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Effects of bonuses on diversification in delegated stock portfolio management

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A B S T R A C T

Our aim is to investigate whether bonuses make stock portfolio managers take higher risks by diversifying less. In two experiments with undergraduates role-playing being professional investors, we test a model implying that they initially anchor on 100% allocation to one of two options delivering the largest bonus payout, then adjust towards allocating equally much to each option (maximal diversification) depending on the degree of perceived uncertainty of the bonus outcome. In Experiment 1 we find as expected that when the bonus is reduced, investment in the preferred option decreases such that diversification increases. Diversification is larger when uncertainty of the bonus outcome is made salient. In Experiment 2 we show that a majority herd strengthens the effect of a bonus for investing in a preferred option despite salient uncertainty of the bonus outcome. In actual stock markets such herding effects would result from investors being similarly rewarded by bonuses.

Performance-related payments or bonuses are used by investment organizations to incentivize stock portfolio managers (Golec, 1988). An example is that bonuses are awarded conditionally on portfolios producing superior returns relative to an index. An expressed concern is that bonuses based on short time intervals push portfolio managers towards short-term goals even though their organizations (e.g. pension funds) have long-term investment horizons (e.g. Guyatt, 2008; Marginson and McAulay, 2008). In an experiment investigating this issue, Gärling et al. (2015) found that delegated stock purchases were made earlier for a short-term than for a long-term bonus such that it resulted in purchases at higher prices for the clients as well as lower bonus payouts for the traders.

Another drawback with bonuses is highlighted in other experimental research showing that bonuses not penalizing losses lead to increased risk taking (Holmen et al., 2014). For instance, Kleinlercher et al. (2014) observed that in double-auction experimental markets, a high-risk asset was traded more than a low-risk asset when bonuses not penalizing losses were paid to participants. Our aim here is to follow this up by investigating whether bonuses cause managers of stock portfolios to take higher risks by diversifying less.

We report two experiments with participation of undergraduates who are asked to role-play professional portfolio managers delegated to invest in two stocks. In the experiments a bonus payout is presented that depends on how investments are allocated. The results indicate that diversification is reduced because more is allocated to the stock that delivers a higher bonus payout (Experiment 1). We also find that making salient uncertainty about the bonus payment reduces its effect such that diversification increases. Yet, Experiment 2 shows that this is counteracted by an influence from others investing more in the stock if they are awarded the same bonuses.

In the next section we review previous research showing how risk diversification may decrease by strong preferences for individual options despite a naïve tendency
to diversify. From this we then develop the hypotheses to be tested in the experiments. Finally, the experiments are reported and their results discussed.

1. Previous research

A strong human tendency is to diversify when allocating resources. This does however not preclude that diversification is naïve. Reviewing studies covering several domains (decision analysis, managerial decision making, consumer choice), Fox and Clemen (2005) conclude that people who allocate scarce resources among a fixed set of options tend to allocate the resources evenly across all options, insufficiently adjusting according to their preferences.

In stock markets diversifying risk is generally considered a sensible strategy (Levy and Sarnat, 1970; Markowitz, 1952). Investors nevertheless often fail to diversify such that their portfolios have a preferred average risk (Baltussen and Post, 2011; Hedesström et al., 2004, 2007). A reason may be that diversification is based on the erroneous belief that any multi-asset portfolio will be well-diversified (Goetzmann and Kumar, 2008; Kroll et al., 1988). This was demonstrated by Hedesström et al. (2006) who conducted experiments in which neglect of the covariance structure among assets made diversification increase instead of decrease risk. Only through providing explicit information was naïve diversification eliminated.

In further experiments risk-averse participants tended to choose a portfolio including several specialized funds rather than one generic fund, even though choosing the latter would entail less risk (Hedesström et al., 2009). These findings are in line with the suggestion by Ayal and Zafary (2009) and Ayal et al. (2012) that the level of perceived diversity in a portfolio depends not only on how the selected investments options differ from each other but equally much on how many they are, and that this sometimes results in what they call “pseudo diversification” instead of effective diversification.

Diversification is also susceptible to framing effects (Kahneman and Tversky, 1984), that is, influences of the way options are presented. This was shown by Benartzi and Thaler (2001) who analyzed US employee pension plans and found that participants tended to use a 1/n heuristic implying that they allocate their investments evenly across all available investment options. In schemes offering a majority of stock funds most contributions were invested in stocks, while in schemes offering a majority of interest funds most contributions were instead invested in interest funds. In experiments Fox et al. (2005) demonstrated how allocations vary systematically with how options are partitioned. They also showed that strong preferences for individual options reduced susceptibility to partitioning effects. While strong preferences for investment options thus may reduce use of the 1/n heuristic, it may conversely lead to less than desired diversification. Strong preferences may arise from familiarity (Huberman, 2001) that reduces perceived risk (Heath and Tversky, 1991) and are, for instance, manifested in the tendency to invest too much in stocks from one’s home country (French and Poterba, 1991; van Nieuwerburgh and Veldkamp, 2009), in companies whose headquarters are located close to one’s home and whose CEO shares one’s ethnicity (Grinblatt and Keloharju, 2001), and in the employer’s stock (Huberman and Sengmueller, 2004). Preferences for individual investment options may also stem from endorsement by others, either by individuals perceived to be knowledgeable (Benartzi and Thaler, 2007) or by large groups of unknown investors, as evidenced by herding in stock markets (Hirshleifer and Teoh, 2003). Investors’ preferences for individual stocks are furthermore influenced by analysts’ forecasts of future company earnings (Clement and Tse, 2003; Gleason and Lee, 2003).

Why do people diversify despite apparently not knowing how? It has been suggested that people seek variety because they are uncertain about their preferences (Kahn and Lehmann, 1991; Simonson, 1990). Thus, they select a bundle of options that is likely to include the option with the highest utility instead of a single option that has the potentially highest utility. Implied by this reasoning is that diversification should decrease when uncertainty is reduced about what is preferred (Read and Loewenstein, 1995; Salisburry and Feinberg, 2010). Studies accordingly demonstrate that diversification decreases as the relative strength of preferences for individual options increases (Mitra and Lynch, 1995; Salisbury and Feinberg, 2012; van Trij et al., 1996).

In summary, previous research shows that strong preferences for individual investment options are likely to attenuate diversification while high perceived uncertainty is likely to exacerbate diversification. Since preference strength should be inversely related to uncertainty about what one prefers, perceived uncertainty has in the previous research both referred to this source of uncertainty and uncertainty about the outcome of a preferred option without any clear distinction being made. In the following we distinguish preference strength (inversely related to preference uncertainty) from outcome uncertainty.

2. Overview of experiments

In the experiments our aim is to investigate whether a bonus payout that increases preference for a single investment option counteracts diversification such that risk increases. We next derive a formal model of how preference strength and outcome uncertainty interact in determining allocations of from 100% to the preferred option to equally much to all options (maximal diversification). In this model we thus distinguish strength of preference for a single option (inversely related to preference uncertainty) from uncertainty about the outcome of the preferred option.

A robust finding is that people anchor judgments and choices on an initial value from which they subsequently make adjustments such that the initial value importantly influences the final choice (e.g. Epley and Gilovich, 2006; Mochon and Frederick, 2013; Simmons et al., 2010; Tversky and Kahneman, 1974). We propose that when one investment option is preferred, 100% is initially allocated to this option. Adjustments are then made from this anchor proportional to the degree of uncertainty about how much the option is preferred and the degree of uncertainty about its outcome. Formally, for one preferred option assuming
that no other option is preferred,

$$A_i = 100\% \left(1 - \frac{1}{n}\right) \left(P_i U_i\right),$$

where $A_i$ is allocation in percent to the preferred option $i$, $n$ ($\geq 2$) the number of options, $P_i$ the strength of preference for option $i$, and $U_i$ the uncertainty of the outcome of option $i$. Both $P$ and $U$ vary from 0 (no preference strength, no outcome uncertainty) to 1 (maximal preference strength, maximal outcome uncertainty). Allocation of 100% occurs when the option is maximally preferred and its outcome is certain. If the option is not preferred more than the other options or its outcome is maximally uncertain, equally much (100/n%) is allocated to all options.

Hypotheses derived from the formal model are tested in the experiments. In Experiment 1 preference strength is varied by offering different bonus levels for choosing one of two options, whereas perceived outcome uncertainty is varied by making salient uncertainty of the bonus outcomes. Preference strength is in Experiment 2 varied for salient outcome uncertainty by offering different bonus levels and informing about other investors’ choices.

### 3. Experiment 1

In Experiment 1 we present participants with two stocks that differ in value development over a four-year period. The value of one of the stocks (S for short-term) has a steep initial incline that later levels off, whereas the value of the other stock (L for long-term) increases slightly in the beginning followed by a steep incline towards the end. Participants are asked in their hypothetical role of stock portfolio manager employed by an investment organization to invest a sum of money for a client, either in one of the stocks or both. Before making their choice, they are informed about how much bonus each possible allocation would render them each of the four years. Allocations by those who have full faith in the forecasts should depend solely on preferences for size and distribution of the bonuses across the period, either preferring Stock S to obtain the largest possible initial bonus or preferring Stock L to obtain the largest possible final bonus and the largest accumulated total bonus.

In line with research on temporal discounting (Frederick et al., 2002), we found in a previous study (Hedesström et al., 2012) that in order to be preferred by investors, long-term bonuses need to be larger than short-term bonuses. The larger accumulated total bonus would accordingly make the long-term bonus more attractive such that Stock L is preferred to Stock S. We therefore expect that participants initially anchor on 100% investment in Stock L. We then reduce preference strength for this option by stepwise decreasing the bonus level for investments in Stock L relative to the bonus level for investments in Stock S. As shown in Fig. 1 (upper solid line), our first hypothesis (Hypothesis 1) is that this would linearly increase adjustments towards equal allocation (50%) to both options and thus increase diversification.

While any stock forecast is inherently uncertain, investors may not perceive them as such unless the uncertainty is salient. In one forecast condition referred to as non-salient uncertainty only point estimates are presented, whereas in another forecast condition referred to as salient uncertainty, we add confidence intervals to the point estimates to make uncertainty of the bonus outcomes become salient. When uncertainty is salient compared to non-salient, our second hypothesis (Hypothesis 2) is that, as the broken line in Fig. 1 shows, allocations to the preferred option would decrease linearly at a lower rate towards equal allocation.

#### 3.1. Method

**Participants.** Forty undergraduates (29 women) enrolled in different study programs at University of Gothenburg, Göteborg, Sweden, were recruited through sign-up sheets and electronic mails. Their mean age was 26.9 years ($SD = 10.2$). They received the equivalent of approximately US$ 15 in a flat compensation.

**Experimental design.** The experimental design was a 5 × 2 factorial design (experimental design, uncertainty condition: salient vs. non-salient) that varied over two years.

**Procedure.** When arriving at the laboratory participants were seated in separate cubicles and given a booklet to fill out at their own pace. An experimenter was present to supervise them. A session lasted for approximately 15 min.

Participants were asked to imagine being a stock portfolio manager employed by an investment organization (see the full instructions translated from Swedish presented in Appendix A). The task was to construct a portfolio by choosing how much to invest in Stock S with a larger short-term value increase and Stock L with a larger long-term and accumulated value increase, either 100%–0%, 80%–20%,
60%–40%, 40%–60%, 20%–80%, or 0%–100%. Participants had 10 million SEK (about US$1.2 million) to invest for an investment horizon of four years. No changes in allocation were allowed during this time. Participants were before making their choice shown a graph displaying each stock’s forecasted value development during the following four-year period.

On each following page in the booklet a table displayed the bonus that each of the six possible stock portfolios would generate each year according to the forecasts. Of the total increase in the portfolio’s worth each year, the proportion invested in Stock S always generated a 20% bonus, while the proportion invested in Stock L generated either a 24%, 22%, 21%, or 20% bonus. In the salient uncertainty conditions the table displayed an interval between the best-case and worst-case bonuses for each portfolio and year, and this interval grew each year compared to the preceding year.

In all experimental conditions, investments in Stock S were forecasted to generate larger bonuses in the first years than investments in Stock L, while investments in Stock L were forecasted to generate larger bonuses in the last years as well as a larger accumulated total bonus than investments in Stock S. Any allocation would each year render a bonus in excess of the previous year’s bonus. Participants were told that paid-out bonuses would be adjusted for any real-value changes over time caused by inflation. The order in which bonus levels were presented was randomized for each participant. Half of the participants received the salient uncertainty condition before the non-salient uncertainty condition and the other half in the reverse order.

3.2. Results

The main dependent measure in the following statistical analyses is how much in percent (100%, 80%, 60%, 40%, 20%, or 0%) is allocated to Stock L. A complementary dependent measure is the percent diversifying choices of both stocks (80%–20%, 60%–40%, 40%–60% or 20%–80%) that vary from 0% to 100%.

### Table 1

Percentage of Choices of Diversified Investments\(^1\) (\%), Mean (M) and Standard Deviation (Sd) of Percentage Investments in Stock L Related to Bonus Level\(^2\) in the Non-Salient Uncertainty and Salient Uncertainty Conditions (Experiment 1).

<table>
<thead>
<tr>
<th>Bonus level</th>
<th>Non-salient uncertainty</th>
<th>Salient uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% M (Sd)</td>
<td>% M (Sd)</td>
</tr>
<tr>
<td>24% vs. 20%</td>
<td>37.5 80.0 (26.7)</td>
<td>62.5 74.0 (26.9)</td>
</tr>
<tr>
<td>22% vs. 20%</td>
<td>40.0 74.5 (34.2)</td>
<td>65.0 66.0 (30.4)</td>
</tr>
<tr>
<td>20% vs. 20%</td>
<td>47.5 64.5 (36.7)</td>
<td>62.5 70.0 (29.7)</td>
</tr>
</tbody>
</table>

\(^1\) Choices of 80%–20%, 60%–40%, 40%–60% or 20%–80% in Stock L and Stock S.

\(^2\) Bonus for Stock L investment is 20%, 22% or 24%; bonus for Stock S investment is 20%.

The average percent investment was higher in Stock L than in Stock S for the 24% versus 20% bonus level. When the bonus level decreased, investments in Stock L decreased (\(M_{24%–20%} = 77.0\%, M_{22%–20%} = 70.2\%, M_{21%–20%} = 67.2\%\)) and diversification increased (\(\%_{24%–20%} = 50.0\%, \%_{22%–20%} = 52.5\%, \%_{21%–20%} = 55.0\%\)). The former was substantiated by a 3 (24% vs. 20%, 22% vs. 20%, and 20% vs. 20% bonus level) by 2 (salient vs. non-salient uncertainty) repeated-measures analysis of variance (ANOVA) yielding a significant main effect of bonus level, \(F(2, 78, \text{Greenhouse–Geisser}) = 0.99\) = 6.48, \(p = 0.003\), \(\epsilon_{\text{partial}} = 0.21\). The pairwise mean differences between bonus levels were all significant in Bonferroni-adjusted post hoc t-tests.

In the non-salient uncertainty condition compared to the salient uncertainty condition, investments in Stock L did not decrease with a decreasing bonus level. In the ANOVA on investment in Stock L, the interaction between bonus level and uncertainty was significant, \(F(2.78, \text{Greenhouse–Geisser}) = 0.93\) = 4.15, \(p = 0.022\), \(\epsilon_{\text{partial}} = 0.14\). In the non-salient uncertainty condition the linear increase with bonus level reached significance, \(F(1, 39) = 9.87, p = 0.003\), whereas it marginally failed to reach significance in the salient uncertainty condition, \(F(1, 39) = 1.84, p = 0.186\). Bonferroni-adjusted post hoc t-tests showed that the investment in Stock L was significantly larger in the non-salient than in the salient uncertainty conditions for the 24% versus 20% and 22% versus 20% bonus levels, respectively, whereas the difference for the 20% versus 20% bonus level was not significant. Diversification was significantly more prevalent in the salient uncertainty condition than in the non-salient uncertainty condition for all bonus levels, as revealed by McNemar tests of dependent percentages, \(z = 3.90 (24\% \text{ vs. } 20\%), 3.50 (22\% \text{ vs. } 20\%), \text{ and } 3.36 (20\% \text{ vs. } 20\%)\), all \(p < 0.001\), and the decrease in bonus level increased diversification only in the non-salient uncertainty condition.

3.3. Discussion

The results indicated that investments were larger in Stock L than in Stock S for the highest bonus level, hence
suggestions that Stock L as expected was initially preferred to Stock S. When decreasing the bonus level and thus presumably the preference strength, Hypothesis 1 was confirmed in that a linear decrease of investment in Stock L was observed in the non-salient uncertainty condition. In contrast, when uncertainty was salient investment in Stock L did not decrease with the decreasing bonus level. In contrast to Hypotheses 2, this should only occur for maximal uncertainty that would also result in maximal diversification (lower solid line in Fig. 1), that is 50% allocation to both options. Yet, the allocation to Stock L was larger than 50%.

4. Experiment 2

In stock markets portfolio managers tend to be similarly rewarded by bonuses. If a majority responds to the bonuses by making the same choices, it would result in clustering or herding (Hirshleifer and Teoh, 2003; Sias, 2004). It is possible then that herding strengthens the bonus effect. In Experiment 2 we investigate whether this will occur, that is, whether the participants would follow others in making investment choices.

The condition in Experiment 1 with salient uncertainty about the bonus outcomes is employed. Our hypothesis is that receiving information that a majority of others (a “herd”) invest only in Stock L (the stock with the highest bonus payout) will make participants anchor on 100% investment in this stock compared to information that a majority invests only in Stock S or no herd information. As a result diversification will be less prevalent in the condition where a majority invests only in Stock L compared to the other conditions.

4.1. Method

Participants. Another 36 undergraduates (24 women) enrolled in different study programs at University of Gothenburg were recruited through sign-up sheets and electronic mails. Their mean age was 26.6 years ($SD = 7.9$).

They received the equivalent of approximately US$ 15 in compensation.

Experimental design. The experimental design was a 2 (bonus level: 24% for Stock L and 20% for Stock S vs. 20% for both stocks) by 3 (herd information: 75% choosing only Stock S vs. 75% choosing only Stock L vs. no herd) within-groups factorial.

Procedure. The procedure was essentially the same as in the salient uncertainty condition of Experiment 1. In the herd information conditions, participants were either told that 75% of investors employed by other investment organizations had chosen only Stock L (S) while the remaining 25% had chosen both stocks (i.e., diversified) or given no information about other investors’ choices. The instructions translated from Swedish are given in Appendix B.

The same tables as in Experiment 1 displayed the worst and best possible bonuses each year. Of the total increase in the portfolio’s worth, the proportion invested in Stock S always generated a 20% bonus, while the proportion invested in Stock L generated a bonus of 24% in one of the conditions and of 20% in the other. In order to determine whether participants accurately interpret information about the bonus payout, half of the participants were asked immediately after having made their choice to indicate how large they expected their bonus to be each year given their choice.

The experimental conditions were presented in different orders across participants ensuring that each combination appeared equally often in all positions. The same bonus level or herd information never appeared consecutively.

4.2. Results

The same dependent measures are analyzed as in Experiment 1. Table 2 reports the average percentage investment in Stock L and the percentage of diversifying choices of both stocks related to herd information and bonus level.

Investment in Stock L increased for 75% choosing Stock L herd information but remained essentially unchanged for 75% choosing Stock S herd information compared to no herd information. A 2 (24% vs. 20% and 20% vs. 20% bonus level) by 3 (75% choosing only Stock S vs. 75% choosing only Stock L vs. no herd information) repeated measures ANOVA only yielded a significant main effect of herd information on investments in Stock L, $F(2, 68, Greenhouse–Geisser = 0.97) = 3.23, p = 0.046, \alpha_{\text{partial}}^2 = 0.04$. Bonferroni-adjusted t-tests showed that investment in Stock L was significantly larger for 75% choosing Stock L herd information than for 75% choosing Stock S herd information and no herd information. The latter two conditions did not differ significantly. Diversification decreased when herd information was presented, as revealed by significant McNemar tests of differences between dependent percentages comparing the 75% choosing only Stock L herd information to no herd information.

3 Clustering refers to that investors are observed to make the same choice, whereas herding implies that they imitate each other. Experiments conducted by economists (Anderson, 2001; Anderson and Holt, 1997; Celen and Kariv, 2004; Drehmann et al., 2005), as well as by psychologists (Anderson et al., 2005, 2014), demonstrate that people are likely to imitate a majority of others in making investment choices. One motive is to comply with a social norm, another motive is the belief that the investment outcome will be better.

4 A preliminary ANOVA including as between-groups factor whether or not the participants were asked to indicate the expected bonus did not yield any significant effects of this factor ($p > 0.25$).
z = 2.52, p = 0.006, and comparing the 75% choosing only Stock S herd information to no herd information, z = 2.35, p = 0.009.

No significant effects of bonus level were observed. The results also indicated that participants accurately interpreted the bonus information since 93.9% of their estimates fell inside the range bounded by the lowest and highest bonus payout, and the difference between the average estimate and the lowest bonus payout was 50.2% of the difference between the lowest and highest value.

4.3. Discussion

The results confirmed the hypothesis in showing that herd information increased investment in Stock L when the herd chose this stock compared to information that the herd chose Stock S or no herd information. An explanation is that, consistent with the results of Experiment 1, 100% allocation was initially made to Stock L that would result in a higher total bonus. Adjustments due to making salient uncertainty of the bonus (added confidence intervals) were then counteracted by 75% choosing Stock L herd information, thus resulting in more allocation to Stock L and less diversification. Adjustments of investments were not counteracted to the same degree by 75% choosing Stock S herd information, since it only reduced the strength of preference for Stock L. In this condition allocation to Stock L was therefore less such that the effect of herd information did not differ from no herd information. A slightly higher degree of diversification was still observed than when no herd information was presented.

5. General discussion

Our results are consistent with previous research (Kleinercher et al., 2014) in showing that bonuses not penalizing losses lead to higher risk taking. When a bonus favored investment in one of the options the participants diversified less, apparently placing less weight on the uncertainty inherent in the forecasts. Our study also extends previous research (e.g. Fox and Clemen, 2005) in deriving and confirming a model of how diversification is jointly determined by preference strength and outcome uncertainty. Experiment 1 thus showed that when outcome uncertainty is non-salient, choice of a preferred option decreases and diversification increases with decreasing preference strength due a decreasing bonus level. However, when uncertainty of the bonus outcome is salient and diversification as a consequence increases, no decrease of preference strength and increase of diversification with the decreasing bonus are observed. In addition, Experiment 2 showed that when outcome uncertainty is salient, choice of a preferred option increases and diversification decreases due to information that a majority of others choose the same preferred option. A proposed explanation of the different results due to salience is that a decreasing bonus whose uncertainty is salient does not influence strength of preference for an option, only the higher total bonus payout does.

The results raise two questions. First, does decreased diversification in the experiments imply more risk taking? Secondly, would professional stock portfolio managers respond similarly to bonuses? In answering the first question it should be noted that since one investment option (Stock L) is associated with a higher forecasted total bonus one may argue that more should be invested in this option. Yet, diversification was less prevalent at the highest bonus level compared to the lower bonus levels, thus indicating that risk taking depended on the bonus level. Note that while the two stocks differed in expected returns, they did not differ between the different bonus levels. Generalized to a financial setting our results would thus imply that portfolio managers take more risk because they thereby expect a larger bonus and not because it is likely to benefit the clients. One could in fact argue that the bonus makes portfolio managers ignore the uncertainty of the forecasts and therefore take too much risk, when it would be in the clients' best interest to instead hold a well-diversified portfolio. In the salient uncertainty condition the effect of bonus level was however eliminated. More was allocated to the option forecasted to yield a larger bonus, while a high degree of diversification was still preserved. This closer to optimal investment was then changed by herd information despite no information being provided that the herd had more knowledge.

We asked undergraduates without extensive knowledge of stock investments to role-play being a stock portfolio manager. A number of studies show that, as compared to lay investors or students, finance professionals are less prone although not immune to judgmental biases (Feng and Seasholes, 2005; Grinblatt et al., 2012) and herding (Sias, 2004). Therefore, caution needs to be exerted in generalizing the results to professional stock portfolio managers. Also, our experiments investigated choices between

Table 2
Percentage Choices of Diversified Investments[^1] [%, Mean (M) and Standard Deviation (SD) of Percentage Investment in Stock L Related to Herd Information and Bonus Level[^2] in the Salient Uncertainty Condition (Experiment 2).

<table>
<thead>
<tr>
<th>Bonus level</th>
<th>Herd information</th>
<th>75% investing in only Stock L</th>
<th>75% investing in only Stock S</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>24% vs. 20%</td>
<td>75% investing in only Stock L</td>
<td>75.0 ±22.2 (28.5)</td>
<td>80.6 ±5.3 (30.6)</td>
<td>88.9 ±5.4 (28.5)</td>
</tr>
<tr>
<td>20% vs. 20%</td>
<td>72.2 ±62.8 (31.0)</td>
<td>79.4 ±4.4 (31.6)</td>
<td>88.9 ±6.7 (28.5)</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>73.6 ±62.5 (27.7)</td>
<td>79.6 ±4.9 (28.1)</td>
<td>88.9 ±5.5 (25.5)</td>
<td></td>
</tr>
</tbody>
</table>

[^1]: Choices of 80%–20%, 60%–40%, 40%–60% or 20%–80% in Stock L and Stock S.
[^2]: Bonus for Stock L investment is 20% or 24%; bonus for Stock S investment is 20%.
Table A.1

<table>
<thead>
<tr>
<th>Purchase of</th>
<th>Stock A</th>
<th>Stock B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1 Bonus (SEK)</td>
<td>Year 2 Bonus (SEK)</td>
<td>Year 3 Bonus (SEK)</td>
</tr>
<tr>
<td>100%</td>
<td>100,000</td>
<td>120,000</td>
</tr>
<tr>
<td>80%</td>
<td>86,000</td>
<td>108,000</td>
</tr>
<tr>
<td>60%</td>
<td>72,000</td>
<td>96,000</td>
</tr>
<tr>
<td>40%</td>
<td>58,000</td>
<td>84,000</td>
</tr>
<tr>
<td>20%</td>
<td>44,000</td>
<td>72,000</td>
</tr>
<tr>
<td>0%</td>
<td>30,000</td>
<td>60,000</td>
</tr>
</tbody>
</table>

only two investment options. It may be asked whether diversification choices are made in the same way when there are more than two options. Some extended conceptualization may be needed to take into account the possibility that there is more than only one preferred option. Furthermore, bonuses are frequently conditional on portfolios producing superior returns relative to an index. In our experiment this is similar to awarding a bonus to the option having the highest forecasted returns, but it is uncertain whether this formal similarity is sufficient to produce the same incentive effect.

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Appendix A

A.1. Instructions in non-salient uncertainty condition for bonus 20% versus 20%

In your job as a portfolio manager for an investment organization you are delegated to purchase stocks for clients. You are paid a fixed monthly salary and a performance-related bonus paid out at the end of each year based on the value of the stocks in your portfolio relative to a market index.

The organization you work for is now developing a new bonus program and wants to know what stocks you purchase for your clients given the new type of bonus. On the following pages of the booklet you will be asked to indicate how much of two stocks (A and B) you would purchase for each of five different bonus programs being in place.

Your organization has made a forecast of how the market value of stocks A and B will develop during the next four years. Today both stocks have the same market value. The forecast is the expected market value of the stocks at the end of each year. The solid line represents stock A and the broken line stock B.

Choose now how much to invest in stock A and stock B. You have SEK 10 million to invest. When you have made this investment, you cannot change it during the next four years. This is bonus program #1 in which the bonus renders you an annual payout of 20% of the value development of both stock A and stock B. The table below shows in SEK how large your bonus will be if you choose to purchase only stock A, only stock B, or the following different percentages of stock A and stock B: 80%–20%, 60%–40%, 40%–60% or 20%–80%. The bonus payouts in Table A.1 are adjusted for inflation. You should therefore not take into account any value changes over time.

I choose to purchase:

- 100% of stock A and 0% of stock B
- 80% of stock A and 20% of stock B
- 60% of stock A and 40% of stock B
- 40% of stock A and 60% of stock B
- 20% of stock A and 80% of stock B
- 0% of stock A and 100% of stock B.

A.2. Instructions in salient uncertainty condition for bonus 24% versus 20%

In your job as a portfolio manager for an investment organization you are delegated to purchase stocks for clients. You are paid a fixed monthly salary and a performance-related bonus paid out at the end of each year.
based on the value of the stocks in your portfolio relative to a market index.

The organization you work for is now developing a new bonus program and wants to know what stocks you purchase for your clients given the new type of bonus. On the following pages of the booklet you will be asked to indicate how much of two stocks (A and B) you would purchase for each of five different bonus programs being in place.

Your organization has made a forecast of how the market value of stocks A and B will develop during the next four years. Today both stocks have the same market value. The forecast is however uncertain. The upper and lower solid lines represent the best and worst possible value development of stock A, the upper and lower broken lines the best and worst possible value development of stock B.

Choose now how much to invest in stock A and stock B. You have SEK 10 million to invest. When you have made this investment, you cannot change it during the next four years. This is bonus program #5 in which the bonus renders you an annual payout of 20% of the value development of stock A and 24% of the value development of stock B. Table A.2 shows in SEK how large your bonus will be if you choose to purchase only stock A, only stock B, or the following different percentages of stock A and stock B: 80%-20%, 60%-40%, 40%-60% or 20%-80%. The bonus payouts in the table are adjusted for inflation. You should therefore not take into account any value changes over time.

I choose to purchase:

- 100% of stock A and 0% of stock B
- 80% of stock A and 20% of stock B
- 60% of stock A and 40% of stock B
- 40% of stock A and 60% of stock B
- 20% of stock A and 80% of stock B
- 0% of stock A and 100% of stock B.

### Appendix B

#### B.1. Instructions for bonus 20% versus 20% and no herd information

In your job as a portfolio manager for an investment organization you are delegated to purchase stocks for clients. You are paid a fixed monthly salary and a performance-related bonus paid out at the end of each year based on the value of the stocks in your portfolio relative to a market index.

The organization you work for is now developing a new bonus program and wants to know what stocks you purchase for your clients given the new type of bonus. On the following pages of the booklet you will be asked to indicate how much of two stocks (A and B) you would purchase for each of two different bonus programs being in place.

Your organization has made a forecast of how the market value of stocks A and B will develop during the next four years. Today both stocks have the same market value. The forecast is however uncertain. The upper and lower solid lines represent the best and worst possible value development of stock A, the upper and lower broken lines the best and worst possible value developments of stock B. When you make the purchase you have no information about what investors employed by other investment organizations are purchasing.

Choose now how much to invest in stock A and stock B. You have SEK 10 million to invest. When you have made this investment, you cannot change it during the next four years. This is bonus program #1 in which the bonus renders you an annual payout of 20% of the value development of stocks A and B. Table B.3 shows in SEK how large your bonus will be if you choose to purchase only stock A, only stock B, or the following different percentages of stock A and stock B: 80%-20%, 60%-40%, 40%-60% or 20%-80%. The
Table A.2

<table>
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<tr>
<th>Purchase of</th>
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<th>Year 3</th>
<th>Year 4</th>
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<td>Stock A</td>
<td>Worst possible bonus (SEK)</td>
<td>Best possible bonus (SEK)</td>
<td>Worst possible bonus (SEK)</td>
<td>Best possible bonus (SEK)</td>
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<td>Worst possible bonus (SEK)</td>
<td>Best possible bonus (SEK)</td>
<td>Worst possible bonus (SEK)</td>
<td>Best possible bonus (SEK)</td>
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<tr>
<td>100% 0%</td>
<td>80,000</td>
<td>120,000</td>
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<td>160,000</td>
</tr>
<tr>
<td>80% 20%</td>
<td>66,000</td>
<td>106,000</td>
<td>68,000</td>
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<tr>
<td>60% 40%</td>
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<tr>
<td>40% 60%</td>
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<td>78,000</td>
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<td>124,000</td>
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<tr>
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<tr>
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Table B.3

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<th>Year 3</th>
<th>Year 4</th>
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</thead>
<tbody>
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<td>Stock A</td>
<td>Worst possible bonus (SEK)</td>
<td>Best possible bonus (SEK)</td>
<td>Worst possible bonus (SEK)</td>
<td>Best possible bonus (SEK)</td>
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<tr>
<td>Stock B</td>
<td>Worst possible bonus (SEK)</td>
<td>Best possible bonus (SEK)</td>
<td>Worst possible bonus (SEK)</td>
<td>Best possible bonus (SEK)</td>
</tr>
<tr>
<td>100% 0%</td>
<td>80,000</td>
<td>120,000</td>
<td>80,000</td>
<td>160,000</td>
</tr>
<tr>
<td>80% 20%</td>
<td>66,000</td>
<td>106,000</td>
<td>68,000</td>
<td>148,000</td>
</tr>
<tr>
<td>60% 40%</td>
<td>52,000</td>
<td>92,000</td>
<td>56,000</td>
<td>136,000</td>
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<td>40% 60%</td>
<td>38,000</td>
<td>78,000</td>
<td>44,000</td>
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<tr>
<td>20% 80%</td>
<td>24,000</td>
<td>64,000</td>
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<tr>
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<td>10,000</td>
<td>50,000</td>
<td>20,000</td>
<td>100,000</td>
</tr>
</tbody>
</table>

Bonus payouts in the table are adjusted for inflation. You should therefore not take into account any value changes over time.

I choose to purchase:
- 100% of stock A and 0% of stock B
- 80% of stock A and 20% of stock B
- 60% of stock A and 40% of stock B
- 40% of stock A and 60% of stock B
- 20% of stock A and 80% of stock B
- 0% of stock A and 100% of stock B.

B.2. Instructions for bonus 24% versus 20% with herd information and question about expected bonus payout

In your job as a portfolio manager for an investment organization you are delegated to purchase stocks for clients. You are paid a fixed monthly salary and a performance-related bonus paid out at the end of each year based on the value of the stocks in your portfolio relative to a market index.

The organization you work for is now developing a new bonus program and wants to know what stocks you purchase for your clients given the new type of bonus. On the following pages of the booklet you will be asked to indicate how much of two stocks (A and B) you would purchase for each of five different bonus programs being in place.

Your organization has made a forecast of how the market value of stocks A and B will develop during the next four years. Today both stocks have the same market value. The forecast is however uncertain. The upper and lower solid lines represent the best and worst possible value developments of stock A, the upper and lower broken lines the best and worst possible value developments of stock B. When you make the purchase you know that 75% investors employed by other investment organizations purchase only stock B and that the remaining 25% purchase both stocks.

Choose now how much to invest in stock A and stock B. You have SEK 10 million to invest. When you have made this investment, you cannot change it during the next four years. This is bonus program #5 in which the bonus renders you an annual payout of 20% of the value development of stock A and 24% of the value development of stock B. Table B.4 shows in SEK how large your bonus will be if you choose to purchase only stock A, only stock B, or the following different percentages of stock A and stock B: 80%–20%, 60%–40%, 40%–60% or 20%–80%. The bonus payouts in the table are adjusted for inflation. You should therefore not take into account any value changes over time.
Table B.4

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<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock A</td>
<td>Stock B</td>
<td>Worst possible bonus (SEK)</td>
<td>Best possible bonus (SEK)</td>
<td>Worst possible bonus (SEK)</td>
</tr>
<tr>
<td>100%</td>
<td>0%</td>
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<td>120,000</td>
<td>80,000</td>
</tr>
<tr>
<td>80%</td>
<td>20%</td>
<td>66,000</td>
<td>106,000</td>
<td>68,000</td>
</tr>
<tr>
<td>60%</td>
<td>40%</td>
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<td>40%</td>
<td>60%</td>
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</tr>
<tr>
<td>20%</td>
<td>80%</td>
<td>24,000</td>
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<tr>
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Table B.5

<table>
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</table>

Indicate in Table B.5 whether you choose to purchase 100% of stock A and 0% of stock B, 80% of stock A and 20% of stock B, 60% of stock A and 40% of stock B, 40% of stock A and 60% of stock B, 20% of stock A and 80% of stock B or 0% of stock A or 100% of stock B. Indicate then for the choice you make how much you think you would receive in bonus each year. Note that you cannot receive less than the worst possible bonus and not more than the best possible bonus.

References


