixed gambles, option exercise, stock options

1 | INTRODUCTION

Employee stock option and ownership plans are a widespread feature of company remuneration packages in many countries (Ligthart et al., 2021), and often an integral element of strategic human resource management and high-performance work systems (Poutsma et al., 2017). Much of the theoretical rationale for these plans is derived from agency theory and the alignment of incentives, with the effects of these plans on company performance being the primary focus of the literature (Blasi et al., 2016; Kim & Ouimet, 2014; O'Boyle et al., 2016). This performance effect is widely attributed to changes in employee attitudes and behavior induced by employee participation in these plans (Kaarsemaker et al., 2010; Long, 1980; Pendleton et al., 1998).

Although these effects of plan participation will likely depend on employees continuing to hold stock or options, decisions by plan participants have received almost no attention in the HRM literature. In the case of option plans, a key decision is whether participants exercise their options and, if so, whether they immediately sell the stock to realize gains or retain it in the hope that the stock price will rise further? If they exercise and sell immediately, incentives will be unraveled and the posited benefits of employee ownership for the company may not be achieved. If, by contrast, they exercise and hold, their fortunes remain closely tied to those of the company. While this maintains incentive effects, employees exchange a sure pay-off now for an uncertain gain (or loss) tomorrow. From an employee perspective, this decision can be viewed as a gamble. This choice could affect their wealth, possibly to a considerable extent.

The article focuses on whether employees exercise and immediately sell the acquired stock ("cashless exercise") or exercise and hold the stock. Using British data, we find that twice as many participants hold rather than sell the stock from exercising their options. This is

intriguing because the theoretical presumptions against taking this gamble are substantial. Agency theory highlights risk aversion, and the preference for a sure rather than an uncertain outcome (Eisenhardt, 1989). Prospect and endowment theory show the importance of loss aversion, with behavioral agency theory specifically suggesting that holders of "in-the-money" options will incorporate the current value of options into wealth endowments at or prior to exercise (Devers et al., 2007; Wiseman & Gomez-Mejia, 1998). The implication is that employees will sell exercised stock to avoid potential future wealth losses. A key question, then, is why, and under what conditions, many employees take a gamble when they exercise their options?

Our approach draws on the "mixed gambles" version of behavioral agency theory (Martin et al., 2013). This argues that the power of loss aversion to encourage playing safe may be countered by the potential to increase wealth by taking a gamble (with the possibility that wealth may be lost) when there is a high perceived probability of future stock price rises. This approach proposes that primary influences on whether to take a gamble are recent and prospective movements in stock prices (moderated by "situational" factors such as tenure). We similarly focus on movements in stock price as an explanation for employee behavior but extend "mixed gambles" theory by incorporating individual characteristics on the basis that decision-makers are not passive responders to stock price stimuli. We also propose that exercise behavior will be a function of current stock prices relative to recent reference points, as has been shown in the behavioral finance literature (Heath et al., 1999).

Survey data from participants in the British Save As You Earn (SAYE) stock option plan in 41 companies (106 separate plans) is matched with administrative data and stock price data in the year leading up to the maturity decision. This data matching is an empirical novelty in HRM since previous studies of broad-based employee stock options and ownership in HRM have rarely used stock prices despite the importance of financial returns in guiding employee decisions and participation (Brown et al., 2012; French, 1987; Jackson & Morgan, 2011; Klein, 1987; Pendleton, 2005).

The key findings are that option gain and our measure for likely future gains have little effect on whether participants take a gamble or not. The only stock price measure that affects the decision is when there has been a recent deep price low: here loss aversion appears to discourage employees from taking a gamble to hold exercised stock. A strong influence upon the exercise decision is individual appetite for risk: those with lower risk aversion are more likely to take a gamble. The implication is that the mixed gambles perspective should incorporate agent characteristics to a greater degree.

The research advances our knowledge of employee behavior in broad-based stock option and stock ownership plans by showing that stock prices have a limited impact on employee choices (subject to options being in the money). Nevertheless, price reference points can be important, and our results here confirm the importance of loss aversion as an influence upon decision-making. Our results also highlight the role of individual differences and the importance of human agency (not always considered in stock options research, especially in

Finance). As well as the contribution to theory, our findings have practical implications for companies offering stock options since they provide a guide to predicting employee behavior at option maturity, and hence an indication of the costs and benefits of offering this form of contingent compensation.

2 | LITERATURE, THEORY, AND HYPOTHESES

2.1 | Empirical and conceptual background

Stock options are a common feature of remuneration packages for both executives and non-managerial employees (Blasi et al., 2000). They are notable for their asymmetric risk properties (Sanders, 2001). There is no downside risk during their lifetime: if the share price falls below the grant price ("out of the money"), the holder does not suffer an actual reduction in wealth if the options are not exercised at this time. When they mature and can be exercised, participants become fully exposed to downside risk if the options are exercised and stock acquired (Sanders, 2001). If, however, they exercise and sell immediately, they will secure an immediate and certain gain in wealth from any increase in stock price between grant and exercise. On this basis, the more likely outcome when options vest will be exercise and sell rather than exercise and hold, as indeed has been found in much of the US finance literature on executive options (Carpenter, 1998; Core & Guay, 2001; Heath et al., 1999).

The employee decision at exercise is clearly important from the perspective of employee stock ownership, and it has important ramifications for research findings that stock ownership has beneficial effects on company performance (O'Boyle et al., 2016). If employees immediately sell the stock at exercise, the incentive effects are unraveled, and the full potential of employee ownership may not be realized (Ofek & Yermack, 2000). Sesil and Lin (2011) address this issue, finding that the productivity effects of broad-based option plans are small and transitory. They attribute this to exercise and immediate sale ("cashless exercise") of stock at vesting, along with intermittent frequency of all-employee schemes. Option exercise decisions made by employees, therefore, have implications for companies.

Despite the significance of employee decisions at option exercises, there has been very little research in HRM into this issue. This contrasts with the extensive literature in Finance on the *timing* of option exercises, where it is found that option holders tend to exercise well before expiry (Carpenter, 1998; Huddart & Lang, 1996). This is usually attributed to risk aversion (Hemmer et al., 1996) and, in some cases, insider information (Huddart & Lang, 2003). To date, much of the management and HR literature on decision-making in employee stock plans has focused on the initial joining decision, finding that income, age, gender, peer effects, and financial literacy, as well as contextual features such as regulatory regimes, are potentially important factors (Ahrens et al., 2018; Babenko & Sen, 2014; Brown et al., 2012; Degeorge et al., 2004; Oehmichen et al., 2018; Pendleton, 2010). An important difference between the initial joining

decision and the exercise decision in option plans is that various forms of risk protection or mitigation, such as discounts on current market price at grant, are offered at grant but not at exercise.

Although there is growing interest in the *effects* of exercise decisions, such as on portfolio concentration (Kruse et al., 2021; Pendleton & Robinson, 2018), the only studies on the content and determinants of the exercise decision are, to our knowledge, those conducted by Liu et al. (2009) and Pendleton and Robinson (2021). Liu et al. (2009) investigate whether employees in a "new economy" firm sell or retain their "free shares" at the end of the vesting period. Contrary to their expectations, they find that risk-positive preferences have a negative relationship with the intention to retain stocks, while wealth alignment has a positive effect (i.e., stock holders want even more of their wealth in company shares). Both affect psychological ownership which, in turn, has a positive effect on ownership preferences. Limitations of this study, however, are a focus on intentions rather than actual decisions and an absence of explicit consideration of stock price movements. By contrast, Pendleton and Robinson (2021) focus on the decision not to exercise when options are "in the money." Relatively few option holders do this but it is potentially costly in terms of foregone wealth. This study finds that lack of financial capability and experience are key influences on this course of action.

Studies of stock options and ownership in HRM seldom incorporate stock price performance even though it is likely to influence exercise and retention decisions as found in the finance literature on exercise timing (Carpenter, 1998; Heath et al., 1999; Huddart & Lang, 1996). This omission is perhaps surprising because the literature has shown over many years that financial returns are central to employee evaluations of employee stock plans. In a landmark piece, Klein (1987) showed that extrinsic orientations (financial returns) are as important as instrumental (involvement in decisions) motives in explaining views toward stock plans, a finding consistently echoed in subsequent research (Buchko, 1992; French, 1987; Jackson & Morgan, 2011; McConville et al., 2016).

The focus of this article, therefore, is what participants in all-employee stock option plans do at the maturity of their plan, and our explanation utilizes measures of individual attributes and stock price movements. Participants have a three-way choice: they can choose not to exercise, they can exercise and sell the stock instantaneously ("cashless exercise"), or they can exercise and hold the stock, at least for the time being. Our focus is the choice between the second and third courses of action, which will normally occur when options are "in the money." Exercise and sell is a certain means of capitalizing on increases in stock value at zero risk; exercise and hold is a risky gamble since future stock prices are uncertain and may decline, leading to a loss of wealth.

Our findings show that a sizeable proportion of option holders buy and hold at exercise. The theoretical presumptions against so doing are substantial. Agency theory highlights risk aversion, and the preference for a sure rather than an uncertain outcome (Eisenhardt, 1989). Prospect and endowment theory suggest that exercise behavior will be influenced by loss aversion – better to take a

sure bet that avoids losses. Behavioral agency implies that holders of "in-the-money" options will exercise and sell to avoid losses of endowed wealth from potential declines in stock price in the future (Devers et al., 2007; Wiseman & Gomez-Mejia, 1998). Since acquiring stock exposes employees to the risk of future losses, this raises some important questions. Why, and under what circumstances, do some choose this risky outcome?

2.2 | Hypotheses

Since those choosing the risky outcome are taking a gamble, we draw on a recent reformulation of behavioral agency theory suggesting that behavior induced by stock options can take the form of "mixed gambles." This approach posits that the balance of prospects of gain and loss from options will drive behavior and choices (Martin et al., 2013). Although option holders usually seek to avoid loss of endowed wealth (the current value of their options) by playing safe, some may take risky actions to pursue wealth gains in some circumstances. Martin, Gomez-Mejia, and Wiseman's view is derived from empirical findings which, while showing the important role of loss aversion (Devers et al., 2007), indicate that actors will take a gamble in some circumstances. They cite Küberger's (1998) finding that subjects will take a 50–50 gamble if the likely value of the gain is double or more the potential loss. There is also the possibility that option holders overweight low probability outcomes, especially where potential gains are involved (Tversky & Kahneman, 1992). Thus, option holder behavior is not always solely or primarily influenced by loss aversion and protection of endowed current wealth.

Martin, Gomez-Mejia, and Wiseman treat past stock price movements (from option grant to the point of observation) as relating to endowed wealth subject to loss aversion, while the size of possible future stock price increases (actually based on past market movements and the time to option expiry) relates to the willingness to gamble. They hypothesize that prospective wealth will positively moderate the negative effect of current wealth upon risk taking, and their results confirm this hypothesis. They also identify further moderating influences: availability of hedging (ability to trade options) and CEO vulnerability (measured by position tenure).

We draw upon and extend the "mixed gambles" perspective. We follow the core intuition that stock price movements are likely to affect behavior. We extend it by applying it to decisions *within* option plans by participants. Further, we investigate decisions by employees in a broad-based plan, not just top executives.

However, there are some criticisms of the "mixed gambles" approach, and our empirical strategy responds to these. Although current wealth is reasonably viewed as the current level of gain relative to option grant, their measure of prospective wealth is also in essence backward looking (past movements in the Dow index). While there may be extrapolation from past stock trends to the future (Benartzi, 2001), it is questionable whether executives will extrapolate from broader exchange trends rather than their own company's stock price, and that they will do it in the quasi-rational way presented (annual movement

multiplied by time to option expiry).[1] Our intuition, based on the availability heuristic (Tversky & Kahneman, 1973) is that option holders are more likely to draw on own company stock trends close to the point of observation as these will have greater salience. A further concern derives from the findings from Behavioral Finance that people judge current prices (and the scope for future changes) against reference points or benchmarks. Thus, prospective wealth may be calculated by comparing current prices against recent price highs or low (Heath et al., 1999; Huddart et al., 2009). Finally, there is a deeper criticism that treating stock price movements as the primary influence on option holder behavior removes human agency from the decision, and views option holders as largely passive responders to stock price stimuli. It is important therefore to also consider the role of individual attributes.

A further difference between our study and that of Martin, Gomez-Mejia, and Wiseman is that our focus is options at expiry rather than mid-term: we are therefore dealing with the "crunch point" in terms of effects on wealth. The potential endowment of option value into wealth, and hence the potential for wealth foregone, is a very real not hypothetical calculation.

In line with the commentary above, we develop our hypotheses in relation to current wealth (loss aversion), prospective wealth (willingness to gamble), and the role of individual attributes.

2.2.1 | Current wealth

An important influence on the decision to exercise and acquire stock is likely to be the extent to which the stock price has risen since the options were awarded. Where options are "in the money," behavioral theory and the mixed gambles perspective imply that option holders will exercise and sell to avoid any possibility of losses to endowed wealth. On this basis, the larger the option gain, the greater the probability that option holders will exercise and sell rather than hold.

This reasoning is expressed in Hypothesis H1.

> **Hypothesis H1.** *The higher the gain between grant and exercise, the higher the probability of exercise and sell ("playing safe").*

2.2.2 | Prospective wealth

The "mixed gambles" perspective predicts that the probability of taking a gamble will be influenced by predictions of prospective wealth (i.e., how much the stock price will increase in the future). The key issue here is how actors predict uncertain events. Based on the availability effect, whereby the perceived probability of an event is influenced by how readily relevant events come to mind (Thaler & Sunstein, 2009; Tversky & Kahneman, 1974), it is expected that very recent stock price movements will be especially salient indicators of future stock price trends. If the stock price rise is especially high in the month before exercise (as the exercise decision is being made), option holders may attach a higher probability to prices continuing to rise after exercise. They will therefore be more likely to take a gamble by exercising and holding stock.

> **Hypothesis H2.** *The greater the price rise in the immediate lead-up to exercise, the higher the probability of exercise and hold (taking a gamble).*

We also predict that decision-takers evaluate potential gains and losses relative to reference points (Kahneman & Tversky, 1979). Prospect theory itself provides little guidance on the location and generation of reference points as it is mainly based on experiments where the experimenter frames the choices and reference points (Bromiley & Rau, 2022). Subsequently, various studies have indicated that recent extreme values function as reference points in stock acquisition/divestment decisions due to their salience to (amateur) investors whose attention-focus and understanding of stock movements is limited (Heath et al., 1999; Huddart et al., 2009; Klein & Maug, 2020). Reference points are typically located within the previous 12 months due to limited cognition (Benartzi & Thaler, 1995).

Reference points provide guides for action by affecting the calculation of the perceived probability of various outcomes. Previous studies have found that exercise events increase in number when the current price exceeds a recent high (Heath et al., 1999; Klein & Maug, 2020). We predict that expectations of price movements, and the willingness to take a gamble, are based on comparisons of current stock prices and these references points. The closer the price at exercise to the previous recent high, or the more it exceeds the previous high, the higher the probability that option holders attach to the possibility that stock prices will continue to rise after exercise, meaning that a buy and hold decision is a good choice. This is consistent also with Kahneman's finding that decision-makers tend to ignore reversion to the mean (2011). On this basis, a positive relationship is expected between a ratio of current price to previous high and exercise and hold. We therefore propose the following hypothesis

> **Hypothesis H3.** *The closer the stock price at exercise comes to or exceeds a stock price high in the previous year, the higher the probability of exercise and hold.*

Lower stock price bounds are also likely to influence decision choices on the basis that extreme stock price events in the year leading up to exercise also catch the attention of the option holder (Huddart et al., 2009), and that the option holder compares the current price to the annual low when making a prediction about future price rises. The greater the gap between a previous stock price low and the current price, the greater the perceived probability of a loss in future. On the basis that loss aversion is a strong determinant of behavior, the option holder will be less likely to take the risk of acquiring stock where there has been a relatively deep low.

> **Hypothesis H4.** *The deeper the stock price low in the previous year relative to the exercise price, the lower the probability of exercise and hold.*

2.2.3 | Individual attributes

A limitation of the "mixed gambles" perspective is that it largely ignores the role of human agency, and thereby views option holders as passive responders to stock price movements. Despite the importance of price movements, the role of employee attributes and differences should not be ignored in shaping responses to these influences. In particular, appetite for risk seems likely to affect whether option holders take the riskier course of action at exercise. There is extensive evidence that variations in risk aversion are associated with differences in the propensity to invest in risky assets, such as stocks (Dohmen et al., 2018; Kapteyn & Teppa, 2011), while the option exercise literature in Finance has emphasized the key influence of risk aversion on exercise timing (Hall & Murphy, 2002; Hemmer et al., 1996; Huddart & Lang, 1996). On this basis, we predict that positive risk preferences will be associated with a greater propensity to buy and hold shares at exercise (i.e., to take a gamble).

> **Hypothesis H5.** *Positive risk preferences will be associated with a higher probability of buy and hold.*

3 | DATA AND METHODS

3.1 | The Save As You Earn plan

We examine the exercise decision in the British Save As You Earn (SAYE) all-employee stock option plan. This long-standing plan is currently used by 570 companies, with options granted to around 310,000 employees in 290 companies in 2018/2019 (National Statistics, 2020). The highly prescriptive regulation of this plan means that there is very little or no variation in plan design between companies. Participating employees are granted options to a value chosen by them up to an annual value of £3000 for each year of the life of the option. This is determined by how much they contribute to a SAYE savings scheme, with a minimum monthly subscription of £5 and a maximum of £250 (now £500). Options can be granted at a discount of 20% on market price without attracting a tax charge. The savings scheme coincides with the vesting period so that the savings are available to exercise the option and purchase shares. The vesting period is either 3 or 5 years (chosen by the participant). Communications from the plan administrator encourage employees to make a decision at maturity, and nearly all employees do so.[2]

In SAYE, the key decision is what choice to make at exercise. Aside from a decision not to exercise, there are two main choices: one, option holders can exercise and simultaneously sell the acquired shares (buy and sell) and two, they can use their savings to exercise, acquire, and retain the shares (buy and hold). The decision is almost frictionless in that the plan administrator executes the decision at nil or minimal cost to the option holder: there is a small (usually lump sum) brokerage charge on stock sales. There is no income tax payable on the acquisition of stock on favorable terms. Capital gains tax (CGT) may be due on sales of stock above a certain value, and this could encourage some employees to buy and hold at exercise rather than buy and sell (Cicero, 2009). However, in most cases, the absolute gain is lower than the annual CGT allowance so no tax is payable.

3.2 | Data source

Data were obtained from an employee-level survey, conducted among the clients of a UK plan administrator in autumn 2015. The research used a mixed-mode of a paper invitation and a web-based survey questionnaire. Each year, plan administrators send a hard copy savings statement to each participant. In the autumn 2015 statement, there was a short item announcing the research. Potential respondents could access the survey via a web-link or a QR reader. To encourage responses, those participating in the survey were entered into a prize draw for a tablet computer.

Altogether 3301 SAYE participants entered the survey from a participant pool of around 170,000. To evaluate the representativeness of the respondent sample, we compared the demographic structure of our sample with the population of SAYE participants. Our sample has broadly the same composition by sex and age but there is a small bias toward higher income, higher contributing employees in our sample. Nevertheless, in terms of the decision choice, our sample is highly representative of the SAYE population.

Fifty-five per cent of respondents (1558) had been in the plan long enough to experience a maturity. Excluding those who cannot remember what they did at maturity, along with those whose most recent maturity is more than 4 years previously (on the grounds that decision recall will likely become increasingly inaccurate beyond this), the sample is reduced to 1272. The sample size is further reduced by 233 cases where a company has more than one maturity each year (as we are unable to identify the relevant maturity), where the year of entry to the plan is uncertain, and where less than five respondents in a company had experienced a maturity during the period.[3] Taking into account missing values on key survey variables, the final sample is 864, spread across 44 companies (an average of 20 respondents per company) and 106 plans (based on duration and year of maturity).

An obvious issue is whether these reductions introduce biases. We investigate this by running a logit where the dependent variable equals 1 if the case is included in the sample, and 0 if there has been a maturity but no inclusion (see Table A1). The final sample is slightly younger (at $p < 0.006$) with a mean of 47 (age at observation not maturity) compared with 48 in the excluded cases. Gender and income constraints do not achieve significance at $p < 0.05$, and the overall model fit is very weak (pseudo $r^2 = 0.006$). These results suggest that the differences between initial and final samples are unlikely to bias results in a substantial way.

3.3 | Variables

3.3.1 | Dependent variable

Maturity is a three-category variable corresponding to the choices available at exercise. The analysis focuses on the two categories relating to option exercise.

TABLE 1 Exercise decision: Frequencies

	Take cash savings back	Risk-free decision with immediate wealth outcome	Risky decision—"gamble"	
	Do not exercise	Exercise and sell	Exercise and hold	Total
Option gain				
Mean	1.17	2.28	2.16	1.86
Median	0.79	2.21	1.85	1.62
Standard deviation	0.87	1.18	1.14	1.17
Total potential wealth gain/loss at maturity (£)				
Mean	216.93	3980.57	4670.12	3095.18
Median	−150.95	2029.49	2513.07	1476.65
Standard deviation	2306.06	7828.67	7829.05	6863.68
n (%)	280 (32%)	168 (19%)	416 (48%)	864 (100%)

Table 1 shows that just under half of the sample exercised and held the stock, while just under 20% chose to exercise and sell immediately. Then, 32% do not exercise (mainly because options are underwater), and this group is not examined further (though see Appendix 2 for regression results). The average gain on the options at exercise is similar for those selling and holding (2.28 vs. 2.16) ($t = -1.1684$, not significant at $p = 0.05$). The average potential wealth gain is somewhat higher for those choosing to exercise and hold but the difference with those selling exercise stock is not significant ($t = 0.9584$).

3.3.2 | Independent variables

The main independent variables used to test the hypotheses are as follows. Descriptive statistics and a correlation table can be found in Table 2.

Option gain. This compares the stock price 1 month before the maturity date with the grant price. This is when option holders receive notification from the administrator that maturity is approaching, and it directs their attention to the current stock price. This approach enables us to include a separate variable to record the trend in the final month (see below).[4] This measure provides a measure of the gain that is available as the decision is being made and is therefore used as the measure of current wealth.

An alternative measure of wealth gain is the total monetary gain (*Stock gain*), calculated by multiplying the total value of options at grant by the option gain (constructed as above) minus the total value of options at grant.[5] This is natural log-transformed in the regressions (but presented un-transformed in descriptive statistics).

Stock trend. This is used as an indicator of prospective wealth. This compares the median price in the final month against that at the start of the month, based on the supposition that price movements occurring simultaneously with the decision will provide a salient indicator of likely future price rises.

Stock high. Based on previous work (Heath et al., 1999), we identify the stock price high in the first 10 months of the final year. We then create a ratio of this to the stock price 1 month before maturity.

The mean value is 1.16, with the previous high exceeding the current price in 90% of cases. This provides a further measure of prospective wealth with a higher ratio posited to suggest a higher probability of future price increases.

Stock low. This is the stock price low in the first 10 months of the year compared against the price 1 month before maturity using the same approach as above. In nearly all cases, the low is below the exercise price (mean = 0.80). Our supposition is that as this ratio approaches (or exceeds) the value of 1, the lower the probability participants will attach to future price falls.

Risk preferences are measured with a single item 11-point scale whereby individuals evaluate their preference to take/avoid risks (based on the scale used in the German Socio-Economic Panel [see Mata et al., 2018]). This is underpinned by a substantial evidence base indicating strong predictive validity (Kapteyn & Teppa, 2011).

We also use several further variables to control for individual attributes and characteristics.

Financial literacy measures financial literacy, drawing on the three-item "core" financial literacy test developed by Lusardi and Mitchell (2014). Greater financial knowledge and understanding lowers the costs of acquiring relevant information for financial decisions, enhances the motivation to acquire financial assets, and increases confidence to make risky financial decisions (Van Rooij et al., 2011). Those exhibiting better financial knowledge are more likely to participate in stock purchase plans (Aubert et al., 2018; Babenko & Sen, 2014; Englehardt & Madrian, 2004). Correct answers to each question are coded to 1 while wrong answers and "don't know" are coded to 0. A short scale (0–3) is created by adding the scores.

Experience. For similar reasons, we anticipate that those with more experience of option exercises will have a higher probability of buy and hold. Experience will enhance knowledge and confidence in taking the risky decision to acquire stock. This variable records the number of plan maturities experienced by the individual.

Income constraints. Option holders' capacity to acquire stock is likely affected by their disposable income after meeting other commitments, similar to stock purchase plans (Babenko & Sen, 2014). Income constraints are measured by asking respondents how difficult (easy) it

TABLE 2 Independent variables: Descriptive statistics and correlation table

Variable	Mean (SD)	Min.	Max.	Gender	Age	Experience	Financial literacy	Contribution	Income constraint	Risk	Option gain	Total gain	Stock high	Stock low	Stock trend	Tax
Gender	0.68 (0.47)	0	1	1.00												
Age	46.43 (9.41)	21	68	−0.04	1.00											
Experience	4.10 (3.39)	1	11	−0.03	0.25	1.00										
Literacy	1.86 (0.88)	0	3	0.18	0.02	0.10	1.00									
Contribution	96.12 (80.60)	5	250	0.10	0.03	−0.10	0.21	1.00								
Income constraint	3.33 (1.02)	1	5	0.13	0.15	0.11	0.25	0.22	1.00							
Risk preference	5.51 (2.47)	1	11	0.25	−0.06	−0.02	0.19	0.16	0.26	1.00						
Option gain	1.16 (0.29)	0.01	2.01	0.08	−0.05	−0.09	−0.06	−0.03	0.05	0.07	1.00					
Total gain	0.80 (0.18)	0.01	1.15	0.10	−0.02	−0.09	0.06	0.36	0.17	0.09	0.69	1.00				
Stock high	1.01 (0.05)	0.69	1.20	−0.13	−0.02	0.00	−0.00	−0.05	−0.02	0.09	−0.28	−0.18	1.00			
Stock low	1.86 (1.17)	0.26	10.98	−0.02	−0.02	0.04	−0.06	−0.11	−0.12	−0.09	−0.15	−0.12	0.56	1.00		
Stock trend	3095.18 (6863.00)	−11,161.05	89,777.78	−0.11	0.11	−0.02	−0.00	0.08	0.01	0.05	−0.02	0.00	0.08	−0.22	1.00	
Tax	0.07	0	1	0.05	−0.03	−0.13	0.02	0.42	0.06	0.08	0.35	0.66	−0.09	−0.07	0.05	1.00

is to make ends meet, using a 1–5 scale. This is preferred to a measure of actual income because it provides a more reliable indication of how far individuals are constrained financially.[6]

Contributions records the monthly contributions made during the plan, which range from £5 to £250. This can also proxy for higher income in that contributions are typically highly correlated with income.[7]

Gender. We use a dummy where male = 1. Some previous research has shown that women are less likely to participate in stock plans (Degeorge et al., 2004; Pendleton, 2010) or to engage in stock trading activity (Barber & Odean, 2001).

Age is a continuous variable based on age in years at the time of maturity. Previous work has found that employee stock plan participation has a rising but concave relationship to age, consistent with standard life-cycle savings models (Pendleton, 2010).

Tax. Buy and hold may be influenced by tax considerations (Cicero, 2009). If the gain from selling stock exceeds the CGT exemption allowance, CGT will be payable. In these circumstances, option holders may buy and hold to defer or dissipate the tax liability. To control for this, we create a dummy equal to one where the option gain exceeds the CGT allowance in that year.[8] This is not ideal because respondents may have unobserved CGT liabilities. However, the number of UK taxpayers incurring a CGT liability during the period is very small, typically under 1% of the employed population.[9] Here, 7% of the sample secure a gain exceeding the CGT exemption, and these cases all decide to buy and hold.

4 | RESULTS

4.1 | Regression models

The hypotheses are tested by estimating a series of multinomial and mixed effects logit models. We report the results of buy and hold against a base category of buy and sell as this is the choice of interest: a risky, uncertain gamble versus a risk-free, certain wealth gain (see Table A2 for the third, non-exercise category). Since employees are grouped into plans that mature at a certain time, and those in each plan experience the same stock price movements, there is a risk that observations violate the assumption of independence. For this reason, we run a multilevel mixed effects logit with the higher-level variable being each 3- or 5-year plan. Since coefficients in logit models are difficult to interpret as measures of effect size, we also report average marginal effects of each independent variable on the predicted probability of the exercise outcomes (Williams, 2012).

Table 3 reports the results of these estimations.

In Table 3, Model 1 reports a model with just demographic and control variables. Model 2 reports the full model, where stock price variables are included. Model 3 repeats the full model with the addition of year controls (for year of exercise). Model 4 substitutes the actual wealth gain (transformed to a natural log) for the option gain. Model 5 reports the mixed effects model (run as a logit with the third exercise category excluded so the *n* is smaller).

There is considerable consistency across the models. Individual characteristics are mainly insignificant, though the number of plan maturities (*Experience*) is significant at $p < 0.05$ in Model 1. The exception is *Risk preferences*, which is significantly associated throughout (at $p < 0.01$) with buy and hold (as predicted), thereby confirming Hypothesis H5. We experimented (not shown) with a polynomial term for age since age effects may be non-linear but insignificant results were obtained.

The coefficients on the two gain variables (*Option gain* and *Total gain*) are small and insignificant throughout, contrary to predictions (Hypothesis H1) that they would be negatively associated with buy and hold. The variable *Stock trend*, used to proxy for expected future price increases, is also insignificant, thereby not confirming Hypothesis H2. The variable *Stock high*, which records the ratio of a recent high to current price, and is also used as an indicator of the probability of future price rises, is insignificant. Thus, Hypothesis H3 is not supported. Meanwhile, *Stock low* is positively related to buy and hold at $p < 0.05$, indicating that the smaller the recent low relative to current price the higher the probability of taking a gamble by holding stock after exercise. This confirms Hypothesis H4, and suggests that loss aversion is a (negative) influence on the willingness to take a gamble. The mixed effects model is notable for generating the same pattern of results, with little difference in the size of coefficients and standard errors (implying that non-independence is not a major issue in Models 1–4). Overall, the results indicate that current and recent stock price movements have mainly little effect on the decision whether to sell or hold, though the relative depth of recent stock price lows discourages participants from taking a gamble.

Individual risk preferences are an important influence on whether participants take a gamble.

We conduct a variety of robustness tests on these models (not shown, available from the authors). One potential issue is the high correlation between *Stock high* and *Stock low* ($r = 0.56$), suggesting the potential for multicollinearity. To determine whether this has any impact, we ran a set of regressions with each of the stock price variables excluded in turn. This had little effect on effect sizes or significance. There is also the possibility that patterns of behavior differ between high and low earners or between top executives and other employees. We do not have occupational level in the survey but we can proxy it using income levels. We created a dummy for the highest earning category but found that this had insignificant effects on the decision outcome probabilities. Note also that the *Contributions* variable can in effect proxy for income but this is resolutely insignificant throughout.

We ran the main logit model as a linear probability model but this generated the same pattern of results. Given the presence of missing values, we also experimented with multiple imputation of missing values in the survey data thereby bringing the sample size up to 975.[10] The results became slightly stronger in terms of significance levels while the overall pattern of results was unchanged with no new variables becoming significant at $p < 0.05$. Although these results increase the sample, they are not used for the main analysis because of the challenges in mounting post-estimation commands after multiple imputation.

TABLE 3 Influences on the exercise decision: Whether exercise and hold. *Mlogit/Mixed logit coefficients (standard errors)*[a]

	Demographic model *Mlogit* (1)	Main model *Mlogit* (2)	Main model with year effects *Mlogit* (3)	Alternative model with total potential wealth gain at maturity *Mlogit* (4)	Multilevel model (share plan groups) *Mixed logit* (5)
Gender	−0.24 (0.21)	−0.24 (0.22)	−0.24 (0.22)	−0.28 (0.22)	−0.22 (0.23)
Age	0.01 (0.01)	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)
Experience	0.05* (0.03)	0.04 (0.03)	0.04 (0.03)	0.04 (0.03)	0.04 (0.03)
Literacy	0.13 (0.11)	0.16 (0.12)	0.16 (0.12)	0.17 (0.12)	0.19 (0.12)
Contribution	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Income constraint	−0.06 (0.10)	−0.04 (0.10)	−0.04 (0.10)	−0.03 (0.10)	−0.04 (0.10)
Risk preferences	0.11** (0.04)	0.12** (0.04)	0.12** (0.04)	0.12** (0.04)	0.12** (0.04)
Option gain	-	−0.02 (0.08)	−0.02 (0.09)	-	−0.06 (0.09)
Stock high	-	−0.40 (0.46)	−0.24 (0.48)	−0.45 (0.60)	−0.42 (0.51
Stock low	-	1.66* (0.68)	1.57* (0.69)	1.69* (0.78)	1.79* (0.75)
Stock trend	-	2.34 (2.64)	2.07 (2.70)	2.44 (2.81)	1.72 (2.98)
Tax	-	0.34 (0.43)	0.32 (0.43)	0.34 (0.41)	0.39 (0.45)
Total gain (log)	-	-	-	−0.01 (0.03)	-
Year dummies	No	No	Yes	No	No
n	864	864	864	862	580
Number of groups	-	-	-	-	106
Pseudo r^2	0.06	0.20	0.21	0.25	-
LR chi^2/Wald chi^2	103.56***	365.46***	370.01***	450.14***	26.14*
ICC	-	-	-	-	0.02

Note: * = significant at 0.05; ** = significant at 0.01; *** = significant at 0.001.
[a]Base category is exercise and sell: Take cash without exercise results are not shown.

4.2 | Marginal effects

To facilitate interpretation of effect sizes, we calculate marginal effects relating to the probability of a change in the outcome variable arising from the first derivative of an instantaneous change in value. Because of scaling differences between variables, caution is required in interpreting effect sizes between variables. In Table 4, the first column reports average marginal effects while the second reports marginal effects for each variable of interest with all other variables held at their means. As would be expected, there is little difference between them.

The pattern of marginal effects is similar to the results reported earlier in Table 3. As before, significant results are obtained for risk preferences and the stock price low. It is notable that option gain has almost zero effect (at two decimal places) while the other stock variables are somewhat larger. In the third and fourth columns of Table 4, we report the predicted probabilities of buy and hold (relative to buy and sell) at the 5th and 95th percentile of each variable. As can be seen, the predicted probability of exercise and hold varies hardly at all (between 69 and 73%) across the range of *Option gain* from just over half through to nearly four and a half times the grant price. It is a similar story for *Stock trend* and *Stock high*, where the difference in

probability across the range of values is slightly larger at 5–6%. By contrast, predicted probabilities of exercise and hold range more widely across the range of risk preferences and stock price lows (from 59 to 78%, and 64 to 78%, respectively).

To provide an illustrative demonstration of these results we plot the effects of *Option gain* and *Risk preferences* on the predicted probability of taking the gamble—exercise and hold—compared with the safer choice of exercise and sell.[11] As can be seen in Figure 1, there is little variation in effect size of option gain whereas the effects of different values of *Risk preferences* are more marked.

Overall, these further results affirm the regression results reported earlier: Hypothesis H1–Hypothesis H3, which refer to the posited effects of various measures of stock price movements on the likelihood of taking a gamble by exercising and holding stock, are not supported. However, Hypothesis H4, relating to the potential impact of recent stock price lows on exercise choices, is supported. Likewise, Hypothesis H5, which proposes that risk preferences will be related to the exercise choice, is supported in the direction predicted.

An obvious issue is whether the various stock price variables and individual risk preferences moderate each other. For instance, do the effects of *Option gain* vary according to the level of *Risk preference*?

TABLE 4 Influences on the exercise decision: Marginal effects and predicted probabilities

	Average marginal effects	Marginal effects at means	Predicted probability (%) of buy and hold at 5th percentile	Predicted probability (%) of buy and hold at 95th percentile
Option gain (H1)	−0.01	−0.01	73	69
Stock trend (H2)	0.41	0.43	68	74
Stock high (H3)	−0.07	−0.07	72	67
Stock low (H4)	0.33**	0.34**	64	78
Risk preferences (H5)	0.02**	0.02**	59	78

Note: ** = significant at 0.01.

Two particular suppositions lay behind this. One is the argument in the "mixed gambles" perspective that the potential for future stock price rises (*Stock trend*) attenuates the effects of past price rises (*Option gain*). The other is that individual characteristics such as risk preferences might be associated with variations in individual reactions to particular levels of price movements. We therefore tested for interaction effects between all of these key variables. The estimates (not shown) do not generate any significant moderation results (at $p < 0.05$). Stock price movements other than the depth of recent stock lows continue to have an insignificant relationship with the decision choice whatever the level of risk preference. There is also no evidence that the magnitude of future price rises (*Stock trend*) counteracts the posited tendency of past gains (*Option gain*) to encourage playing safe.

5 | DISCUSSION

5.1 | Summary and implications of results

Our results show that a sizeable proportion (48%) of participants in a stock option plan exercise, acquire, and retain employer stock at their plan maturity. Although consistent with some previous research (e.g., Pendleton, 2005), this finding contrasts with other research in finance (e.g., Core & Guay, 2001; Heath et al., 1999) and predictions from behavioral theory. Behavioral agency theory (Wiseman & Gomez-Mejia, 1998) suggests that option holders will endow their wealth with the realizable value of the options at exercise and will be reluctant to entertain the potential for losses of this endowed wealth. When options are "in the money," participants might be expected to prefer a certain and immediate pay-off (achieved via exercise and immediate sale) to a risky possible gain in the future. But, contrary to these predictions, the research shows that over twice as many option exercisers are prepared to gamble than those who play safe. They forego a certain gain now for an uncertain gain tomorrow. The results also show that the size of the option or total wealth gain has very little effect on the probability of buy and hold, which stays broadly constant across the range of gains.

The objective of the research was to identify the conditions under which this gamble is taken. "Mixed gambles" research (Martin et al., 2013) identified the potential for future gain (as shown by
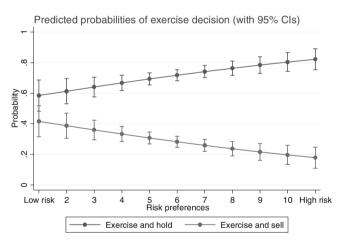

FIGURE 1 Effects of option gain and risk preferences on the predicted probability of exercise and hold

recent price movements in the market index) as a key influence, and counterbalance to the loss aversion identified in behavioral theory. We followed this approach overall but posited that option holders would be swayed more by current movements in their own company's stock than in market indices. However, we found that the current trend at the point of decision had little effect. Following work on stock reference points (Heath et al., 1999; Huddart et al., 2009), we also proposed that plan participants would compare current price to recent extreme values (reference points). The finding that stock price lows (but not highs) impact the decision choice suggests that loss aversion affects the willingness to take a gamble by acquiring and

holding stock at option exercise. It seems to heighten the perception that "what goes up may well come down."

Contrary to Martin et al. (2013), we also proposed that individual differences will affect decision-making. Their approach referred only to stock prices and situational features of decision-makers. We find that generalized risk preferences, irrespective of the objective riskiness of the specific decision, are an important individual-level factor. Those with more positive risk preferences have a higher probability of taking the risky decision. This is consistent with recent findings in behavioral finance that subjective risk attitudes are more potent than other demographic and socioeconomic attributes in explaining the degree of risk in investor portfolios (Dorn & Huberman, 2010, p. 156).

Other individual level influences do not affect the choice between holding and selling. As regards income constraints, we suspect that these are factored into the initial participation decision, given the known importance of income levels in determining stock plan participation and contribution levels (Babenko & Sen, 2014; Pendleton, 2010). This finding is also consistent with past findings from the option exercise literature, which finds little difference in the *timing* of exercises between higher paid executives and other employees (Huddart & Lang, 1996, 2003).

Financial literacy and maturity experience also do not affect the likelihood of taking a gamble. Financial literacy may well have opposing effects. On the one hand, it is associated with a greater propensity to acquire stocks (Van Rooij et al., 2011) and to participate in employer stock acquisition plans (Babenko & Sen, 2014; Englehardt & Madrian, 2004). On the other hand, those with better financial understanding might be more wary of taking a gamble in employer stock rather than securing a certain, immediate financial gain.

Overall, our results indicate that for the most part stock price movements have little impact on the choice whether to sell or hold stock at exercise (to play safe or take a gamble), with the proviso that deeper recent stock price lows (relative to current price) appear to discourage option holders from taking a gamble. Individual differences (risk preferences) are important in whether participants take a gamble. Although perhaps initially surprising, the limited role of stock price movements may be due to countervailing effects—higher stock prices may increase the perceived probability of making a gain but equally increase the threat of losing what has already been endowed into wealth. This is not to say that stock price movements are unimportant for option exercises: as the table in Table A2 shows, the level of option gain has a very important influence on whether option holders exercise or not. But conditional on exercise, its influence on the particular choice is much less important.

5.2 | Theoretical contribution

The research is notable for considering how stock prices and individual attributes explain why some participants in an employee stock option plan are prepared to substitute a certain and immediate reward with an uncertain and risky choice. This adds to a body of evidence emphasizing the role of subjective factors, such as generalized risk preferences, in influencing financial decisions (Dorn &

Huberman, 2010). It adds to the HR reward literature by considering whether and how stock prices influence employee choices within company stock plans. Even though research over many years has shown the importance of financial returns from stock ownership plans (Buchko, 1992; French, 1987; Klein, 1987; McConville et al., 2016), the HR literature on stock plans has not utilized stock price metrics and has been largely silent on the level of plan gains. Our findings indicate that variation in key decisions is a combination of individual differences and (some) stock price variations. Stock price is important for the overall option exercise process but less so for particular choices conditional on exercise. While making money is clearly an important objective for participants, how they make it (and how much) is more complex.

We also add to the recent literature on the impact of option holding on managerial decision-making (e.g., Devers et al., 2007; Sanders & Hambrick, 2007) by shifting the focus to decision-making within the option plan. We are also to able to widen the focus on top executives found in much of the options literature to employees as a whole. Although not a central objective of the article, we find little difference in decision-making and the propensity to take a gamble between those at the top of organizations and those further down.

A more specific theoretical contribution relates to the "mixed gambles" revision of behavioral agency theory (Martin et al., 2013). Whereas behavioral agency theory had emphasized loss aversion in relation to endowed wealth from options (Wiseman & Gomez-Mejia, 1998), "mixed gambles" argues that prospective wealth increases can counterbalance this. Our results are supportive of this contention in so far as a substantial proportion of option holders choose to hold rather than sell exercised stock. Unlike their results, this is not a function of the size of recent or current (likely future) stock price gains. Instead, our results indicate the importance of loss aversion in taking a gamble—a strong negative influence on the willingness to take a gamble is the depth of the low point in recent stock prices, presumably suggesting that future losses are more probable. Our results also emphasize the importance of individual-level characteristics (risk preferences), something on which the "mixed gambles" perspective has been mainly silent. We therefore propose that the role of human agency ought to be enhanced in this theoretical approach.

5.3 | Practical implications

Understanding the exercise decision and the influences upon it is an important issue for companies issuing options to their employees. Since companies provide stock for option exercises, either by new issues or market acquisitions, predicting the exercise decision has an important bearing on the costs of operating an option plan. While companies will not usually have access to the employee level preferences identified in our model, simple measures of risk preference might be incorporated in the surveys that many large companies now regularly conduct among their employees. Further, companies may be able to make forecasts of the likelihood of particular exercise decisions using information from recent movements in stock prices. Our results suggest that they should pay particular attention to stock price

lows in the final year before maturity and the characteristics of their workforces. In operating their stock plans, companies tend to focus on the magnitude of positive stock prices changes. Our results indicate that, while this will affect the likelihood of exercise (see Pendleton & Robinson, 2021), it has hardly any effect on the likelihood of employees becoming stockholders conditional on exercise.

More broadly, the results can help companies to understand how far their employees are prepared to become part owners of the company, and the circumstances in which they are prepared to do so. They also shed light on which employees are more likely to become stock owners, namely those with a greater appetite for risk. This understanding is especially important if one of the objectives of the option plan is to facilitate employee ownership.

5.4 | Strengths, limitations, and future research directions

A key strength of the research is that it combines stock price data and information on individual level characteristics. By combining them, we can generate deeper insights into influences on behavior in employee stock plans. The research is also a natural experiment focusing on gambles taken by employees with real wealth at stake as opposed to a lab experiment with gambles artificially constructed by researchers. Nevertheless, there are some limitations with our approach.

A key challenge is that we utilize data from various points in time. Thus, while the survey collected data during 2015, in 44% of cases the observed maturity occurred in a previous year. The challenge here is whether observed employee characteristics can be reliably assumed to be present at the time of the maturity. We minimize the difficulties arising from this by careful variable selection. For instance, gender will nearly always be time-invariant while factors such as risk aversion have been shown to be more or less stable over time (Schildberg-Hörisch, 2018). Some other variables can be readily adjusted to fit the time of the maturity (e.g., age). Ideally, we would observe maturities that occur simultaneously with the survey but unfortunately the *n* would be smaller. Alternatively, future surveys might be run alongside each maturity but companies may be unwilling to cooperate because of the dangers of confusing their own maturity communications.

An example of the limitation emanating from survey timing relates to sentiment. It is possible that the granting of options to employees on favorable terms generates a sense of reciprocity among some employees (Cappelli et al., 2019), which then influences exercise behavior (see Pendleton & Robinson, 2018). We have data on commitment, reciprocity, and involvement in the survey but in most cases, these were observed after the maturity, and hence we cannot be sure that they influenced the maturity decision (contrary to the findings in Caramelli & Carberry, 2014). Given this "chicken and egg" issue, we chose not to use commitment and involvement. Experimentation with them (not reported here), however, generated insignificant results in all estimations suggesting that they were probably unimportant influences on the maturity decision.

It is also arguable that wider social norms may influence exercise choices. In particular, peer pressure and "key influencers" may play a role in plan decisions (Ahrens et al., 2018; Duflo & Saez, 2002;

Oehmichen et al., 2018). Unfortunately, we could not address this issue directly but peer effects should be considered more fully in future research. More broadly, company culture may affect the propensity to acquire stock at maturity. These points to the importance of collecting data on company-level factors in addition to stock price and individual characteristics.

The analysis is limited by non-observation of existing wealth and portfolio composition at the point of maturity. Rational finance theory implies that the exercise decision will be influenced by the need to maintain diversification (Ofek & Yermack, 2000). Thus, prior holdings of company stock may lower the probability of exercising to acquire stock. However, both the stock ownership and retirement savings literatures show that stock acquisition decisions are weakly constrained by the desirability of diversification (Benartzi & Thaler, 2007; Pendleton & Robinson, 2018) so this omission may not be a deep-seated flaw in the research. Even so, the level of existing wealth may be important because it could affect the perceived risks of taking a gamble.

Finally, in common with both the Finance and "mixed gambles" literatures, we extrapolate employee perceptions and beliefs about future price movements from current or recent prices. Ideally, we would also have employee data on their expectations of future price movements (we have these at the point of survey observation but not point of option exercise), and we will include relevant questions in future surveys.

6 | CONCLUSIONS

The article has focused on factors associated with making a risky decision at stock option maturity. The main findings are that the size of the option gain between grant and exercise and the current trend at the point of decision have little effect while risk preferences and the depth of recent stock price lows do influence the choice between a safe and risky course of action.

We believe this study makes a novel contribution to our knowledge of employee behavior in stock ownership plans, and could be of considerable benefit to HR professionals and others charged with managing them. It has expanded our knowledge of factors influencing employee acquisition of company stock, most notably the (limited) role of stock price movements in the run-up to the decision. It has shed light on why some employees take a risky decision to forego an immediate and certain increase in wealth in favor of an uncertain gain in the future. Finally, it has shown the utility of a "mixed gambles" perspective on stock options and extended this to the exercise decision. In so doing, some revisions to the "mixed gambles" perspective have been recommended.

DATA AVAILABILITY STATEMENT

A reduced version of the dataset (containing the variables used in the analysis, with any identifying information removed) can be made available, along with the Stata Do file.

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ENDNOTES

[1] Martin, Gomez-Mejia, and Wiseman face the conceptual and statistical challenge of finding a metric that is different from recent movements of each CEO's company stock.

[2] A later survey indicates that 1% of those with a maturity fail to give an instruction, and hence default after 6 months to a cash payment with options canceled. The plan administrator has confirmed that this is a typical default rate.

[3] This is a pragmatic decision. Stock price data is hand-collected and matched, and is thus an onerous process. Five respondents per company seemed a reasonable trade-off between coverage and effort.

[4] Note, however, that replacing the 1-month pre-expiry gain with an alternative variable recording the gain over the life of the options does not make a material difference to the results.

[5] To log transform this negative values are changed to 0 with a constant of 0.001 added to all values.

[6] A further consideration favoring this approach is a strong correlation between a "raw" income measure and our control for tax, rendering the latter instable.

[7] $R = 0.33$ using a multi-category ordered income variable.

[8] The exemption was £10,600 in 2012 rising to £11,000 in 2015.

[9] HMRC (2018) *Estimated taxpayer numbers, gains and tax accruals by year of disposal and size of gain.* See https://www.gov.uk/government/statistics/estimated-taxpayer-numbers-gains-and-tax-accruals-by-year-of-disposal-and-size-of-gain.

[10] It is legitimate to impute only the survey variables since stock prices are drawn from a different source.

[11] Derived from Model 2 in Table 3, Figure 1 excludes the "not exercise" category to ease presentation of probabilities (so that the combined probability of the two categories of interest add to 1).

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TABLE A1   Sample selection bias analysis. Logit—Final sample relative to all those experiencing an option maturity

	Coefficients (standard errors)
Age	0.02*** (0.00)
Gender	−0.14 (0.12)
Income constraints	−0.03 (0.05)
N	1410
Pseudo R^2	0.006

Note: ** = significant at 0.01.

TABLE A2   Influences on the exercise decision: Not exercise. Mlogit coefficients (standard errors)[a]

	Main model
Gender	−0.30 (0.25)
Age	0.02 (0.01)
Experience	−0.04 (0.04)
Literacy	0.01 (0.14)
Contribution	−0.00** (0.00)
Income constraint	−0.18 (0.12)
Risk preferences	−0.06 (0.05)
Option gain	−1.24*** (0.15)
Stock high	1.35* (0.54)
Stock low	1.80* (0.86)
Stock trend	−4.52 (2.74)
Tax	−0.62 (1.12)
Total gain	-
Year dummies	No
N	864
Pseudo r^2	0.21
LR chi^2	365.46***

Note: * = significant at 0.05; ** = significant at 0.01; *** = significant at 0.001.
[a]Base category is exercise and sell. This forms part of the model presented in Table 2, Model 2.