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Price Path Satisfaction with Buying Decisions

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1. Introduction

As an investor, trading is a key part of building your portfolio with the stocks you want. You'll likely feel satisfied as the prices of your stocks rise. This increase in stock prices is a reward for the effort and decisions you've put into selecting them, where you now bear the fruits from your labour.

A study by Grosshans and Zeisberger (2017) investigate whether investor satisfaction and investment behaviour are influenced by the price path by which the final return is achieved. They demonstrate that investor satisfaction substantially depends on the price path by which the final return is achieved. Price paths also affect returns expectation of investors in the form of short-term momentum beliefs. To answer their research question they conducted a series of experiments in which they use different paths of stock price that produce an equal final return over a fixed investment period. A so-called "Holding approach" is used in their experiment to test whether satisfaction levels and investment behaviour differ between price paths. In the "Holding Approach" participants have to imagine buying the respective stock a year ago for their own portfolio and they observe its performance after a year. Participants are given the stock at the beginning of the experiment and have to imagine holding that stock already.

This contrasts with real-world scenarios where investors typically purchase stocks. Stock investors almost never see an opportunity where stock is simply presented to them. Furthermore, receiving and holding stock may in turn introduce an endowment effect—an observed phenomenon where individuals attach additional value to goods they own simply because they belong to them (Thaler, 1980). This may induce a interplay between ownership, value and satisfaction. The combination of ownership and additional value can affect how satisfied investors feel with their investment. Belk (1988) argues that when a person is endowed with a good, it becomes part of the extended self, it is not merely an external object but becomes intertwined with their self-concept and identity. This in turn can have an effect on satisfaction, since individuals get emotional attached (Frost & Hartl, 1996).

Given these insights, a replication of Grosshans and Zeisberger's (2017) study can give an essential insight in validating and extending their findings. An important argument for replication is confirmation for reinforcing the robustness of results. Replication can help strengthen the base of empirical evidence (Block and Kuckertz, 2018). Furthermore, extending on the model, where an additional concept in integrated in to the model that mimics the original study as closely as possible, enhances the explanatory power of the original model (Woodside, 2016).

This approach follows the latter, where an additional component to the original experimental design is introduced. Introducing a "Buying Approach" that captures a more realistic approach. Grosshans and Zeisberger (2017), referred to as GZ, use a "Holding Approach" in their experiment, where participants have to imagine buying the respective stock a year ago for their own portfolio and they observe its performance after a year. This paper investigates whether investors report different satisfaction levels and investment behaviour when freedom of choice to make their own buying decisions is present. To answer this research question an experiment with similar price paths are used compared to GZ. The different price paths of stock prices produce equal final returns over a fixed investment period. For this study, a "Buying Approach" is added to test if participants report different satisfaction levels and trading behaviour compared to the "Holding Approach". The "Buying Approach" gives participants the opportunity to make their own buying decisions when buying stock.

Adding a buying opportunity may result in different perceived satisfaction levels and different trading behaviour. Choice is an important aspect for many individuals. Social psychologists argue that human needs constitute a source of the intrinsic value of power and autonomy (Bartling, Fehr and Herz, 2005).

Over the years, there have been vigorous debates about freedom of choice (Sunstein, 2014). Choice is an extraordinary benefit to have. Nussbaum (2000) emphasizes that the freedom of choice is important for a person's quality of life. "The central capabilities are not just instrumental for further pursuits: they are held to have value in themselves, in making the life that includes them fully human" (Nussbaum (2000, p. 74)). Bartling, Fehr and Herz (2005) confirm that individuals assign a positive intrinsic value to decision rights and that individuals have a stable preference for having control in most situations. It might also be objected that on grounds of both welfare and autonomy, active choosing is desirable even if people have a tendency to make errors (Sunstein, 2014).

Everyone that has made an important decision knows that emotions can play a role. The emotion one can experience while making a choice, shape decisions but also anticipate emotions about future consequences (Mellers, 2000). This anticipate emotion can manipulate beliefs in a self-serving way (Zimmermann, 2020). One of the most prominent consequences of these beliefs is for example overconfidence. People want to believe that they are able or skilled for the decisions they make. For instance, due to motivational reasons (Bénabou and Tirole, 2002) or ego-utility (Kőszegi, 2006). People have a tendency to deceive themselves to achieve such beliefs. Bénabou and Tirole (2016) offer a conceptual framework thinking about motivated beliefs. People use their beliefs to give their immediate actions a boost (e.g. Am I able to make profit here?). There is a certain motivation for individuals to distort their interpretation of information and help support their ability to persevere and succeed. However, when these motivated beliefs do not reflect reality, reality will hit hard. In this experiment, this could mean that investors overvalue their ability to make a gain when making purchasing decisions. When such an gain is not realized, emotions can cloud their judgement and frustration might come into play. Such that satisfaction can dramatically differ from when investors do not have to make their own decisions and are given stock ("Holding Approach"). To strengthen this claim, some argue that choice is not always an extraordinary benefit to have.

Choice can also be an immense burden (Sunstein, 2014). Sometimes people want other people to choose for them. A well-known concept is the disposition effect, where investors have a greater propensity to sell assets when they are at a gain than when they are at a loss (Shefrin and Statman, 1985). However, the disposition effect is reversed in mutual funds, as investors in a mutual fund have a greater propensity to sell losers funds compared to winning funds (Friend, Blume, and Crockett, 1970). Chang et al. (2016) examines the cognitive dissonance, where cognitive dissonance can generate a disposition effect in nondelegated assets like stocks, but a reverse disposition effect in delegated assets such as mutual funds. An important difference is where the decision-making authority has been ceded to an outside agent. For these delegated assets, where they had no hand in, investors can resolve the disutility of realized losses by scapegoating or blaming the manager (Chang, Solomon, and Westerfield, 2016). The asset is delegated, the investor can simply blame the fund manager for the poor performance and won't have to admit his or her own mistakes. The idea here is that investors do not like to admit that they were wrong and will blame someone else to avoid admitting a mistake if they can. There is a possibility that there is an in- or decrease in satisfaction levels when simply the "holding approach" can be blamed. Where investors were given stocks and had no control over the outcome.

Grosshans and Zeisberger (2017) demonstrate that investor satisfaction heavily depends on the price of the assets, the path a stock price takes. Investors are most satisfied if their asset first fall in value and then recovers, and they are least satisfied with the opposite pattern. Given this experiment is using a "holding approach", this paper is interested in whether these satisfaction levels significantly change when complementing the "holding approach" with an "buying approach". As described above, there is some validity in believing a discrepancy exists in satisfaction levels between receiving the asset and buying the asset, where in the former investors have to make their own decisions.

This study, therefore, seeks to bridge the gap between experimental settings and real-life investment scenarios. This follow-up research will offer a richer understanding of how price paths influence investor decisions and satisfaction, further contributing to the field of behavioural finance. Investigating investors reported satisfaction when making their own buying decisions. It is expected that there is a significant difference in satisfaction levels between investors in the "holding approach" compared to investors in the "buying approach". Equally as interesting, is the question whether price paths affect trading behaviour. Where participants in the "Buying Approach" exhibit different trading behaviour compared to the "Holding Approach".

The results demonstrate that investors satisfaction in the "Buying Approach" does not differ from the reported satisfaction in the "Holding Approach". Overall, participants in both treatments are most satisfied when their assets first fall in value and then recovers. However, there is no significant difference between the "Buying Approach" and "Holding Approach" for any price path. Furthermore, a significant difference exists between the reported trading behaviour of both treatments, where the "Buying Approach" has a stronger preference for selling their asset. Participants have a stronger preference for selling their asset when shown a "Up-Down" price path. The opposite is true for the "Buying Approach", investors have a lower tendency to sell their asset compared to the "Holding Approach".

2. Experimental Procedure

2.1 Stock Price Paths

The underlying idea of Grosshans and Zeisberger (2017) experiment is testing whether a stock's price path affect investor satisfaction and investment behaviour. GZ test this hypothesis by using three characteristic stock price developments. These stock price developments, all with their own price path, are called "Down-Up", "Straight" and "Up-Down". These three development suggest the path they follow. "Down-Up" represents a stock development that shows a decrease in price but recovers afterwards. Analogously, "Up-Down" represents a stock development that shows an increase in price but decreases afterwards. "Straight" is a bit different, where it represents a quasi-monotonic stock price development. A development that has no profound peaks or troughs. These three characteristic stock price developments are presented in Graph 1.

Grosshans and Zeisberger (2017) simulated these price paths with 2520 ticks plotted on a time axes back one year from today. These ticks correspond to the 252 trading days in a year, where 10 ticks a day are used to make the price paths look as realistic as possible. This experiment will use the price paths simulated by GZ to keep deviation to a minimum. Each of these three simulated price paths is combined with an overall return of +10% ("Winner Stock") or an overall return of -10% ("Loser Stock"). With a minimum trough or maximum peak of -/+30% in the non-straight price paths. These troughs or peaks occur after seven months to guarantee that the sloped before and after the turning point are not to different. GZ used an initial stock price between 53 and 82 monetary units.

Graph 1: Price paths for winner stocks.

The price paths in this experiment will not be altered and are kept the same as the GZ price paths (Graph 1). However, the initial stock price and the overall return are slightly altered. This experiment will use an initial stock price of 50 monetary units and an overall return of +20%, meaning the stock price, after one year, will increase to 60 monetary units. This change was introduced to (I) introduce a meaningful and implementable buying option in the online environment and (II) deals as an additional robustness check to GZ. As illustrated in Graph 1, “Down-Up”, “Straight” and “Up-Down” price paths are similar to that of GZ. A change was made in the Y-Axis, where the initial price now starts at 50 monetary units and after one year increases to 60 monetary units, with an overall return of +20%. Loser stock is not included in this experiment, participants will only be presented with winner stocks. Table 1, shows one of three price paths participants can be presented with. The exclusion of loser stock is due to budget constraints, where priority is given to more participants in the winner stock treatment.

Treatment	**Return Type**	**Value**	**Graph Observed (1 of 3)**
Holding group	Positive	+20%	Up-Down/Straight/Down-up
Buying group	Positive	+20%	Up-Down/Straight/Down-up

Table 1: Treatments and possible price paths

2.2 Experimental Design

2.2.1 Experimental treatments

This experiment consists of two treatments, namely the “Holding Approach” and the “Buying Approach”. In the baseline experiment, participants are presented with the “Holding Approach”, which is similar to the experiment of GZ. Where participants have to imagine that they had bought that stock one year ago and are now observing its performance over that year. These investors are randomly presented with a price development of one stock out of three stocks. Participants have an equal chance of receiving one out of three price paths leading to a +20% gain, namely “Down-Up”, “Up-Down”” or “Straight” (Figure 1).

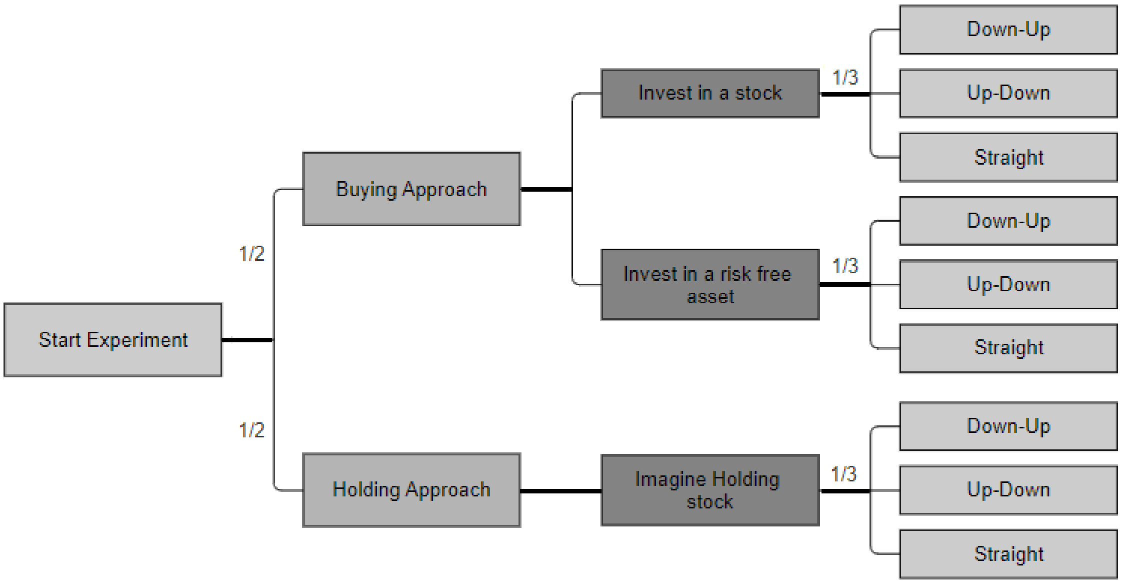

Figure 1: Experiment structure[1]

For the “Buying Approach”, a similar design will be implemented, where participants are randomly presented with a price development of one stock out of three stocks (Figure 1). However, in the “Buying Approach” participants are asked to allocate endowment between a risk asset, offering either a positive expected return or a negative expected return (Appendix A), and a riskless asset that offers no return. To reduce complexity, a simple endowment allocation is implemented, where investors can purchase only one stock. Investors are given 50 MU to either invest in a stock with a price of 50 MU or a riskless asset with a price of 50 MU. Offering more monetary units, option of buying multiple stocks, can initiate a feeling of regret, which adds a

[1] Participants are equally distributed in the buying or holding treatment. Participants are faced with either; a buying opportunity or a holding approach. Depending on the treatment, investors are presented with 1 out of 3 price paths.

layer of complexity. This layer of complexity adds noise to the comparison of the "Holding Approach" and "Buying Approach", thus to reduce noise participants are offered a one risky asset or one riskless asset. Furthermore, only participants whom decided to buy the stock are compared to the "Holding Approach". Participants who decided to buy a risk free asset face a payoff that is not equal to that of the "Holding Approach". It is important that the payoff is kept equal for a fair comparison between treatments. Only investors who allocate all MU to buy one stock will be compared to the "Holding Approach", where investors are given one stock with a value of 50 MU. Participants that allocate their endowment to the risk free asset will still be presented one of three price paths (Figure 1). Buyer's remorse can be induced after seeing a gain could have been made. Participants will be asked if they regret not buying the stock, after being presented with a price path.

2.2.2 Experimental Procedure

Both treatments (For the "Buying Approach" only participants who invest in a risky asset) are shown one of three price paths, illustrated in Graph 1. After buying or holding the stock for a fictional year, a sell order is executed in both treatments. A sell order is executed to make the "Buying Approach" comparable to the "Holding Approach". After seeing the performance of one stock, participants are asked how satisfied they are with the performance of presented stock.

Satisfaction is measured by a 9-point Likert scale from "Very unsatisfied" to "Very Satisfied" (Appendix A). Reported satisfaction on a 9-point Likert scale ranges from -4 to +4, where 0 is a neutral evaluation of satisfaction. "Very unsatisfied" indicates a satisfaction of -4, vice versa "Very satisfied" indicates a satisfaction of +4. Investors were asked to report if they rather would have held the stock or would have sold it[2] . A 4-point Likert scale ranging from "Very likely hold stock" to "Very likely sell stock" is used to capture investor preference (Appendix A). Where 0 indicates "Very likely hold stock" and 4 indicates "Very likely sell stock". Participants allocating their endowment in a risk free asset were asked if they felt regret after seeing the stock development. Regret was measured by a 5-point Likert scale ranging from "No Regret" to "Regret. Furthermore, participants were asked how likely they would buy this stock. Using a similar 4-point Likert scale, from "not very likely" to "very likely". At the end of the experiment participants had to answered some control questions. These are socio-demographic question, such as age, gender, mood and investment experience.

[2] A sell order is executed for the Buying Approach and Holding Approach, the asset is sold after one year to make both treatments comparable.

2.3 Participants and Incentives

The data is collected via an online experiment using Qualtrics, an online survey software. The Qualtrics survey is distributed via Amazon Mechanical Turk (MTurk), this is an online platform that allows participants to fill out academic surveys in exchange for money. MTurk is a widely accepted recruiting platform for economic experiments. GZ conducted their experiment between spring 2014 and spring 2016 and recruited their participants on MTurk, for consistency and comparability[3]. All data will be collected via MTurk, 350 participants were recruited for this experiment. A goal was set to achieve around 150 participants per treatment ("Buying and Holding Approach"), meaning 50 usable data point per price path ("Down-Up", "Up-Down" and "Straight"). To achieve this goal, 300 usable surveys were necessary. To compensate for unusable surveys (e.g. participants who rushed the survey), 50 additional surveys were added to ensure our goal of 300 usable surveys. GZ used a subject pool of 144 MTurk participants, to generate a similar amount in each treatment, around 150 participants per treatment are required.

MTurk participants were paid a compensation of $0.10 for participating in this experiment. This was a fixed payment participants receive for completing the survey. Participants also received a bonus payment based on the outcome of their stock. They received instructions stating a bonus payment could be earned based on their decisions and the outcome of the stock development. A bonus payment was added to create a buying opportunity in this setup. Investors now have an incentive to invest, since purchasing stock could lead to potential gain and therefore a higher payment. Every 10 monetary units have a value of $0.01, meaning the initial stock price has a value of $0.05. The winner stock used increases to 60 monetary units after one year, increasing to a value of $0.06. As mentioned before, the payoffs must be equal in both treatments. In both the "Holding Approach" and "Buying Approach" this gain could be made. Participants were informed that their payments consists of two parts and that they can earn an additional payment based on stock price developments. The fixed payment of $0.10 were handled automatically by the Amazon Payment system. The bonus payments were awarded after completion of the survey and send from the requester to worker via the SendBonus operation.

[3] MTurk has a matching demographic and a broad user base. The participant pool is kept the same as in the GZ paper.

3. Results

3.1 Satisfaction

Looking at the results of the baseline experiment (Figure 2), a noticeable difference is visible, where the “Buying Approach” reports a lower overall satisfaction. Investors in the “Holding Approach” report almost identical satisfaction for the “Down-Up” and “Up-Down” price path and a lower satisfaction for the “Straight” price path. These results are not in line with GZ (Table 2), participants, in the GZ experiment, report lower satisfaction means in the winner stocks. Reported satisfaction for “Down-Up” is +2.06, “Up-Down” +0.25 and “Straight” +1.40 (Table 2). An possible explanation for this phenomenon is the return investors received in both experiments. This experiment offers participants a return of +20% and in the experiment conducted by GZ a return of +10% was awarded, an higher satisfaction is reported due to higher returns. Furthermore, GZ report a large satisfaction gap between “Down-Up” and “Up-Down”, whereas it is non-existent in this experiment. The “Buying Approach” is more in line with the baseline experiment of GS, where “Up-Down” receives a lower satisfaction compared to the “Down-Up” price path.

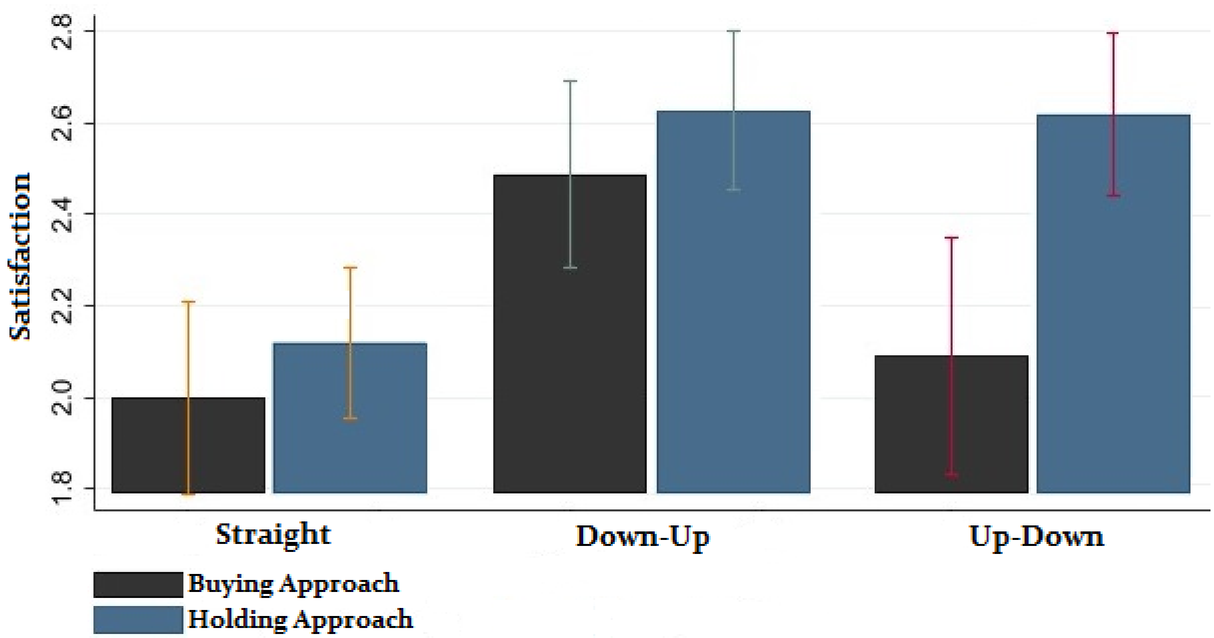

Figure 2: Means of reported Satisfaction for both treatments, reported on a 9-point Liker scale ranging from -4 to +4, 0 indicating a neutral evaluation. Standard errors are depicted by the bars.

A total of 306 participants took part in the experiment. 22 participants in the buying treatment (Buying Approach) preferred the risk free asset over the risky asset. These participants were excluded from the results, leaving us with a total of 284 participants[4] (Table 2).

Reported Satisfaction

Satisfaction	Obs	Mean	GZ
"Buying Approach"			
Down-Up	45	2.488	
		(1.334)	
Up-Down	45	2.09	
		(1.709)	
Straight	44	1.977	
		(1.372	
"Holding Approach"			
Down-Up	51	2.66	2.06
		(1.255)	(0.11)
Up-Down	50	2.653	0.25
		(1.284)	(0.17)
Straight	49	2.14	1.40
		(1.195)	(0.17)

Table 2: Descriptive statistics of the means of reported satisfaction for both treatments. GZ satisfaction means are included. Standard errors are reported in parentheses.

To test whether the reported satisfaction significantly differs in the buying treatment from the holding treatment an OLS regression is estimated with the following model:

$$Satisfaction = \alpha + \beta * Buy\ treatment + \beta * DownUp + \beta * UpDown + \beta * Buy * downup\ \beta * Buy * updown$$

In addition to an OLS regression, a ordered probit regression will be estimated. Categorical data is used to investigate a difference in reported satisfaction, using a Likert Scale. The same model is used to estimate the dependent variable, where the dependent variable is reported satisfaction. The independent variable included is a dummy variable of the buying and holding treatment, with the holding treatment as the reference group. Furthermore, three price paths are added to test whether a significant difference exists between the price paths. The "Straight" price path is used as the reference group. "Straight" shows us the lowest reported satisfaction in both group and are somewhat similar in both treatments. A interaction term is included between the buying treatment

[4] A total of 150 participants in the Holding Approach and 134 participants in the Buying Approach

and the price paths, testing whether a price path is significantly different from in buying treatment compared to the holding treatment.
Similar regressions will be run with control variables, giving us the following model:

$$Satisfaction = \alpha + \beta * Buy\ treatment + \beta * DownUp + \beta * UpDown + \beta * Buy * downup\ \beta * Buy * updown + mood + knowledge + gender + age$$

These are socio-demographic question, such as age, gender, mood and investment experience, to adjust for confounding variables. Where mood can significantly impact decision-making and behaviour. For example, a person in a positive mood might be more optimistic and willing to take risks, whereas a person in a negative mood might be more cautious. Accounting for mood can help distinguish between effects due to mood fluctuations and other variables. Financial literacy can affect how individuals interpret information, assess risks, and make decisions. Experienced investors might behave differently compared to novices. Controlling for investment experience ensures that the results are not simply reflecting differences in expertise levels.

3.1.1 OLS regressions

To statically test the difference between both treatments an OLS regression (Table 3, (I)) is estimated without control variables. Where the dependent variable is reported satisfaction**.**

Linear regression

Satisfaction	(I) Coef.	(II)
Buy	-.14	-.148
	(.284)	(.234
Price path:		
"Down-Up"	.513*	.299
	(.271)	(.225)
"Up-Down"	.281	.281
	(.272)	(.227)
Interaction:		
Buy*Down-Up	.009	.005
	(.399)	(.332)
Buy*Up-Down	-.357	-348
	(.400)	(.331)
Knowledge	.	.465***
		(.102)
Mood	.	.778***
		(.099)
Gender	.	.048
		(.145)
Age	.	-.027***
		(.0090
Constant	2.41	-2.162
		(.607)
R-squared	0.036	0.364
F-test	2.082	16.966
N	284	284

Table 3: Satisfaction OLS regression to explain satisfaction. (I) Regression estimation without control variables, (II) Regression with control variables.

The estimation results show that satisfaction is not significantly altered in the buying treatment. The holding treatment does not significantly differs from the buying treatment. Investigating whether a difference exists in the price paths, shows a marginal significant effect when comparing the "Down-Up" price path to the "Straight" price path. However, it is only significant with a p-value of 0.059, suggesting weak evidence supporting this claim. Furthermore, the interaction term between the buying treatment and different price paths, show no significance. Comparing each price path from the buying treatment to the holding treatment yields no significant difference. To exclude that the results are driven by alternative factors, control variables were added to the OLS regression. Weak evidence showing some significance in the “Down-Up” price path compared to the “Straight” is no longer present. Again, the “Buying Approach” does not significantly differ from our reference (holding treatment). The control variables see a significant effect for knowledge, mood and age. Where a higher knowledge in stock investment compared to a normal persons lead to higher reported satisfaction. Furthermore, investors in a good mood seem to report higher satisfaction levels.

3.1.2 Ordered Probit Regressions

The ordered probit regression method is intended for use when the dependent variable is *ordinal*. Since, our dependent variable is ordinal (Likert scale), an ordered probit regression is a better fit for our data to test whether a significant difference exists between the holding an buying treatment. However, we can only interpret if it falls in a lower or higher category.

Ordered probit regression

Satisfaction	(I) Coef.	(II)
Buy	-.083	-.097
	(.216)	(.220
Price path:		
"Down-Up"	.416**	.333
	(.208)	(.215)
"Up-Down"	.372*	.329
	(.209)	(.217)
Interaction:		
Buy*Down-Up	-.021	-0.053
	(.306)	(.317)
Buy*Up-Down	-.273	-354
	(.305)	(.315)
Knowledge	.	.475***
		(.100)
Mood	.	.772***
		(.099)
Gender	.	.047
		(.139)
Age	.	-.028***
		(.009)
R-squared	0.011	0.364
Chi-square	10.082	126.966
N	284	284

Table 4: Satisfaction Ordered probit regression to explain satisfaction. (I) Regression estimation without control variables, (II) Regression with control variables.

The results show us that the buy treatment report lower satisfaction than the holding treatment. Again, there is no significant difference between the holding and buying treatment. However, when investigating the different price paths, both "Down-Up" and "Up-Down" significantly differ from the "Straight" price path, where both reported satisfaction a higher satisfaction. "Down-Up" has significantly higher reported satisfaction (p-value of 0.046), whereas "Up-Down" only shows weak evidence of being significant (0.075). The interaction term tells us a similar story as the OLS regression, there is no significant difference between price paths of the buy treatment compared to the holding treatment. Adding control variables eliminates any significant effect that were present in regression (I), indicating that these effects are driven by alternate factors. Similar to the OLS regression, knowledge, mood and age are significant.

3.1.3 Interpretation

The regression analyses suggest that there is no difference in reported satisfaction between the buying treatment and holding treatment. However, different price paths do significantly influence investor satisfaction, with "Straight" as the reference group. Higher satisfaction is reported with the "Up-Down" price path and the "Down-Up" price path. This is not in line with GZ finding, where they find that "Up-Down" has a lower reported satisfaction.

Comparing price paths between the buying and holding treatments yields no significant results. There is no significant difference between the price paths of the buying treatment to that of the holding treatment. Reported satisfaction in the buying treatment is not significantly different compared to the holding treatment for any price path. The significant role of control variables like mood and knowledge highlights the importance of psychological factors and financial literacy in shaping investor satisfaction. The negative impact of age suggests that younger investors might be more satisfied with their investment outcomes, possibly due to differing risk preferences or investment horizons (Stoian et al., 2021).

3.1.4 Robustness checks

F-tests for both models are not significant at the 95% confidence for the buying vs holding treatment. However, F-tests for both price paths are significant, the "Down-up" is significant at the 95% confidence interval, whereas "Up-Down" is significant at the 90% confidence interval for the ordered probit regression. The presence of heteroskedasticity, which may indicate that there is a non-constant error variance, is tackled by using robust standard errors (Appendix B, Table 12 & 13). Regression run with robust standard errors results in similar outcomes. Since OLS regressions are run under the assumption that the dependent variable is normally distributed, non-parametric tests in the form of Mann-Whitney U tests are run to provide robustness. A Mann-Whitney U test does not assume normality and evaluates whether two samples are likely to originate from the same population. Similar to the OLS analysis, *satisfaction* is compared with the *buy or holding treatment*. This test yields a p-values of 0.1924 (Appendix B, Table 10). Using a any confidence interval, the results remain qualitatively the same.The R-squared value of both models relatively low, indicating limited explanatory power. Adding control variables helps us explain the dependent variable better, where mood and knowledge have an significant impact on reported satisfaction.

3.2 Trading behaviour

The results on reported satisfaction do not demonstrate a very pronounced price-path dependency compared to the GZ paper. Investor satisfaction itself is an interesting topic, depending on the price path with which the return was achieved. Equally as interesting, is the question whether price paths also affect investment trading behaviour. Table 5 shows a relative preferences for selling the stock for both treatments. Participants preferred having the stock sold compared to holding it. In the GZ paper the opposite is true, where a preference for holding the stock is present (Table 5). A noticeable difference in trading behaviour is present, where in this experiment participants for all price path had a strong preference for selling the stock. This discrepancy may be caused by the forced sell order that was executed in this experiment, where stock was sold after a year of observing its performance, whereas GZ let participants hold their stock.

Reported trading behavior

Variable trading	Obs	Mean	GZ
"Buying Approach"	43		
Down-Up		3.326	
		(0.715)	
Up-Down	44	3.45	
		(.719)	
Straight	44	3.25	
		(.615)	
"Holding Approach"			
Down-Up	50	3.16	.42
		(0.71)	(0.03)
Up-Down	49	3.347	.57
		(.879)	(0.03)
Straight	50	2.98	.24
		(.937)	(0.02)

Table 5: Descriptive statistics of the means of reported trading behaviour for both treatments. GZ trading behaviour means are included (dummy propensity to sell). Standard errors are reported in parentheses.

To test if the reported trading behaviour levels significantly differs in the buying treatment from holding treatment an OLS and an Ordered probit regression will be estimated with a similar independent variables as to that of the baseline experiment:

$$Trading\ behaviour = \alpha + \beta * Buy\ treatment + \beta * DownUp + \beta * UpDown + \beta * Buy * downup\ \beta * Buy * updown$$

Similar estimation will be run with control variables, giving us the following model:

$$Trading\ behaviour = \alpha + \beta * Buy\ treatment + \beta * DownUp + \beta * UpDown + \beta * Buy * downup\ \beta * Buy * updown + mood + knowledge + gender + age$$

3.2.1 OLS Regressions

To statically test the difference between both treatments an OLS regression (Table 6) is estimated. The dependent variable is reported trading behaviour.

Linear regression

Investment Behavior	(I) Coef.	(II)	(III)
Buy	.338**	.332**	.317**
	(.162)	(.154)	(0.161)
Price Path:			
"Down-Up"	.219	.144	0.18
	(.155)	(.148)	(.154)
"Up-Down"	.406***	.333**	.367**
	(.156)	(.149)	(.155)
Interaction:			
Buy*Down-Up	-.172	-.219	-.180
	(.229)	(.219)	(.227)
Buy*Up-Down	-.435**	-.417**	-.386*
	(.229)	(.218)	(.226)
Satisfaction	.	.	.228
	.		(.158)
Mood		.264**	
		(.065)	
Knowledge	.	.130*	
		(.067)	
Gender	.	-.006	
		(.094)	
Age	.	-.008	
		(.005)	
Constant	2.941	.402	
	(.402)	(0.402)	
R-squared	0.032	0.1356	0.034
F-test	1.831	4.71	1.61
N	284	284	284

Table 6: Trading behaviour OLS regression to explain trading behaviour. (I) Regression estimation without control variables, (II) Regression with control variables, (III) Regression conditional to satisfaction. Satisfaction dummy variable is added, where 0 indicates -4 to 0 and 1 indicates +1 to +4 on the Likert scale.

The results show a significant difference between the buying treatment and holding treatment, where the buying treatment has a stronger preference for selling their asset, with a p-value of 0.039. However, there is a notable preference for selling stock regardless of the treatment (Table 5), but the effect is more pronounced in the buying treatment. The "Up-Down" price path significantly influences trading behavior compared to the "Straight" price path, leading to a higher propensity to sell their asset. The opposite is true for the interaction term, where investors in the buying treatment have a stronger preference for holding their asset. Investors have a stronger preference for holding the “Up-Down” asset compared to the holding treatment.

Significance stays consistent when adding the control variables (II) compared to the regression without controls (I). Mood and knowledge significantly impact trading behavior, highlighting psychological and financial literacy factors as having an impact on trading behavior. Furthermore, the regression analyses conditional on satisfaction show consistent significance for the buying treatment and the “Down-Up” treatment. However, it suggests that satisfaction is not significant on trading behavior, investors are not influence by how satisfied they are with their stock performance.

3.2.2 Ordered probit regressions

Ordered Probit regression

Investment Behavior	(I) Coef.	(II)	(III)
Buy	.390*	.412*	.386*
	(.233)	(.238)	(0.234)
Price Path:			
“Down-Up”	.232	.112	0.19
	(.211)	(.226)	(.222)
“Up-Down”	.604***	.516**	.567**
	(.227)	(.232)	(.228)
Interaction:			
Buy*Down-Up	-.118	-.064	-.0.099
	(.330)	(.339)	(.331)
Buy*Up-Down	-.615*	-.636**	-.565*
	(.322)	(.340)	(.333)
Satisfaction	.	.	.410*
	.		(.228)
Mood		.416**	
		(.102)	
Knowledge	.	.241**	
		(.103)	
Gender	.	-.016	
		(.145)	
Age	.	-.011	
		(.008)	
R-squared	0.015	0.0856	0.099
Chi-square	8.81	50.1	10.9
N	284	284	284

Table 7: Trading behaviour ordered probit regression to explain trading behaviour. (I) Regression estimation without control variables, (II) Regression with control variables, (III) Regression conditional to satisfaction. Satisfaction dummy variable is added, where 0 indicates -4 to 0 and 1 indicates +1 to +4 on the Likert scale.

The ordered probit regression results suggest weak evidence that the buying treatment significantly differs in trading behaviour from the holding treatment, where participants in the buying treatment have a preference for selling their stock. Again, the "Up-Down" price path significantly influences trading behaviour, with a higher likelihood of selling stock compared to the “Straight” price path and the interaction term shows a significant negative relation between the buying treatment and holding treatment for the “Up-Down” price path. The results are consistent with the OLS regression (Table 6). However, satisfaction does have an significant on trading behaviour in the ordered probit regression. Investors whom are more satisfied are more likely to sell their stock.

3.2.3 *Interpretation*

Investors have a strong preference for selling their asset, where the buying treatment has a significant stronger preference to sell their asset compared to the holding treatment. The “Up-Down” price path exhibits a strong preference for selling the asset compared to the “Straight” price path. This is in line with the results of GZ, where “Up-Down” has the lowest propensity to hold stock. Investors prefer selling their asset after seeing a “Up-Down” price development. However, when comparing the buying treatment to the holding treatment, a strong decline in the selling propensity is present for the “Up-Down” price path. Investors are less likely to sell their stock with this development compared to the holding treatment. Furthermore, satisfaction is significant in the ordered probit regression indicating a higher satisfaction leads to a higher selling propensity, a disposition effect may influence investment decisions.

3.2.4 Robustness checks

F-tests for both models are significant, the OLS regression is significant at the 95% confidence interval, a decrease to the 90% confidence interval for the ordered probit regression. As expected, the F-test for the “Up-Down” price path are significant at the 95% confidence interval for both models. The regression are run with robust standard errors, similar to the satisfaction regressions and don’t differ in a significant way compared to the normal standard errors (Appendix B, Table 15 & 16). A Mann-Whitney U test does not assume normality and evaluates whether two samples are likely to originate from the same population. Similar to the OLS analysis, *trading behavior with the buy or holding treatment*. These test yields a p-values of 0.3741 (Appendix B, Table 11). Using a any confidence interval, the results lose their significance, indicating that the distribution of the two groups are equal. Both models suffer from a low R-squared value, indicating limited explanatory power.

3.3 Risk free asset

In contrast to the participants who bought the stock, some participants bought the risk free asset. This asset granted no return and was seen as the "safe" option. However, only gains could be made in this experiment. It is interesting to test whether these participants have buyer's remorse, if they regret buying the risk free asset.

Reported Regret

Regret	Obs	Mean
"Down-Up"	7	.874
		(.364)
"Up-Down"	8	.715
		(.488)
"Straight"	7	.857
		(.378)

Table 8: Descriptive statistics of the means of regret. Standard errors are reported in parentheses.

Table 8 presents us the 22 participants whom chose the risk free asset. Regret is transformed in a dummy where, 0 is having no regrets and 1 is having regrets about their choice. As the descriptive statistics, for all treatment the mean is close to 1, meaning participants suffer from regret not buying the asset. to test whether regret is significant, a t-test is estimated and shows that regret is significant with a p-value of 0.01. This would indicate that participants suffer from buyer's remorse, where they regret buying the risky asset option.

A response from participants would be a high willingness to buy the stock after having regrets about their decision of choosing the risk free asset. This is confirmed by Table 9, where investors would likely buy the stock after seeing the presented price path. Again, a t-test is ran and is significant with a p-value of 0.011.

Trading Behaviour risk-free asset

Trading behaviour	Obs	Mean
"Down-Up"	7	3.286
		(.755)
"Up-Down"	8	3.075
		(0.517)
"Straight"	7	3.143
		(.377)

Table 9: Descriptive statistics of the means of trading behaviour risk free asset. Standard errors are reported in parentheses.

Participants, whom bought the risk-free asset, regret their choice and are willing to buy the stock after presented with a gain of 20%. However, the data sample is very small (n=22) and is not an good indicator for regret, a larger data sample is required to give a better estimation of buyer's remorse.

4. Conclusion

This study aims to replicate and extend the findings of Grosshans and Zeisberger (2017) by investigating whether investor satisfaction and trading behaviour are influenced by the price path by which the final return is achieved. In addition to a “Holding Approach” used in their paper, an “Buying Approach" is introduced. The “Buying Approach” captures a more realistic approach, where investors have to make their own buying decisions.

Investors in the “Buying Approach” do not report significantly different satisfaction levels compared to the “Holding Approach”. In fact, investors in the “Buying Approach” report lower average satisfaction levels, where a higher reported satisfaction would be expected in the “Buying Approach”. Bénabou and Tirole (2016) offer an insight where investors use their beliefs to give their immediate actions a boost, where investors overvalue their ability to make a gain. Furthermore, the self-attribution, that refers to the tendency to credit oneself and one’s own abilities excessively (Campbell & Sedikides, 1999), would suggest an boost in reported satisfaction in the “Buying Approach”. Investors over-credit themselves for receiving a positive outcome and their ability to make a gain is confirmed. However, there is no significant difference between the “Buying” and “Holding” Approach”, rejecting the hypotheses.

Comparing the results to the GZ experiment, higher overall satisfaction levels are reported in the “Holding Approach”. This phenomena may be induced by higher returns given to participants in this experiment (+10% vs. +20%). Furthermore, “Up-Down” price path reports almost a similar satisfaction compared to the “Down-Up” price path, which in not in line with the reported satisfaction found by GZ, where a satisfaction gap of 1.81 is present.

Interestingly, investors in the “Buying Approach” have a significant higher propensity to sell their asset compared to the “Holding Approach”. After a gain is realised, investors in both treatments have a higher preference for selling their asset, however this is significantly more in the “Buying Approach” compared to the “Holding Approach”. Selling assets after a gain is realised is in line with Prospect Theory and with literature on the disposition effect, where winner stock is sold to quickly and losers are likely to be held (Shefrin and Statman, 1985; Odean, 1999; Grinblatt and Keloharju, 2001). GZ finds the opposite, where participants have a relatively low willingness to sell winner stocks, a preference for holding stock is present. A possible explanation for this discrepancy might be much simpler and can be caused by a status quo effect. In the GZ paper, assets remain in their portfolio, whereas in this experiment a sell order is executed. Many people find it difficult to make decisions and tend to leave them for what it is, which is known as the status quo bias (Samuelson and Zeckhauser 1988). Similarly to GZ, a higher propensity to sell the “Up-Down” price path is present, “Up-Down” assets are more likely to be sold.

Additionally, the data revealed that regret plays a role in investment decisions. Participants investing in a risk free asset, which granted no return, report having regret not buying the risky asset. Participants who chose the risk-free asset and later observed significant stock gains reported higher levels of regret and were more likely to indicate a willingness to invest in stocks in the future. Suggesting buyer’s remorse over a lost gain, highlighting a psychological factor. However with only 22 data points, this is not an good indication for buyer’s remorse.

This study allows us to conclude that investor’ satisfaction caused by price paths with equal returns does not statistically differ when investors receive or buy the stock. In contrast, trading behaviour does significantly differ between treatments, where investors have a higher propensity to sell their asset when buying their own stock. Indicating a stronger disposition effect in the “Buying Approach”. Finally, investors whom chose the risk-free asset regret not buying the asset.

5. Discussion

There are various implications, research possibilities and application of this study. First, let’s examine how this experiment holds compared to the experiment conducted by GZ. The results do not replicate with the GZ paper for the “holding approach”. No satisfaction gap is visible for the “Down-Up” price path (2.660) and the “Up-Down” price path (2.653), whereas GZ report a satisfaction gap of 1.81. The “Buying Approach” is more in line with GZ, however “Up-Down” still reports a higher satisfaction compared to the “Straight” price path. These discrepancies may be the results of a change incentive, the winner stock in the GZ experiment yields a return of +10%, whereas in this experiment a return of +20% is awarded. The investor’ perspective has changed due to a difference in return. Another explanation, is a possible time effect, GZ conducted their experiment between the spring of 2014 and spring of 2016. This experiment is conducted 10 years later, indicating a time effect can be present. The MTurk workers pool may have changed, resulting in a change in demographic between then and now.

Trading behaviour does not correspond to the findings of GZ, where investors have higher preference for holding their stock. This does not replicate in this experiment, the opposite is true, where investors have a stronger preference for selling their asset. However, a sell order is executed and may trigger a higher propensity to sell, further research is required to test whether participants are affected by a disposition effect.

Furthermore, there are various implications limiting the application of this experiment. The applicability of this research is limited due to the small scale, for future research it is important to increase complexity for a better application in the real world. This papers considers a simple buying opportunity with two stocks[5] to reduce complexity. Such a simple exchange reduces the 'real-world' application, since stock markets are more complex and not limited to two stocks[5] (risk free asset and risky). Stock return in the 'real-world' are also much higher than the incentives given in this experiment. Incentives given in this experiment were too low to have a meaningful impact on decision-making. Every 10 monetary units have a value of $0.01, meaning the initial stock price has a value of $0.05. The winner stock used increases to 60 monetary units after one year, increasing to a value of $0.06. A monetary gain of $0.01 could be made in this experiment, this is an negligible amount for most people. Investors behave differently when is more money is at stake, a higher incentive mirrors 'real-world' investing more accurately.

By excluding the loser stock in this experiment, the replication is limited and does not strengthen the base of empirical evidence. An additional concept is integrated, however further research is necessary to understand the impact of buying decisions on satisfaction for loser stock. Explanatory power is now limited, by removing loser stock from this experiment. A model that mimics the original study as closely as possible, enhances the explanatory power of the original model.

[5] A risky asset and a risk-free asset.

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Appendix A: Experiment

Start experiment:

Dear participant,

I am a Master Student from the Radboud University in the Netherlands interested in understanding satisfaction levels in stock developments. I would greatly appreciate it if you completed this anonymous survey which will take about 2-3 minutes to complete.

Please answer the questions in the survey honestly. If you do not know an answer or are unsure, just give your best guess. I guarantee that your individual answers are anonymous, meaning that it is impossible to trace the answers back to you. We will not analyze your individual answers. Responses will be analyzed at aggregated (or group) level and we will NOT collect data that allows to identify your identity.

Confidentiality about your personal response is guaranteed. The aggregated information collected may be published in articles or academic presentations, but your personal identity or your involvement as a research subject will not be published or revealed. Participation is on a voluntary basis. Your involvement in this study is appreciated, but you may quit participation altogether at any time without receiving any penalty or prejudice. If you have any questions, please contact us via martijn.hilhorst@ru.nl.

Your payout consists of two parts. At any rate you receive a fee of $0.10 as a reward for your participation in the experiment. In addition to that you can earn an additional payment based on stock price developments during the experiment. You will obtain $0.01 per 10 Monetary units (MU).

Screenshot Holding Approach:

In the following you will be presented with one stock price development.
Please imagine that you bought the stock one year ago for your own portfolio and you now observe its performance.

The presented performance is not related to the current real world market situation.

Please take your time, imagine this was your own stock which you bought a year ago and ask yourself how you would feel when observing this performance.

Screenshot Buying Approach:

In the following you will be presented with one stock price development for the upcoming year and you observe its performance.

The current price of this stock is 50 Monetary Units and you have 50 Monetary Units (MU) to spend.

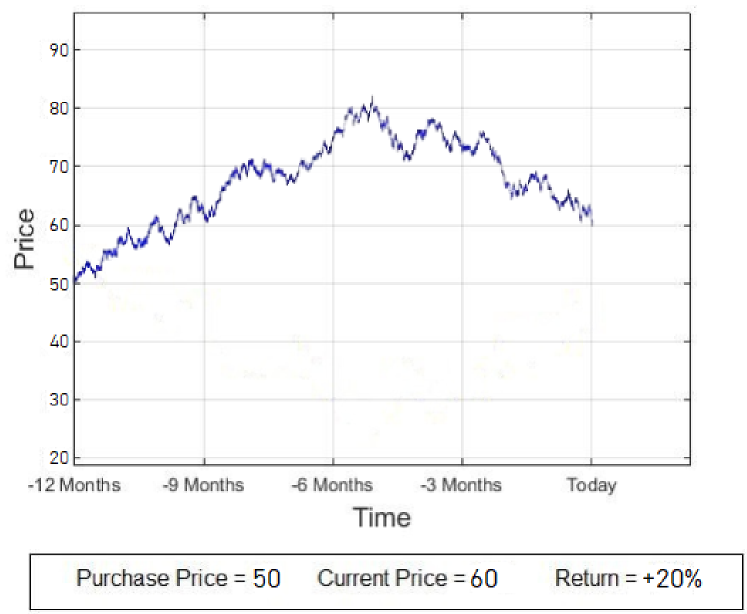
Given this: You can either invest your Monetary Units in:
1. This stock, which can lead to a positive or negative gain over the upcoming year. (Stock)
2. A risk free asset, which yields no return at all over the upcoming year. (Risk-free asset)

Please create a portfolio of the stock you wish to buy:

- ○ Buy a stock at the price of 50
- ○ Buy a risk free asset at the price of 50

→

Screenshot Price path (1/3):



After observing the performance of this stock, you decide to sell this stock for the current price of 60 MU.

How satisfied are you with the performance of your stock?

Very unsatisfied

Neutral

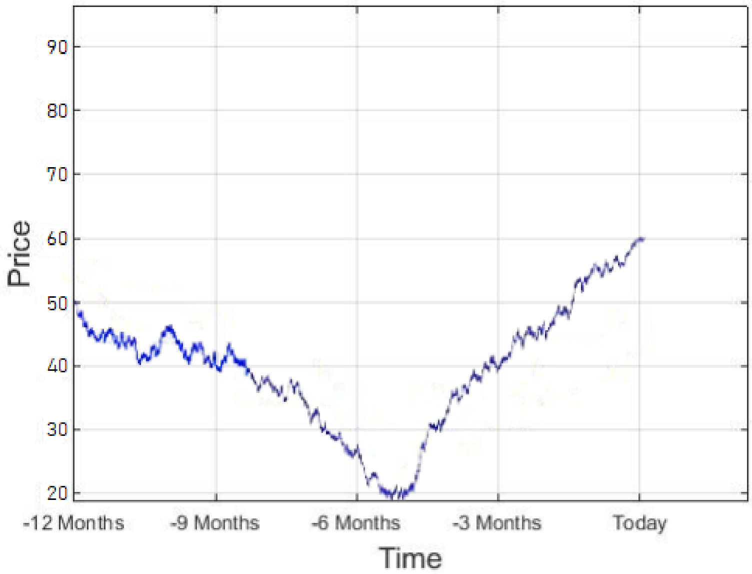
Very satisifed

Would you rather have held the stock or have it sold like here?

Very likely hold stock

Very likely sell stock

Screenshot Risk-free asset:



Purchase Price = 50	Current Price = 60	Return = +20%

The current price of the stock, you decided not to buy, is 60 MU. After seeing this:

Do you regret **not** buying this stock?

Don't regret it ○ ○ Neutral ○ ○ Regret it ○

How likely would you buy this stock?

Not very likely ○ ○ ○ Very likely ○

Questionnaire at the end of the experiment (Control)

- How do you assess your knowledge in stock investments compared to the average person? 5-point Likert scale (labels: much worse, average, much better)
- In what mood are you currently? 5-point Likert scale (labels: very bad mood, normal, very good mood)
- Your gender?
- Please enter your age

Appendix B: Robustness Checks

Two-sample Wilcoxon rank-sum (Mann-Whitney) test

Treatment	Obs	Rank sum	Expected
Holding	153	22679	21802.500
Buying	131	17791	18667.500
Combined	284	40470	40470

Unadjusted variance 476021.25
Adjustment for ties -23818.21

Adjusted variance 452203.04

H0: Satisfaction(Treatment==0) = Satisfaction(Treatment==1)
z = 1.303
Prob > z = 0.1924

Table 10: MWU test, Satisfaction by Treatment

Two-sample Wilcoxon rank-sum (Mannâ€“Whitney) test

Treatment	Obs	Rank sum	Expected
Holding	150	20531.500	21075
Buying	130	18808.500	18265
Combined	280	39340	39340

Unadjusted variance 456625.00
Adjustment for ties -82747.07

Adjusted variance 373877.93

H0: Tradingbehaviour(Treatment==0) Tradingbehaviour(Treatment==1)
z = -0.889
Prob > z = 0.3741

Table 11: MWU test, trading behaviour by Treatment

Linear regression

Satisfaction	(I) Coef.	(II)
Buy	-.14	-.152
	(.26983)	(.23817)
Price path:		
"Down-Up"	.514**	.304
	(.24393)	(.22681)
"Up-Down"	.448*	.250
	(.24842)	(.22822)
Interaction:		
Buy*Down-Up	.0088	.129
	(.33799)	(.33469)
Buy*Up-Down	-.357	-.303
	(.41501)	(.33425)
Knowledge	.	.477***
		(.09948)
Mood	.	.716***
		(.10237)
Gender	.	.066
		(.14407)
Age	.	-.026***
		(.00901)
Constant	2.14	-1,98
		(.606166)
R-squared	0.0361	0.3374
F-test	2.14	15.5
N	284	284

Table 12: OLS regression satisfaction using robust standard errors

Ordered probit regression

Satisfaction	(I) Coef.	(II)
Buy	-.083	-.099
	(.216)	(.21992)
Price path:		
"Down-Up"	.416**	.326
	(.196135)	(.21209)
"Up-Down"	.372*	.287
	(.19492)	(.21301)
Interaction:		
Buy*Down-Up	-.021	-0.069
	(.2976)	(.31308)
Buy*Up-Down	-.273	-300
	(.306749)	(.31136)
Knowledge	.	.479***
		(.09822)
Mood	.	.654***
		(.09825)
Gender	.	.062
		(.13490)
Age	.	-.027***
		(.00841)
R-squared	0.011	0.364
Chi-square	10.27	118.52
N	284	284

Table 13: Ordered Probit regression satisfaction using robust standard errors

Linear regression

Trading behaviour	(I) Coef.	(II)
Buy	.337**	.322**
	(.16004)	(.23817)
Price path:		
"Down-Up"	.218	.144
	(.16882)	(.16022)
"Up-Down"	.405***	.333*
	(.18489)	(.17852)
Interaction:		
Buy*Down-Up	-.172	-.147
	(.2201104)	(.33469)
Buy*Up-Down	-.434	-.413*
	(.23241)	(.22681)
Knowledge	.	.130**
		(.06748)
Mood	.	.2647***
		(.06737)
Gender	.	-.006
		(.10407)
Age	.	-.007
		(.0078)
Constant	2.9	1,59
	(.13567)	(.5186)
R-squared	0.0323	0.1354
F-test	1.40	4.83
N	284	284

Table 14: OLS regression Trading behaviour using robust standard errors

Linear regression

Trading behaviour	(I) Coef.	(II)
Buy	.389*	.412*
	(.2234)	(.227)
Price path:		
"Down-Up"	.232	.111
	(.223)	(.224)
"Up-Down"	.604**	.516*
	(.2643)	(.228)
Interaction:		
Buy*Down-Up	-.118	-.064
	(.223)	(.312)
Buy*Up-Down	-.604	-.636*
	(.2623)	(.251)
Knowledge	.	.240**
		(.102)
Mood	.	.468***
		(.107)
Gender	.	-.016
		(.157)
Age	.	-.011
		(.011)
Constant	2.9	1,59
	(.13567)	(.5186)
R-squared	0.0153	0.0854
Chi-Squared	7.23	41.45
N	284	284

Table 15: Ordered Probit regression Trading behaviour using robust standard errors