Essays in Behavioural and Experimental Economics

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A thesis submitted for the degree of Doctor of Philosophy in Economics

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Submitted October 2024.

Revised February 2025.

Acknowledgements

This thesis would not be possible without the support and guidance of many people in my life. Foremostly, my supervisor, Ahrash Dianat. I wholeheartedly appreciate your patience, passion, and composure through every step of my research journey. I would also express my gratitude to the Department of Economics, who have provided me with many opportunities and who also supported me through a very dark time during my postgraduate studies when I lost a close family member. For your compassion, I will always be grateful.

To my family and friends, who have provided me with laughs and encouragement. Especially my mother and grandparents, who have supported me unconditionally, and my late stepfather, who only saw the beginning of my research journey. Your toughness I still find inspiration in. It would seem incomplete to not mention my secondary school Economics teacher Mrs. Farrell, who made me realise I could, and should, be trying a bit harder.

Finally, to Cesca, you have made the last year of my studies feel much lighter and easier - for which I am so grateful.

Summary

This thesis is a Thesis by Series of papers. It covers three topics in behavioural and experimental economics: financial decision-making, the endowment effect, and risk preferences in an experimental setting.

The first paper is a novel topic that emerges from the increased availability of “Buy Now, Pay Later” (BNPL) financial services. It aims to address whether these types of loans are helpful or harmful to consumers by mimicking an online marketplace and measuring consumer welfare through late fees and bankruptcies. Our experimental results show that when BNPL is accessible, individuals could financially suffer from these consequences. These results are also exacerbated when individuals are given more autonomy in loan repayments.

The second paper seeks to add something new to the well-researched topic of the endowment effect by incorporating probabilistic ownership and tangibility into the well-known coffee mug experiment (Kahneman et al. 1990). We use the BDM mechanism (Becker et al., 1964) to measure the endowment effect. Individuals in this study appear to be unaffected by our experimental variables, however, the disparity between Buyers and Sellers, in general, when the mug is tangible, is strong.

Finally, the third paper challenges the notion that risk preferences are robust and are an immutable characteristic. Individuals participate in a version of the Gneezy and Potters (1997) investment task where the experimental environment moves from a static to a dynamic setting and also introduces insurance to cover partial losses. Our results show that risk preferences remain to be robust.

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Chapter 1

Buy Now, Pay Later

Abstract

Recent years have seen the increased availability of "Buy Now, Pay Later" (BNPL) programs across the UK, which allow individuals to smooth their consumption by delaying or otherwise spreading the cost of their payments over time with interest-free credit. At best, BNPL offers a simple and convenient way to access credit for consumers who are unable to secure credit through traditional channels. At worst, its ease of use and biased marketing can induce overspending and financial losses for consumers. However, there is little empirical evidence on the overall effects of BNPL programs on consumer behaviour and welfare. We fill this gap by conducting a laboratory experiment that mimics an online marketplace. Our treatments vary (1) the availability of BNPL and (2) the ability of borrowers to decide on the timing of payments. Our results help to inform policymakers on the optimal design of interventions and regulations in alternative credit markets.

Section 1: Introduction

Buy Now, Pay Later (BNPL) refers to interest-free instalment credit which allows consumers to defer payments entirely, or by splitting payments into multiple instalments. The providers of BNPL are usually third party, but the financial service can also offered by traditional in store or online retailers. Examples of BNPL services are shown in **Table 1**. Consumer debt in the UK is regulated by the Financial Conduct Authority (FCA) under the Consumer Credit Act 1974 (CCA). This act covers consumers' rights when borrowing, and the actions that creditors can take if payments are late or missed. The purpose is to protect consumers from unfair lending or collection practices. Long-time serving financial services such as credit cards have been subject to regulation for many decades. Currently, Buy Now, Pay Later (BNPL) is not regulated by the FCA. This is due to the main feature of its interest-free loans and therefore, meets the exemption criteria in the Financial Services and Markets Act (2000) CCA.[1] This act covers consumer's rights when borrowing, and the actions that creditors can take if payments are late or missed. The purpose is to protect consumers from unfair lending or collection practices.[2]

In this paper we conduct one of the first laboratory experiments to collect empirical evidence on BNPL to determine its effects on consumer welfare and purchasing decisions. We believe this is important because BNPL is still currently unregulated and our results could help contribute to appropriate legislation. We do this by focusing on consumer autonomy in repaying BNPL loans which is implemented in

[1] The Financial Services and Markets Act., 2000 (Regulated Activities) Order 2001 under Article 60F(C) (Available at: https://www.fca.org.uk/news/statements/fca-drives-changes-buy-now-pay-later-bnpl-firms-contract-terms).
[2] Stepchange., 2023. Consumer credit debt, *Stepchange.* (Available at: https://www.stepchange.org/debt-info/types-of-debt/consumer-credit.aspx

terms of freedom for when loans are repaid during the experiment. To measure welfare effects, we look at three measures: (1) a subject's total monetary losses caused by late fees from missing BNPL payments, (2) a subject's final monetary earnings, and (3) whether a subject went bankrupt.

Since BNPL is a financial service, we also integrate a cognitive reflection test (CRT) which measures participants' ability for problem-solving. The CRT sheds light on the role of financial literacy and how participants' understanding of these services can affect their welfare in terms of monetary gains and losses.

In our experiments, participants take part in an online shopping environment in which they have the option to purchase discounted Amazon vouchers using various payment methods. The treatments are Cash Only (CO), Buy Now, Pay Later (BNPL), and Buy Now, Pay Later+ (BNPL+) in which payment options and autonomy are varied. In all 3 treatments, participants receive a constant income and have the option to purchase the vouchers whose value increases throughout 10 rounds. The purpose of this is to incentivise participants to purchase them as soon as possible either by saving or using BNPL. In CO, participants are only able to pay in cash. In BNPL, participants have the option to use cash or a version of BNPL with a short payment period. In BNPL+, participants must only repay any borrowed amount by the end of the experiment.

To measure welfare effects, we look at the size of losses caused by the number of late fees from missing a BNPL payment, and if if they went bankrupt in each treatment. We also compare participants' decisions over each round with the most optimal path for each treatment. This includes, for example; choosing correctly when to buy or not to buy; saving, and making a purchase as soon as possible; and effectively using BNPL. By making optimal decisions, participants can maximise their

monetary gains in this experiment. The latter is important, as it enables us to consider that BNPL in some cases might be beneficial to consumers when it is used appropriately. Our results showed that when BNPL was available as a payment option, participants could be subject to late fees and bankruptcy. This is exacerbated in BNPL+ where participants are given more autonomy and suffer many more bankruptcies. On the other hand, there were few cases where BNPL+ enabled participants to increase their final earnings due to its timely advantages. In terms of CRT scoring, the results are only significant in the BNPL+ treatment.

This paper continues in the following format: Section 2 provides a review of the literature surrounding consumer debt. Sections 3 and 4 give the theoretical background under our experimental constraints. Section 5 presents our results, and finally, Section 6 provides a discussion and conclusion for the effects of BNPL and suggestions for financial legislators.

Provider	BNPL Options	Late Fees
Klarna	Pay in 30 days or, pay in 3 interest free instalments (paying the first instalment on the day of purchase).	No late fees. May be unable to use the service. Possibility of debt collection agency involvement.
ClearPay	4 fortnightly instalments.	For orders under £24, one late fee of £6. Fees capped to 25% or £36 over £24 depending on which is less. Possibility of

		debt collection agency involvement.
LayBuy	6 weekly instalments.	£6 after initial missed payment. Further £6 if missed again after 7 days. £24 maximum for aggregate missed payments. Possibility of debt collection agency involvement.
PayPal	3 monthly instalments.	£12. May affect credit score. Possibility of debt collection agency involvement.
Openpay	3-7 monthly instalments.	£7.50 after 2 days, and after 10 days. Capped to £15. Possibility of debt collection agency involvement.

Table 1: Examples of BNPL providers and their offers and missed payments process.

Section 2: Literature Review

The Woolard Review

Since 2020, BNPL is growing rapidly with 50% of UK adults having used BNPL at some point. The BNPL market is expected to grow from £22.6 billion to £44.8 billion by 2028.[3] There is currently a very limited amount of literature exploring BNPLs role in society and its effect on consumer behaviour. Insofar, as most of the available information is purely anecdotal and speculative in the form of reports by financial firms or authorities. Nonetheless, this research has been compelling enough to warrant the attention of the Financial Conduct Authority (FCA). In 2021, the FCA released a report highlighting their concerns and offered suggestions for future regulations for BNPL products in the Woolard Review.[4] Potential harm from BNPL products predominantly stems from the consumer's understanding of different offers and their presentation. Many consumers do not view BNPL as debt due to the association of interest rates and debt and view BNPL as closer to a payment technology (Google Pay etc). Finally, BNPL is usually presented as a 'new way to pay' with attention drawn to interest-free purchases. Furthermore, the Woolard Review expresses concerns that consumers' behavioural biases and heuristics may be exasperated by its presentation. Specifically, present, availability and confirmation bias are highlighted in the review. The presentation of BNPL is such that greater attention is given to benefits, the

[3] https://www.finder.com/uk/buy-now-pay-later/buy-now-pay-later-statistics
[4] Financial Conduct Authority (FCA)., 2021. The Woolard Review – A review of change and innovation in the unsecured credit market. https://www.fca.org.uk/publication/corporate/woolard-review-report.pdf

method of payment is quick and simple, and normalises consumer debt. In terms of evaluating consumers' creditworthiness, BNPL loans only require a soft credit check to be performed on the applicant. Thus, BNPL is consequently available to many consumers who are not able to obtain a credit card. A financial report by Good Shepard (2022), states that of those seeking guidance regarding BNPL; 1 in 3 applicants are women; 40% of clients are under the age of 25; and 25% are people living on lower incomes.

The FCA also reports that BNPL poses traditional concerns of consumer debt. Consumers have access to multiple BNPL providers and can take on an accumulation of debt from different retailers. Despite zero interest, consumers must still adhere to repayment schedules as late payments can result in late fees, defaults, and finally collection.

Despite the aforementioned concerns about consumer debt and the financial stability of its users, many BNPL companies argue that their products are more inclusive and fairer than credit cards. The CEO of Afterpay has said that "[their] vision around fairness and financial freedom is something we're focused on every day" which is in reference to increasing income and price gaps.[5] Aalders (2022) finds evidence that BNPL companies such as Afterpay, Klarna and Zip portray themselves and their financial product as responsible. They define their use of credit as responsible consumption as BNPL is more accessible and "fairer" than traditional forms of consumer debt.

Suggestions for future regulation of BNPL in the Woolard Review were drawn from legislative and behavioural approaches. For example, ensuring that details of late

[5] Ernest, M., 2021. How afterpay is becoming the king of 'buy now, pay later' services, *Inverse*. (Available at: https://www.inverse.com/input/style/afterpay-buy-now-pay-later-no-credit-check-clothes-sneakers-furniture-ceo-nick-molnar-interview).

payments are clear and using a neutral tone of advertisement. Although providers do offer help and advice to customers struggling with payments, it is often difficult to find. BNPLs key benefit is arguably, that when it is used responsibly, it is cheaper than other forms of credit and allows consumers to break up large purchases. Another benefit is that consumers with lower incomes who would otherwise be turned away from traditional lending methods can access credit. Thus, future regulation of BNPL would ideally honour its two key features; deferred payments, and remaining interest-free.

Consumption Smoothing & Financial Literacy

The use of high-interest, short-term credit to smooth consumption is a standard economic theory which suggests that consumer debt is countercyclical. Consumers are expected to demand credit when they experience short-term income shocks. Debt allows consumers to live beyond their current levels of consumption which can provide them access to goods or services that they could not otherwise afford. The PIH also explains that consumption smoothing is based on expectations of income. Therefore, consumers who expect higher levels of income in the future may take on debt now. Consumer debt is also beneficial in instances of making large purchases such as a car through finance. On the other hand, if the debtor does not have the means to repay the debt when it is due, then this may signal financial illiteracy or lack of financial responsibility (Gathergood, 2012).

The International Survey of Adult Financial Literacy (Organisation for Economic Co-operation and Development, 2020) defines financial literacy as “a combination of financial awareness, knowledge, skills, attitudes and behaviours necessary to make

sound financial decisions and ultimately achieve individual financial well-being." The OECD considers financial literacy as a key ingredient for the financial freedom of consumers and the stability of the world's financial system.[6] Furthermore, economic research defines financial sophistication as "an individual's understanding of financial concepts, such as asset valuation and investment fees" (Lusardi, Mitchell, and Curto, 2014). These definitions fit with the assumption that individuals have a certain capacity to understand information and formulate strategies. Thus, financial sophistication is a fundamental part of the rational decision-making process and a lack of financial understanding is a significant issue which could lead to various financial welfare losses.

Welfare losses due to lack of financial literacy usually occur through losses due to penalties such as late fees for missed payments, and high interest rates which result in the consumer owing more than initially borrowed. Ru & Schoar (2016) find that less financially sophisticated consumers may be attracted to rewards schemes that entice consumers to acquire high-interest rate cards. This can also lead to increased expenses and financial distress as consumers are encouraged to increase their usage of cards. Furthermore, although financially responsible consumers may ensure they can repay debt; the strategy in which the debtor repays debt can also signal financial illiteracy, as a less-than-optimal strategy can result in welfare losses. For example, if a consumer holds debt on multiple credit cards then the optimal strategy is to prioritise repayment to the card with the highest interest – regardless of its balance. However, the consumer may not choose or be aware of this strategy. This could not only be due to financial illiteracy but also behavioural biases and financial heuristics which are

[6] OECD., 2020, OECD/INFE 2020 International Survey of Adult Financial Literacy, *OECD. (Available at:* www.oecd.org/financial/education/launchoftheoecdinfeglobalfinancialliteracysurveyreport.html

demonstrated in many commonplace debt repayment strategies. One such strategy is the balance-matching heuristic. This heuristic describes a suboptimal credit card repayment method in which the debtor allocates repayments concerning the share of balances on different credit cards (Gathergood et al, 2019). Additional sub-optimal strategies include paying off the card with the lowest balance for a quick hit of satisfaction (Brown and Lahey, 2015).

Through empirical evidence, Deuflhard, Georgarakos, and Inderst, (2019) identify that financial illiteracy is significantly related to households' return on savings accounts. This is striking, since saving – in comparison to other investments – is relatively simple. One of the reasons behind this could be that poorer households simply have less disposable income and therefore a smaller budget to save. However, in terms of financial literacy, a possible explanation for this is that higher financial literacy enables households to select savings accounts that suit their needs. This could be through identifying higher interest rate accounts through a comparison of various banks. Furthermore, Lusardi, Mitchell, and Curto, (2014) find that financial literacy becomes increasingly important as technology advances and individuals age. Older generations appear to get left behind in the ever-growing complexity of financial instruments. Those who are less financially literate may also fall for scams or make clerical errors.

Cognitive Reflection and Decision-Making

The level of ability and speed at which an individual can reason or think abstractly to solve problems is known as their cognitive ability. In general, those who are more intelligent tend to earn more, live longer and have faster reaction times. Ultimately,

cognitive reflection is imperative to survival. Therefore, the individual's ability to reflect on their economic decision-making is arguably a key component in maximising welfare (or minimising welfare losses in the case of consumer debt) and solving their budget constraint.

Frederick (2005) introduces the Cognitive Reflection Test (CRT), whereby cognitive reflection is one's ability to reject an intuitive answer. The CRT is a simple measure of this ability, which in turn aids in predicting outcomes in behavioural and economic decision-making such as prospect theory and expected utility theory. The CRT consists of three questions which vary in difficulty. They are designed to induce an intuitive response which is often incorrect. It is then up to the individual to review their thinking and check the accuracy of their response.

The three questions proposed by Frederick (2005) as are follows:

(1) *A bat and a ball cost $1.10. The bat costs $1.00 more than the ball. How much does the ball cost? __ cents.*

(2) *If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets? __ minutes.*

(3) *In a lake, there is a path of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake? __ days.*

The results of the experiment returned three incorrect intuitive answers which dominated all other incorrect answers. These were 10, 100 and 24 respectively. Frederick also notes that in the scribbles and verbal reports of participants, the incorrect answer was often considered first. Finally, incorrect answers were also commonly submitted by participants who thought the problems were easy. The quick and intuitive responses to these problems are the same System 1 process popularised by Daniel Kahneman in 2011.[7] Although typically useful, System 1 thinking can be inherent with biases and false intuition. Those scoring high on the CRT are showing their ability to check their System 1 decision-making.

The usefulness of Frederick's CRT in predicting or analysing financial decision-making and risk preferences has been tried and tested in many papers and has also been shown to be stable over time (Stagnaro., 2018). For example, in Lind et al., (2020) the CRT is applied to the role of financial knowledge in household finance. They measure financial literacy using the Financial Management Behaviour Scale (FMBS) designed by Dew and Xiao (2011). The FMBS consists of 12 items for which participants report how often they had exhibited certain financial behaviours using a five-point Likert scale. For example, one of the items includes "Paid all your bills on time". The results showed that those with a higher CRT score had higher FMBS and numeracy scores. Furthermore, from higher numerical scores, higher CRT scores are correlated with other potentially important financial decision-making aspects. Oechssler et al., (2019) find that higher test scores on the CRT are correlated with a lower prevalence of behavioural biases such as the conjunction and conservatism fallacies.

[7] Kahneman, D., 2011. *Thinking, fast and slow.* Farrar, Straus and Giroux.

Criticisms of the CRT are investigated by Thomson and Oppenheimer (2016). One of the main considerations is that many subjects have been exposed to the CRT and this could add noise to data. The CRT questions are also confounded with numeracy which puts some subjects - who otherwise might have high cognitive capacity - at a disadvantage. Moreover, numeracy accounts for the CRTs ability to predict normative decision making (Sinayev and Peters (2015). For this reason, questions based on belief bias may be more suitable in some aspects.

Deferring Payments and Transactional Costs & Benefits

It is arguable that when a consumer considers making a purchase, the first problem they must solve is consolidating with their budget. Upon doing so, they must then weigh up the costs and benefits of the transaction to decide if the purchase is in their best interest. Often, the problem meets its conclusion here. However, research has shown that the initial purchase may be just the beginning. There is an aftermath of choices that the consumer must face after completing a financial transaction, and these choices can depend on the timing of the purchase.

Gourville and Soman, (1998) is one of the first papers to consider the effect of payment depreciation (PD). This theory is that the pain of paying decreases over time. In their experiment, consumers who purchased sports tickets over different periods are faced with attending the same event during a snowstorm. The results were that those who had bought the tickets closer to the date of the event were more likely to attend - despite both groups having the same sunk cost. This is noteworthy for the significance of the sunk cost in these circumstances. PD asserts that too much irrational attention is awarded to sunk costs and that their impact may decrease over

time. This is due to the temporal separation of one's consumption behaviour, and this effect is expected to be prevalent when costs precede benefits.

Further experiments such as Siemens, (2007) investigate the psychological response of 'buy now, pay later' transactions over various lengths of temporal delays. The results showed that transaction costs that take place after the initial benefit can be perceived as a greater loss at the time of the payment being made. However, this study is limited as the effect of the transaction on satisfaction is only measured at the time of the payment, and that the depreciation is so far associated with a linear model. This study also takes the traditional perspective of applying these findings to what consumers may experience regarding credit cards.

The most recent analysis into this topic is through Sharma and Pandey, (2020). In this study, PD is examined under short periods ranging from days to two weeks. The payment method is also varied (debit, credit, and cash). The results of the experiment show that PD is found to occur discretely, and the consumer's mental account of sunk costs drops significantly more in the longer period of two weeks. Unfortunately, the study was unable to elicit the effect of payment methods during these short intervals. The authors speculate that longer separation periods between costs and benefits would be necessary to investigate this relationship. Finally, as the experiments in this study were survey-based, it is unclear how these behaviours would translate into real life.

Summary

BNPL is a financial tool that consumers can use to smooth their consumption. This is reflected in the CAPCO 2021 consumer report in which 32% of respondents revealed

that they felt BNPL had increased their spending during the pandemic. This is despite income shocks faced by a large portion of the UK population. To put this into perspective, the unemployment rate peaked at an unprecedented 14.8% in April 2020.[8] In addition to these job losses, the UK Government provided furlough to 9 million jobs under the Coronavirus Job Retention Scheme.[9] This also means that many faced cuts to their income of up to 20%. It is unclear if the rise in the use of BNPL services was due to income shocks, or if before the pandemic BNPLs popularity was already increasing.

Despite the concerns raised by the FCA and the cross-examination of existing literature, BNPL does offer consumers some truly unique benefits. One of these benefits is the ability to return an item before the purchase has been completed. This means that consumers no longer need to wait 7-14 days to receive a refund. Furthermore, one of the most compelling benefits is the accessibility to those who otherwise cannot acquire credit. BNPL receives criticism for its soft credit checks as it enables financially unsophisticated consumers access to credit. Yet, this is arguably one of the biggest factors in increasing consumer welfare and quality of life. Deferring payments interest-free enables lower-income individuals to purchase higher-quality goods. Consider the case of the single parent who needs to buy new shoes for a child – they can now purchase a good quality pair of shoes without the risk of high-interest payments (Alem and Colmer, 2015; Zafar, Livingston, and van der Klaauw, 2014).

[8] Congressional Research Service., 2021. 'Unemployment Rates During the COVID-19 Pandemic. https://fas.org/sgp/crs/misc/R46554.pdf

[9] Office of National Statistics., 2021. Coronavirus Job Retention Scheme statistics: February 2021. https://www.gov.uk/government/statistics/coronavirusjob-retention-scheme-statistics-february-2021/coronavirus-job-retention-schemestatistics-february-2021#main-points

Financial illiteracy and the characteristics of the product provided by financial services can potentially lead to welfare losses. Specifically, poor financial planning and the reduction of transactional costs through decoupling and increased salience can lead consumers to overspend and accumulate debt.

The marketing and presentation of BNPL payment preferences exploit the decoupling and salience effects. Klarna is the current market leader and advertises itself based on its "Smoooth" transaction and application process.[10] Easing and quickening the transaction process means that consumers have less time to reconsider their purchases in comparison to other payment methods. The effect of decoupling reduces the psychological registration of making an online purchase. BNPL services do not require the consumer to enter any payment information and could therefore be exuberating this effect. These factors ultimately reduce the pain of paying by detaching consumers from their purchases and thus make it easier for them to spend money. These effects are similar to that of paying with a credit-card, rather than cash.

The lack of public knowledge regarding BNPL also raises its concerns. The 2021 CAPCO consumer report found that only 36% of consumers think of BNPL as taking on debt, even though 44% of respondents had previous experience in using this service.[11] Money's report also suggests that 18-24-year-old users of BNPL services owe £225 on average.[12] It seems evident that debt held by BNPL users is not

[10] Klarna., 2017. 'Klarna Launches "Smoooth" Brand'. https://www.klarna.com/international/press/klarna-launches-smoooth-brand

[11] Capco., 2021. 'Buy Now Pay Later: The Story so Far' https://www.capco.com/intelligence/capco-intelligence/buy-now-pay-later-the-storyso-far

[12] Haqqi, S., 2020. 'Shop Now, Stress Later: Are millennials living through 'generation debt trap'?' *Money.co.uk,* https://www.money.co.uk/guides/generationdebt-trap.

considered to be on par with other forms of consumer credit. This is a clear indicator of the lack of financial literacy of BNPL users. Another concern is identifying BNPL's true benefactors. For example, Klarna claims to benefit the consumer by offering hassle-free "Smoooth" spending. However, with regards to a report by Klarna,[13] the motivation of Klarna remains unclear as it also boasts that implementing its services will increase order value by 68% (Lusardi, Mitchell, and Curto, 2014).

Furthermore, the payment deferral enables consumers to typically defer the payment for up to 30 days. The literature suggests that this could be concerning for consumers for two main reasons: first, the consumer may experience less overall satisfaction from deferring a payment, and second, deferring the payment for a long period may reduce the likelihood of returning an unsatisfactory product (Gourville and Soman, 1998; Siemens, 2007; and Sharma and Pandey, 2020).

Section 3: Experimental Design

We use a between-subject experimental design where each subject participates in one of the following three treatments:

1. Cash Only (CO)
2. Buy Now, Pay Later (BNPL)
3. Buy Now, Pay Later+ (BNPL+)

[13] Klarna., 2020. 'Shopify + Klarna', https://www.klarna.com/assets/sites/2/2020/01/15150545/Shopify2.0_US_final_2. pdf

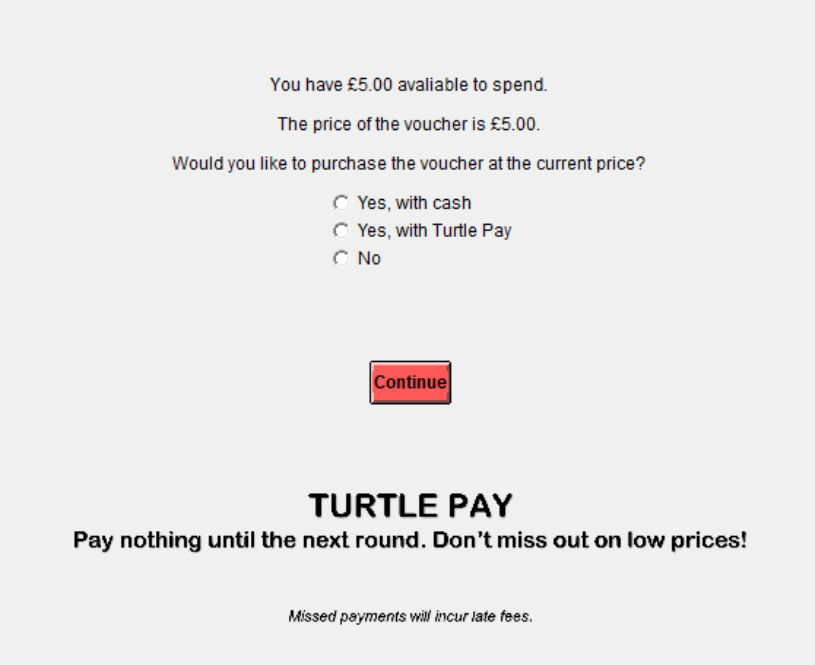

Figure 1: The subject makes their purchase and payment method decision.

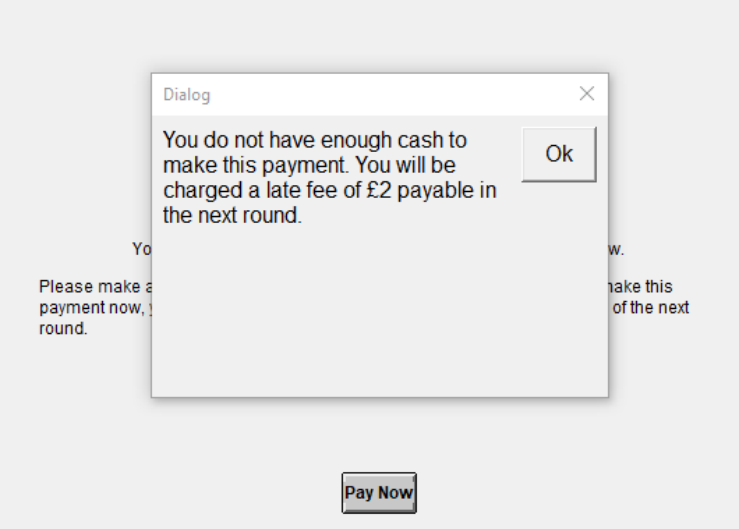

Figure 2: The subject has incurred a late payment fee in the BNPL treatment.

Each treatment consists of 10 experimental rounds where subjects make purchase and debt repayment decisions (where applicable). In the CO and BNPL treatments, each subject receives a cash endowment of £5 in Round 1. In the BNPL+ treatment subjects do not receive an initial endowment. In all treatments, each subject receives an additional £2 in each subsequent round.[14]

The product available for purchase is the same across all rounds and treatments: a £10 Amazon voucher.[15] To incentivise purchasing, the vouchers are always offered at a discount (i.e., the price is always less than £10). To incentivise purchasing in earlier rounds, we increase the price of the voucher by 50p in each round. Thus, the price of a voucher increases from £5 (in Round 1) to £9.50 (in Round 10). In each round, each subject decides whether to buy a voucher and how to finance the purchase. Each subject can purchase at most one voucher in each round. There is no scarcity of vouchers in the experiment, and so there is no competition between subjects over vouchers.

In the CO treatment, each subject can only buy a voucher using their available cash balance. This implies that a subject is unable to buy a voucher in a particular round if the price of the voucher is greater than their cash balance. In the BNPL and BNPL+ treatments, subjects can also buy a voucher using Turtle Pay, which is our experimental operationalisation of a “Buy Now, Pay Later” credit scheme.

It is imperative for our analysis in comparing the welfare effects of each treatment that subjects are able to purchase vouchers. Subjects in BNPL+ have access to credit and can “borrow” from the experimenter with the flexibility to repay by

[14] Thus, if no vouchers are purchased, subjects in treatments CO and BNPL will leave the experiment with £28 (£23 earnings + £5 show-up payment) and subjects in treatment BNPL+ will leave the experiment with £23 (£18 earnings + £5 show-up payment).

[15] Data was not collected on subjects’ usage of Amazon. However, in the UK, Amazon is a dominating e-commerce platform with approximately 86% of the UK population using the platform each year. See https://www.frisbi.com/blog/comprehensive-guide-to-amazon-uk-in-2024.

the end of the experiment. In order for subjects in the BNPL treatment to play optimally, they must purchase the first voucher with cash (see **Table 3** for the full breakdown of optimal decisions). Hence, the initial endowments are selected to enable BNPL and CO subjects to purchase vouchers when they are most desirable. The endowments also encourage subjects in both BNPL treatments to use Turtle Pay (our "Buy Now, Pay Later" service in the experiment). Futhermore, an endowment of £2 in each round gives subjects in all treatments the opportunity to purchase a maximum of 3 vouchers.

The BNPL and BNPL+ treatments vary in their payment deadlines. In the BNPL treatment, if a subject chooses to use Turtle Pay to purchase a voucher in Round N, then the payment is due in Round $N+1$. If a subject is unable to make the payment in Round $N+1$ due to insufficient funds, then they will incur a £1 late payment fee. If a subject is unable to pay their balance (including the late payment fee) in Round $N+2$, then they are declared bankrupt and exit the experiment. In the BNPL+ treatment, if a subject chooses to use Turtle Pay to purchase a voucher in *any* round, then the payment is due at the end of the experiment. Thus, there are no late payment fees in the BNPL+ treatment. If a subject is unable to pay their entire balance at the end of the experiment, they are declared bankrupt.

The design of the experiment is to mimic an online market place and the BNPL experience which includes the threat of late fees for missed payments. BNPL late fees vary depending on the terms of agreement set by each BNPL provider and can be escalated to debt collection (see **table 1**). In our experiment, late fees are set to £1 which is 50% of the endowment given to subjects between each round. Given that further missed payments are only escalated by being removed from the experiment (and all debts forgiven), the purpose of the late fee is to appropriately simulate the real-life financial burden placed upon consumers from BNPL providers.

At the end of each round, subjects are presented with the history of their purchase and payment decisions.At the end of the experiment, subjects complete a cognitive reflection test. They then receive their purchased Amazon vouchers and their remaining cash balance. Subjects who went bankrupt only received a £5 show-up payment for participating in the experiment.

Figures 1 and 2 show examples of the experimental interface for the BNPL treatment.

Section 4: Theoretical Benchmarks

As a theoretical benchmark, we consider the case of a profit-maximising subject in our experiment. Their behaviour in each treatment can be characterised by an optimal consumption path that specifies their purchase and debt repayment decisions (where applicable) in each round. **Tables 2 - 4** describe the optimal consumption paths for the three treatments:

1. In the Cash Only treatment the, maximum final earnings are £32. This is shown in **Table 2**:

Round	Voucher Price (£)	Starting Balance (X,Y)*	Ending Balance (X,Y)	Purchase (Y/N)	Payment Method
1	5	(5,0)	(0,1)	Y	Cash
2	5.5	(2,1)	(2,1)	N	
3	6	(4,1)	(4,1)	N	
4	6.5	(6,1)	(6,1)	N	
5	7	(8,1)	(1,2)	Y	Cash
6	7.5	(3,2)	(3,2)	N	
7	8	(5,2)	(5,2)	N	
8	8.5	(7,2)	(7,2)	N	
9	9	(9,2)	(0,3)	Y	Cash
10	9.5	(2,3)	(2,3)	N	

Table 2: Optimal decisions for the Cash Only (CO) treatment. *(X,Y) denotes cash and vouchers purchased respectively.

2. In BNPL, the maximum final earnings are £34. This is shown in **Table 3**:

Round	Voucher Price (£)	Starting Balance (X,Y)*	Ending Balance (X,Y)	Purchase (Y/N)	Payment Method
1	5	(5,0)	(0,1)	Y	Cash
2	5.5	(2,1)	(2,1)	N	
3	6	(4,1)	(4,2)	Y	Turtle Pay
4	6.5	(6,2)	(0,2)	N	(Pay off debt)
5	7	(2,2)	(2,2)	N	
6	7.5	(4,2)	(4,2)	N	
7	8	(6,2)	(6,3)	Y	Turtle Pay
8	8.5	(8,3)	(0,3)	N	(Pay off debt)
9	9	(2,3)	(2,3)	N	
10	9.5	(4,3)	(4,3)	N	

Table 3: Optimal decisions for the BNPL treatment. *(X,Y) denotes cash and vouchers purchased respectively.

3. In BNPL+, the maximum final earnings are £31.50. This is shown in **Table 4**:

Round	Voucher Price (£)	Starting Balance (X,Y)*	Ending Balance (X,Y)	Purchase (Y/N)	Payment Method
1	5	(0,0)	(0,1)	Y	Turtle Pay
2	5.5	(2,1)	(2,2)	Y	Turtle Pay
3	6	(4,2)	(4,3)	Y	Turtle Pay
4	6.5	(6,3)	(6,3)	N	
5	7	(8,3)	(8,3)	N	
6	7.5	(10,3)	(10,3)	N	
7	8	(12,3)	(12,3)	N	
8	8.5	(14,3)	(14,3)	N	
9	9	(16,3)	(16,3)	N	
10	9.5	(18,3)	(1.5,3)	N	(Pay off debt)

Table 4: Optimal decisions for the BNPL+ treatment. *(X,Y) denotes cash and vouchers purchased respectively.

Experimental Hypotheses

We cast the following hypotheses:

1. The availability of BNPL will lead to welfare losses in the form of late fees and bankruptcies. Thus, we expect lower subject earnings in the BNPL treatment than in the CO treatment.

2. The greater flexibility in repaying debt will lead to further welfare losses in the form of bankruptcies. Thus, we expect lower subject earnings in the BNPL+ treatment compared to both the BNPL and CO treatments.

3. Higher CRT scores indicate higher cognitive ability. Therefore, we expect the number of optimal decisions to be greater for subjects with higher CRT scores in all three treatments.

4. Higher CRT scores indicate higher cognitive ability. Therefore, we expect higher subject final earnings for subjects with higher CRT scores in all three treatments.

Implementation

The experimental sessions were run at ESSEXLab, a social science research laboratory at the University of Essex. We recruited a total of 144 participants across nine sessions from May 2022 to December 2022. Each session lasted approximately 60 minutes. The experiment was programmed and conducted with the z-Tree software (Fischbacher, 2007). **Table 5** provides detailed summary statistics.

Section 5: Results

Credit allows consumers to manage their income and spending. However, consumers can become subject to charges and fines if this credit is used or issued irresponsibly. In our experiment, BNPL is a financial product that allows our participants access to credit. Due to limited research, it is unclear if BNPL harms consumers in the form of welfare losses. Therefore, we organise our results around three key metrics to measure consumer welfare loss: bankruptcy (being unable to repay borrowed currency), late fees (charged when a repayment is missed), and final earnings (the total amount earned by the subject at the end of the final round). We also consider the implications of cognitive reflection task (CRT) scores on subject behaviour.[16]

From **Table 5**, we can see that the average final earnings in the CO treatment were less than the earnings in the BNPL treatment. It also shows that the average cash payments at the end of the treatments were less in BNPL (for at least sessions 5 and 6). These observations are likely because subjects had the opportunity to buy

[16] It should be noted that CRT data is not available for the 19 subjects in the first session of the CO treatment due to a programming error.

the vouchers earlier on at cheaper prices, and that more vouchers were purchased on average in BNPL. Lastly, two subjects missed payments and were required to pay late fees. One of these subjects was declared bankrupt.[17] It is also important to note that a small minority of subjects chose to not purchase any vouchers and left the experiment with a cash payment. In the BNPL+ treatment, subjects received the lowest payments in all treatments. This is likely due to the higher number of bankruptcies compared to BNPL, meaning that 9 subjects lost their experimental earnings. we can also see that in BNPL+, the average number of vouchers purchased was higher.

Discounted vouchers were used to provide an incentive to use BNPL as subjects could purchase vouchers before price increases. Amazon offers a large variety of goods, therefore vouchers were implemented as a close substitute to cash making them desirable to subjects. However, we found that in all treatments the majority of subjects chose to only purchase 2 of the 3 available vouchers. **Figure 3** shows payment preferences and purchase decisions for each subject in every round by percentage. In the CO treatment, most vouchers were bought in round 1 and 5. This runs parallel to the optimal choices that are described in **Tables 2 - 4**. Only 8 subjects in CO opted to purchase the voucher in round 9.

Figure 3 also shows that in the BNPL treatment, a majority of subjects purchased their first 2 vouchers in rounds 1 and 3 with the help of BNPL. Less subjects bought the third voucher, however, overall more subjects purchased the vouchers and notably the third voucher than in the CO treatment. This could be due to the help of BNPL and the desirability of the vouchers relatively lower price in comparison to the first treatment.

[17] This subject was declared bankrupt in round 8 and therefore did not complete round 9 and 10.

Finally, in BNPL+, the mean uptake of vouchers per session is higher on average, although only Session 9 reports an average of 3 vouchers. It is, however, important to note that in session 9 two subjects tried to purchase over 3 vouchers. This is why the average number of vouchers purchased in session 9 is greater than 3. Subjects' cash at the end of this treatment was also less on average. This could be due to a combination of less cash endowed, and relatively more vouchers purchased. This is shown in **Table 5** which includes summary statistics for all 3 treatments. **Figure 3** also shows that most vouchers were bought in the first 3 rounds.

Treatment	Cash Only (CO)	Buy Now, Pay Later (BNPL)	Buy Now, Pay Later+ (BNPL+)
Final Earnings (£)	27.97	30	21.43
Vouchers Purchased	1.49	2.03	2.68
Cash Payments (£)	13.10	9.67	4.37
Late Payments	-	2	-
Bankruptcies	-	1	9
Number of subjects (144)	50	50	44

Table 5: Mean of final earnings, cash payments, and vouchers purchased. Late payments and bankruptcies are count values. The maximum possible earnings for treatments CO, BNPL, and BNPL+ are £32, £34, and £31.50, respectively.

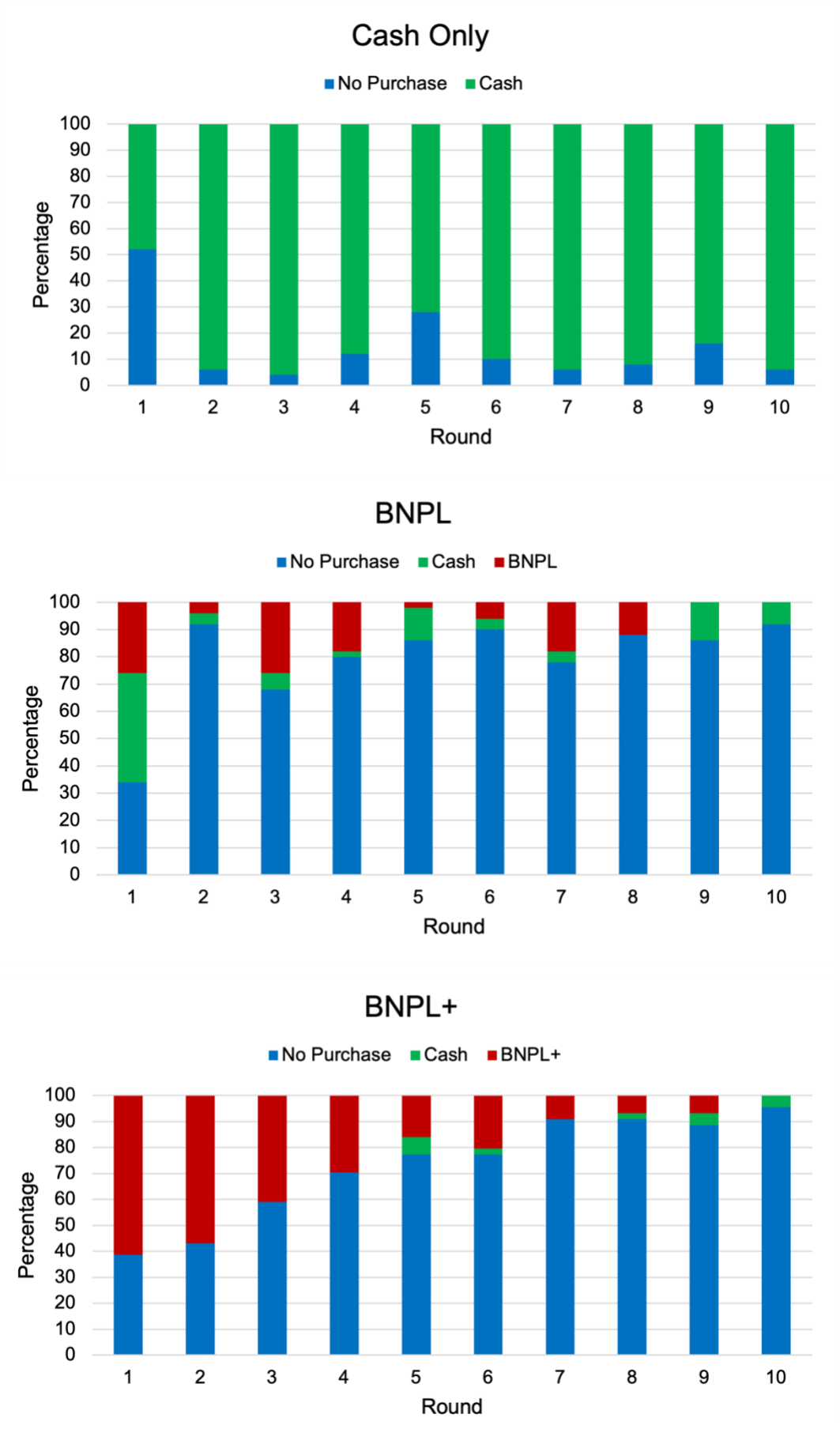

Figure 3. Payment decision by percentage in each treatment.

Result 1: We observe late fees and bankruptcies in the BNPL and BNPL+ treatments.

Table 5 shows the descriptive statistics from each treatment. By construction, there is no scope for late fees and bankruptcies in the CO treatment. If subjects follow the optimal consumption paths in the BNPL and BNPL+ treatments, then there should also be no late fees and no bankruptcies. However, we find that subjects do incur losses through late fees (in the BNPL treatment) and bankruptcies (in both the BNPL and BNPL+ treatments). In particular, two subjects miss the payment deadline and incur late fees in the BNPL treatment. Of these two subjects, only one subject was ultimately unable to repay her debt and was declared bankrupt. This contrasts with a total of nine subjects who were declared bankrupt in the BNPL+ treatment. Indeed, the fraction of bankruptcies is significantly higher under BNPL+ than under BNPL (two-sided t-test, $p < 0.01$). This suggests that bankruptcies are not driven by the availability of credit per se but by the flexibility in the timing of the repayment.

Result 2: BNPL+ significantly reduces final earnings, whereas BNPL is not statistically significant.

Giving individuals autonomy on when to repay their borrowed currency increases their cognitive load. This can lead to an increased number of errors and mistakes. **Table 6** shows the results of the OLS regressions of the BNPL and BNPL+ treatments on final earnings (£).[18] The constant should be interpreted as the average final earnings in the

[18] Final earnings is calculated as the value of the number of tokens purchased (£10 each) + the remaining cash at the end of the experiment. It does not include the £5 show up payment.

CO treatment. We find that BNPL+ significantly reduces average final earnings by £6.50. On the other hand, BNPL has no significant effect.

Result 3: CRT scores have a significant effect on final earnings in the BNPL+ treatment, however, they have no significance in BNPL.

A subject's optimal decision-making ability was scored out of the 10 choices they made during the experiment. An "optimal choice" included; buying the voucher at the earliest opportunity; choosing to not buy the voucher too early or too late; and finally, using BNPL or BNPL+ when advantageous. **Table 7** shows the results of an OLS regression of CRT scores on final earnings.[19] We can see that in the BNPL+ treatment, CRT scores are statistically significant in increasing final earnings leading to an increase of almost £4.50 ($p < 0.01$). However, in the CO and BNPL treatments, CRT scores are not statistically significant on final earnings. Given that subjects had to make their own decisions these results support that cognitive loading was larger in the BNPL+ treatment.

Result 4: CRT scores have little significance on the number of optimal decisions made.

Table 9 shows the number of optimal choices and their corresponding mean CRT score. This table shows that subjects made at least 3 optimal choices in all treatments. To investigate this further, we performed an OLS regression of CRT scores on optimal choices. **Table 8** shows the results. From **Table 8** we find that CRT scores have a

[19] This does not include the £5 show up payment.

weak statistical significance only within BNPL+ ($p < 0.05$). In other treatments, they are not statistically significant.

	Final Earnings, £
BNPL	1.44
	(0.87)
BNPL+	-6.54***
	(1.80)
Constant	27.97***
	(0.43)
R-squared	0.18
Number of subjects	144

Table 6: OLS regression results of the BNPL and BNPL+ treatments on final earnings (£).
Robust standard errors in parenthesis
Significance levels: ***p<0.01, **p<0.05, *p<0.1

	CO Final Earnings, £	BNPL Final Earnings, £	BNPL+ Final Earnings, £
Final Earnings	0.84	0.61	4.45***
	(0.53)	(0.44)	(1.38)
Constant	26.53***	28.57***	17.29***
	(0.86)	(1.11)	(2.35)
R-squared	0.08	0.02	0.15
Number of subjects	31	50	44

Table 7: OLS regression results of CRT Scores on subjects final earnings (£).

Robust standard errors in parenthesis

Significance levels: ***p<0.01, **p<0.05, *p<0.1

	CO Final Earnings, £	BNPL Final Earnings, £	BNPL+ Final Earnings, £
Optimal Choices	0.45**	0.30	0.55**
	(0.17)	(0.22)	(0.24)
Constant	7.19***	6.82***	6.99***
	(0.25)	(0.34)	(0.30)
R-squared	0.13	0.04	0.10
Number of subjects	31	50	44

Table 8: OLS regression results of CRT Scores on the number of optimal choices made

Robust standard errors in parenthesis

Significance levels: ***p<0.01, **p<0.05, *p<0.1

Optimal Choices	Mean Score	CRT Percentage Scoring 0,1,2, or 3 "Low" 0	1	2	"High" 3	N
0	-	-	-	-	-	0
1	-	-	-	-	-	0
2	-	-	-	-	-	0
3	2	0%	0%	100%	0%	1
4	1	33%	33%	33%	0%	3
5	0.80	50%	30%	10%	10%	10
6	0.89	50%	22%	17%	11%	18
7	0.91	58%	6%	24%	12%	33
8	1.41	27%	27%	24%	22%	37
9	1.73	9%	36%	27%	27%	11
10	1.5	8%	42%	42%	8%	12
Overall	1.18	37%	23%	25%	15%	125

Table 9: Number of optimal choices by CRT scores

Section 6: Discussion & Conclusion

This paper gives us a few experimental contexts to explore the impact of “Buy Now, Pay Later” on consumer welfare in the form of late fees and bankruptcies. Our main result in **Table 6** shows that BNPL+ resulted in reduced consumer welfare losses, whereas BNPL had little or no effect. This is likely due to the experimental mechanism of BNPL which plays a huge role in subjects’ success rates in these treatments. The design of the BNPL treatment was paternal and rigid compared to BNPL+ and therefore, it is possible that the structure of the BNPL payment method was “too simple” or restrictive. This could also explain why the CRT scores did not play a statistically significant role in determining optimal choices or earnings in the BNPL treatment, as shown in **Table 8**. For example, subjects knew that they would have to pay any deferred payment in the next round and as such, were only required to think one round ahead at any time. This may not have required a significant cognitive load. Moreover, the times at which subjects could afford to purchase the vouchers were arguably also restrictive because of the tight deferral period. In real life, consumers have up to 30 days to make a repayment, in which they can accumulate debt through a different, or the same financial provider.

In addition, in the BNPL+ treatment, welfare losses were caused by bankruptcies. Subjects using BNPL+ could defer payments whenever they desired and only had to pay off debts by the final round. This means that in comparison to the BNPL treatment, subjects had a much longer repayment period which could increase cognitive load. Furthermore, the prospect of paying off debt is psychologically further away and as such, less thought could be made into purchasing decisions. Many subjects succumbed to bankruptcy by accumulating too much debt with BNPL+. This

occurred mainly by subjects purchasing vouchers in later rounds of the experiment. This meant that these vouchers were more expensive and as such, their balances could not be paid off with their total endowment given to them during the experiment. Some subjects, however, simply forgot to pay off their balances by the end of the final round. Furthermore, subjects would occasionally try to purchase more than three vouchers. It is possible that subjects who purchased too many vouchers did not understand the mechanism of the experiment. The significance of the CRT scores with the results of the BNPL+ treatment reflects these difficulties in cognitive decision-making. This could explain why CRT scores in this treatment had a greater significance than compared to the BNPL treatment. BNPL+ also differed in the sense that subjects could purchase all 3 vouchers in the first 3 rounds of the experiment. This helped to ensure the desirability of the the 3rd voucher by ensuring its price remained low, as in BNPL it appeared to become undesirable due to its relatively expensive price by the time they could purchase it. By enabling the vouchers to be purchased earlier on, all 3 vouchers remained relatively desirable in comparison to a pure cash substitute.

In addition, from **Figure 3**, we can see a low uptake of the third voucher in treatments CO and BNPL where the third voucher could only be purchased in round 9 and round 7 for £9 and £8 respectively. This could be explained by a subject having a cut-off point such that the discounted price of the final voucher is not low enough to be a cash substitute when all other costs (monetary and psychological) are considered. The low uptake of vouchers may also be reflected in the lack of significance of CRT scores; if vouchers are not desirable, it would not be in the subject's best interest to purchase them.

To conclude, this paper has shown that under certain circumstances, “Buy Now, Pay Later” can have a significantly negative effect on consumer welfare. Giving subjects greater autonomy over repayments increases the likelihood of welfare losses through bankruptcy. This is potentially caused by an increase in cognitive loading, reminiscent of a consumer’s 30-day grace period with BNPL, where they have to remember to make payments among other day-to-day tasks. Therefore, regulators may need to consider restricting providers to offering shorter loan periods and consumers should ensure a greater understanding of financial products. More research can be done to test different BNPL mechanisms, not forgetting the role of marketing in consumer attitudes and how these financial services are used.

The objective of this paper is to explore a relatively under-researched area where empirical evidence is scarce. As such, one obvious limitation is the challenge of parameter selection, since there is little existing guidance on appropriate parameter values for this environment. We have chosen parameter values to balance two competing needs: (1) providing sufficient financial incentives and (2) ensuring that subjects’ average earnings are in line with similar experimental studies. It is also important to note that our analysis focuses on welfare losses, particularly in the form of late fees and bankruptcies, rather than potential welfare gains from consumption smoothing. To test the robustness of the experimental findings, we believe that future research should explore both alternative parameter values and potential welfare gains from BNPL.

To ensure the external validity of our results, we created an experimental interface that closely mimics a real-world online marketplace. As such, we believe that the behaviour documented in the experiment can serve as a reasonable predictor of behaviour in other settings.

The selected parameters are justifiable, as they level the playing field for participants without access to credit (e.g., a £5 endowment in the CO treatment) and incentivise responsible behaviour (with late fees set at £1). Nonetheless, future research could explore alternative parameter ranges to test the robustness of the experimental design and identify any underlying effects.

Finally, it is important to note that our analysis focuses on the welfare losses rather than the welfare gains from BNPL (e.g., consumption smoothing). Policymakers should also consider the potential benefits of BNPL when designing appropriate regulatory frameworks. This is a ripe area for future experimental research.

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Section 7: Appendix

Section 7.1: Experimental Instructions

(Begins on the next page).

Welcome to ESSEXLab!

- Thank you for participating in today's experiment.
- Please place all your personal belongings away so that we can have your complete attention.
- Please only use the computer as instructed. Do not attempt to browse the web or use any programs unrelated to the experiment.

Guidelines

- You have each earned a £5 payment for showing up on time to the experiment.
- Any additional earnings depend upon your decisions during the experiment.
- Please DO NOT talk or socialize during the experiment.

Structure of the Experiment

- The experiment consists of 10 rounds.
- In the first round you will receive £5 in cash.
- In each subsequent round you will be receive an additional £2 in cash.
- At the end of the experiment, you will be asked to complete an anonymous questionnaire.

Structure of a Round

- Each round consists of 3 main stages.
- The stages are:
  1. Purchase and Payment Method.
  2. Cash Balance Summary.
  3. Final Summary.

1. Purchase and Payment Method

- In this stage, you will be given the option to purchase an Amazon gift card with a value of £10.
- The value of the gift card will remain the same in each round.
- The starting price of the gift card will be £5.
- The price of the gift card will increase in each round by 50p.

5

2. Cash Balance Summary.

- If you decide to purchase the gift card, you will pay with your cash balance.
- You will be shown your remaining cash balance.
- You will proceed to the next Purchase and Payment Method stage.

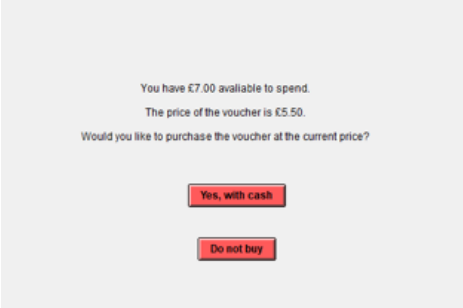
6

3. Final summary Stage

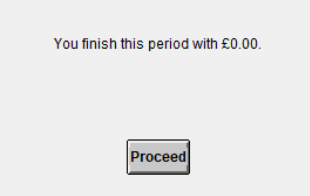
- This is the final stage.
- At the end of the final round, you will be shown total earnings for the experiment.

Experimental Stages

The following screenshots show an example for each stage of the experiment:



Stage 1: Purchase and payment method.



Stage 2: Cash balance summary.

Stage 3: Final summary.

Summary of Stages

1. Endowment.

   You will receive cash and be shown your cash balance.

2. Purchase & Payment Method

   You will be asked if you would like to purchase the gift card in this round with your cash balance.

3. Summary.

   If in this round, you have chosen to purchase a gift card, you will be shown the price and payment method.

   At the end of final round, you will be shown your total earnings in the experiment (remaining cash balance, gift cards purchased, and show up fee).

Let the experiment begin!

Welcome to ESSEXLab!

- Thank you for participating in today's experiment.
- Please place all your personal belongings away so that we can have your complete attention.
- Please only use the computer as instructed. Do not attempt to browse the web or use any programs unrelated to the experiment.

Guidelines

- You have each earned a £5 payment for showing up on time to the experiment.
- Any additional earnings depend upon your decisions during the experiment.
- Please DO NOT talk or socialize during the experiment.

Structure of the Experiment

- The experiment consists of 10 rounds.
- In the first round you will receive £5 in cash.
- In each subsequent round you will be receive an additional £2 in cash.
- At the end of the experiment, you will be asked to complete an anonymous questionnaire.

Structure of a Round

- Each round consists of 3 main stages.
- The stages are:
  1. Endowment.
  2. Purchase and Payment Method
  3. Summary.

1. Endowment Stage

- You will observe your cash balance at the beginning of each round.

2. Purchase and Payment Method

- In this stage, you will be given the option to purchase an Amazon gift card with a value of £10.
- The value of the gift card will remain the same in each round.
- The price of the gift card will increase in each round by 50p.

2. Purchase and Payment Method

- If you decide to purchase the gift card, you will be asked to choose your payment method.

- There are 2 potential payment options available:
  1. Cash – pay now with your available cash balance.
  2. Turtle Pay – buy now and pay in the next round.

- If you choose to use Turtle Pay, you will take part in some extra steps for you to pay the deferred payment.

Turtle Pay Process

- The Turtle Pay payment method allows you to buy the gift card in the current round (n) and defer your payment until the next round (n + 1).

- The payment will be due in the next round.

- Turtle Pay is available up to the 8^{th} round.

Turtle Pay Process

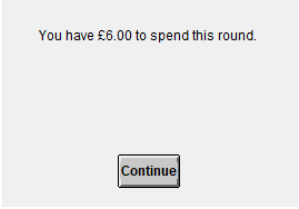
- If your cash balance in the next round (n+1) is not sufficient to cover the payment, you will incur a late fee of £1.
- The payment and late fee must be paid in the next round (n+2).
- If your cash balance in round n+2 is not sufficient to cover the payment and late fee in full, you will be declared bankrupt and exit the experiment.

Turtle Pay, Late Fees, and Bankruptcy

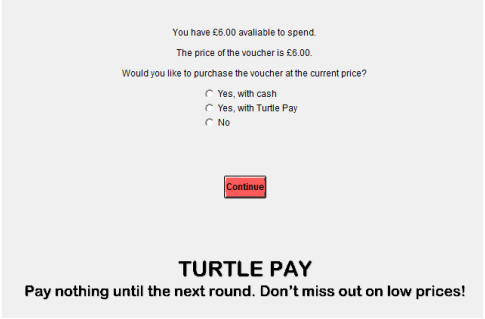
Round	Turtle Pay (no late fee)	Turtle Pay (incurring late fee)	Turtle Pay (incurring late fee and triggering bankruptcy)
n	Payment of £x is deferred to n+1.	Payment of £x is deferred to n+1.	Payment of £x is deferred to n+1.
n+1	Cash balance used to pay outstanding £x.	Insufficient cash balance to pay outstanding £x. Late fee of £1 charged. £x + £1 cash to be paid in round n+2.	Insufficient cash balance to pay outstanding £x. Late fee of £1 charged. £x + £1 to be paid in round n+2.
n+2	-	Cash balance used to pay outstanding £x + £1.	Insufficient cash balance to pay outstanding £x + £1. Bankruptcy triggered. Experiment ends.

Experimental Stages

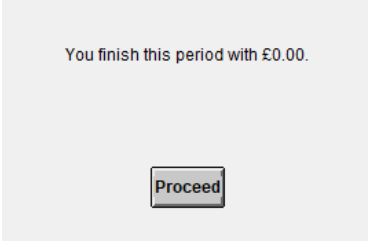
The following screenshots show each stage of the experiment:



Stage 1: £6 endowment.

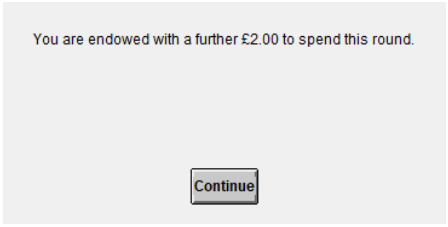


Stage 2: Purchase and payment method.

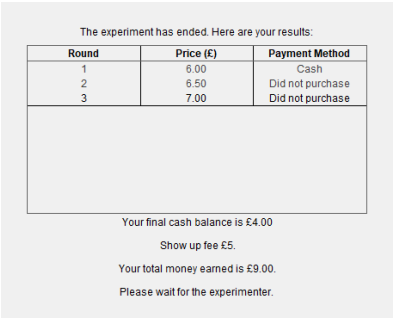


Stage 3: Cash balance summary.

Experimental Stages Continued



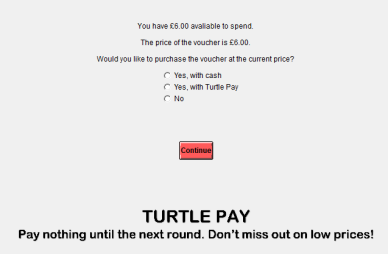
Stage 1: £2 endowment in each subsequent round.



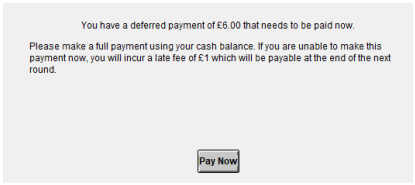
Stage 3: In the final round, the summary will show purchases and total money earned.

Turtle Pay, Late Fees, and Bankruptcy

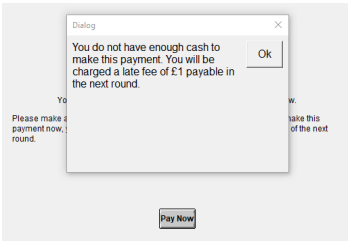
If you choose to use Turtle Pay, there will be extra steps in subsequent rounds. The following screenshots show each stage of the experiment if Turtle Pay is selected as a payment method:



Stage 2: Turtle Pay can be chosen as your payment method.



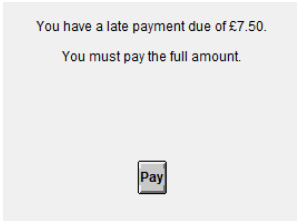
In the next period, you will need to pay your deferred payment.

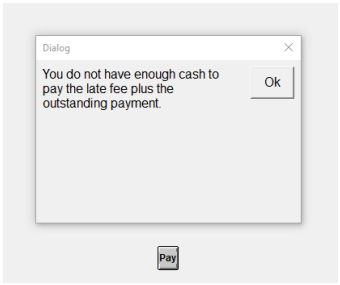


If you do not have enough cash to make the payment, then you will receive a £1 late fee. This will become payable in the next round with the original outstanding payment.

Turtle Pay, Late Fees, and Bankruptcy Continued…

If in the next round you do not have enough cash to pay the outstanding payment plus late fee, then you will become bankrupt. You will only be awarded your £5 show up fee.





3. Summary Stage

- This is the final stage.
- You will be shown your remaining cash balance.
- You will proceed to the Endowment stage in the next round.
- At the end of the final round, you will be shown total earnings for the experiment.

Summary of Stages

1. Endowment.

   You will receive cash and be shown your cash balance.

2. Purchase & Payment Method

   You will be asked if you would like to purchase the gift card in this round.

   If you would like to purchase the gift card you will be able to choose your payment method (cash balance or Turtle Pay).

3. Summary.

   If in this round, you have chosen to purchase a gift card, you will be shown the price and payment method.

   At the end of final round, you will be shown your total earnings in the experiment (remaining cash balance, gift cards purchased, and show up fee).

   If you go bankrupt, you will only receive your show up fee.

Let the experiment begin!

Welcome to ESSEXLab!

- Thank you for participating in today's experiment.
- Please place all your personal belongings away so that we can have your complete attention.
- Please only use the computer as instructed. Do not attempt to browse the web or use any programs unrelated to the experiment.

Guidelines

- You have each earned a £5 payment for showing up on time to the experiment.
- Any additional earnings depend upon your decisions during the experiment.
- Please DO NOT talk or socialize during the experiment.

Structure of the Experiment

- The experiment consists of 10 rounds.
- You will begin the experiment with £0.
- In each subsequent round you will receive an endowment of £2 in cash.
- At the end of the experiment, you will be asked to complete an anonymous questionnaire.

Structure of a Round

- Each round consists of 3 main stages.
- The stages are:
  1. Purchase and Payment Method.
  2. Cash Balance and Summary.
  3. Final Summary.

1. Purchase and Payment Method

- In this stage, you will be given the option to purchase an Amazon voucher with a value of £10.
- The value of the voucher will remain the same in each round.
- The price of the voucher will start at £5.
- The price of the voucher will increase in each round by 50p.

1. Purchase and Payment Method

- If you decide to purchase the voucher, you will be asked to choose your payment method.
- There are two potential payment options available:
  1. Cash – pay now with your available cash balance.
  2. Turtle Pay – buy now and pay in the next round.
- If you choose to use Turtle Pay, you will take part in some extra steps for you to pay the deferred payment.

2. Cash Balance and Summary Stage

- You will be shown your remaining cash balance and history of purchases and payment methods.

Turtle Pay Process

- The Turtle Pay payment method allows you to buy the voucher in the current round and defer the payment.
- Deferred payments will increase your Turtle Pay balance.
- This means you can use Turtle Pay to buy multiple vouchers and accumulate a balance.
- You can make payments after each purchasing stage.

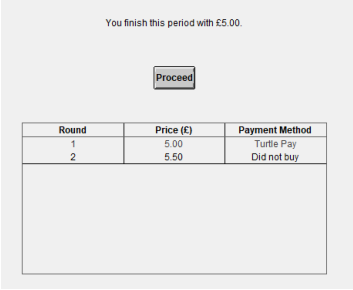
Turtle Pay Process

- Turtle Pay is available up to and including the 9th round.
- You must pay your balance in full by the 10th and final round.
- If you have not repaid your accumulated Turtle Pay balance by the end of the final round, you will be declared bankrupt and will only be rewarded your show up fee.

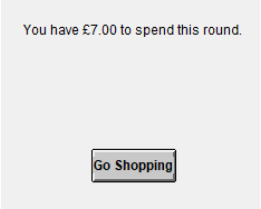
Experimental Stages

The following screenshots show an example for each stage of the experiment:

Stage 1: Purchase and payment method.



Stage 2: Cash balance and summary.

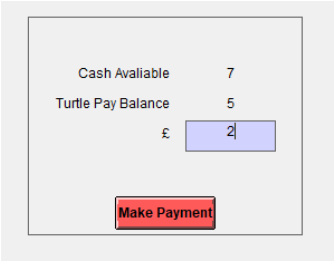


Balance at the beginning of the next round.

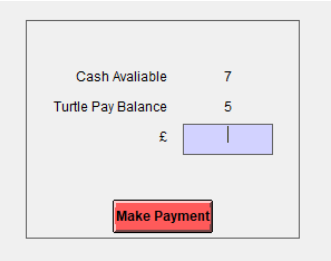
Turtle Pay and Bankruptcy

If you choose to use Turtle Pay, there will be extra steps in subsequent rounds. The following screenshots show each stage of the experiment if Turtle Pay is selected as a payment method:

Stage 1: Turtle Pay can be chosen as your payment method.



Stage 2: In the next period, you will be able to make a payment towards your balance.



If you do not want to make a payment, leave the box empty,

3. Final Summary Stage

- This is the final stage.
- At the end of the final round, you will be shown your total earnings and results for the experiment.

Summary of Stages

1. Purchase & Payment Method

   You will receive cash and be shown your cash balance.

   You will be asked if you would like to purchase the gift card in this round.

   If you would like to purchase the gift card you will be able to choose your payment method (cash balance or Turtle Pay).

2. Cash Balance Summary.

   If in this round, you will be shown your remaining cash balance, the price, and payment method if you have chosen to purchase a gift card.

3. Summary

   At the end of the experiment, you will be shown your total earnings (the total number of vouchers purchased, cash remaining, and show up fee).

   If you go bankrupt, you will only receive your show up fee.

Let the experiment begin!

Chapter 2

Testing the Robustness of the Endowment Effect

Abstract

The endowment effect is a well-documented behavioural bias where individuals report a higher valuation for an item when it is in their possession. We conduct a laboratory experiment using university-branded coffee mugs to investigate the robustness of the endowment effect. To do so, we use a between-subject experimental design that varies subjects' perceptions of tangibility (i.e., whether subjects can physically hold the mug) and ownership (i.e., the probability that subjects have the right to take home the mug). We find that tangibility significantly increased sellers' valuations regardless of the certainty of property rights, thus increasing the size of the endowment effect. Whereas the effect of ownership was ambiguous. When combined with intangibility increases in valuations were less significant. Our results can help to shed light on the robustness of behavioural biases more generally.

1 Introduction

The endowment effect is a well-documented behavioural bias where individuals report a higher valuation for an item when it is in their possession. Empirically, it is measured as the difference between an individual's willingness to accept (WTA) to sell a particular item and willingness to pay (WTP) to purchase the same item. Classical economic theory predicts that WTA and WTP are identical. However, the endowment effect arises whenever WTA is greater than WTP. In the behavioural economics literature, the mechanism that drives the endowment effect is often thought to be ownership. Intuitively, ownership confers a psychological benefit that induces individuals to place a higher valuation on the item.

This is demonstrated in Kahneman et al. (1990) through an experiment where participants are given a coffee mug and can exchange it for an equally priced alternative. The results showed that the participants required a higher payment to part with the endowed item. Kahneman et al. (1990) uses the BDM mechanism to elicit these paradigms (Becker et al., 1964). This approach draws a random price for an item once the individual has reported their WTP or WTA. If the WTP is greater than the price, the individual receives the item and pays the random price. If the WTP is less than the price, the individual does not receive the item and pays nothing.

Berry et al., (2011) states that the BDM mechanism has some significantly robust qualities: demand estimation precision; quasi-experimental variation in treatment; and random variation in price paid (conditional on WTP). The first quality simply states that the exact value of WTP is only limited by the conditions of the researcher e.g., pounds and pence. The second quality enables instrumental variables (IV) estimation of treatment effects since the responder's draw is random.

Furthermore, unlike take-it-or-leave-it the BDM mechanism allows for separate IV estimates at different levels of WTP. Finally, this mechanism is considered to be robust and incentive compatible. This is because the price is randomly drawn and does not need to be kept a secret. If the individual reports a valuation greater than their true WTP then they may purchase an item for more than they would like and vice-versa. Thus, telling the truth is considered a dominant strategy by many (Kahneman et al., 1990; Shogren et al., 2001; Davis and Holt, 2021).

Of course, there are criticisms of the BDM mechanism. Horowitz (2006a) points out that the BDM is not incentive compatible for individuals who are not expected utility maximisers. Karni and Safra (1987) also find that it is not incentive compatible over lotteries or where there is uncertainty over the goods value. The reasoning is such that when an individual places value on an item, the circumstances under which he does so are significant. These circumstances are defined as the distribution of potential prices that will be randomly drawn.

In this paper, we conduct a laboratory experiment to investigate plausible mechanisms underlying the endowment effect. We use a 2x2 between-subject experimental design that varies subjects' perceptions of tangibility and ownership. To implement tangibility, we either place the coffee mug itself (i.e., tangible) or an image of the coffee mug (i.e., intangible) on the computer screen of the participant. We operationalise ownership as the probability with which the participant can take the coffee mug home at the end of the experiment. This probability can take on two values: ½ or 1.[1]

[1] For buyers, the probability of ownership is always 1. For sellers, the probability of ownership can be either ½ or 1.

We use the Becker-DeGroot-Marschak (BDM) procedure to elicit subjects' valuations for the coffee mug. Buyers (sellers) are asked to state their maximum WTP (minimum WTA) to buy (sell) the coffee mug. The reported valuations are then compared to a randomly drawn price between £0 and £10, rounded to the nearest pence. If the participant is a buyer, they will buy the mug if and only if their WTP is greater than or equal to the random price. If the participant is a seller, they will sell the mug if and only if their WTA is less than or equal to the random price.[2] The BDM procedure guarantees that it is incentive-compatible for both buyers and sellers to report their true valuations.

Our results showed that tangibility, regardless of property rights, significantly increased sellers' valuations of the coffee-mug and thus the size of the endowment effect. On the other hand, the effect of property rights was more ambiguous. The size of the endowment effect is greater under tangible conditions, although in intangible conditions the property rights revealed mixed results. Intangibility combined with ownership uncertainty led to an increase albeit at a less significant level to its tangible counterparts. However, intangibility with certainty was also positive, but with no significance. Table 4 reports the OLS regression results in section 4.

This paper proceeds in the following format: Section 2 discusses existing literature, Section 3 explains our experimental design in greater detail, Section 4 presents our results, and Section 5 discusses the broader implications of these results and then concludes.

[2] Each subject interacts with the experimenter in their buying and selling decisions, rather than with other subjects.

2 Literature Review

The endowment effect is traditionally associated with the two cornerstones of prospect theory which are reference dependence and loss aversion. (Thaler., 1980 and Kahneman et al. 1990). A decision maker who exhibits reference dependence evaluate an outcome based upon its relative value rather than its absolute value. Loss aversion describes the increased sensitivity to a loss compared to an equivalent gain (losses have a greater psychological impact than gains). In the context of the endowment effect, reference dependence exists in how buyers and sellers view their status-quo. For buyers, goods are gains whereas for sellers they are losses. Samuelson and Zeckhauser (1988) demonstrates this. In this experiment subjects were given a hypothetical choice framed as either ‘neutral’ or the status-quo. They found that an option was more likely to be chosen when it had been framed as the status-quo.

Furthermore, reference dependence may impact how an item is valued. Rational buyers will want to purchase an item for the lowest possible price whereas sellers want to sell an item for the highest possible price. In the decision to make a trade, it is likely that an individual may have to compromise on their price. Hence, the difference between their reference point and the agreed upon price may vary. Loss aversion considers the negative psychological effect of giving something up, which is generally greater than the utility associated with gaining it. The status-quo bias is a natural outcome of this. Thus, those selling an object may request a higher price to compensate for its loss (Kahneman et al. 1991).

Despite the research suggesting its strong link to prospect theory and loss aversion, the endowment effect continues to be subject to scrutiny and emerging

theories. The classical theory may suggest explanations for the disparity of valuations through inexperience, signalling, and an unforeseen chain of events due to revelations of preferences. On the other hand, other theories consist of evolution, cultures, and relationships. Evolution is thought to take a role in the way we make purchases. For example, the decision to overvalue goods that we own may be thought to be beneficial as we can acquire more resources (Huck et al, 2005). A further explanation has been that of strategic misrepresentation, in which the difference between WTP and WTA could be explained by premeditated bargaining in the valuation of the item (Klass and Zeiler, 2013). That said, these explanations may be overshadowed though Kurt and Inman (2013) which states that the endowment effect may be reduced through traits of high cognitive ability and emotional intelligence. These facts reduce the endowment effect through what the authors describe as the “empathy gap.” This is the ability to connect with others.

Further applications and experiments show a strong connection between the framing of the reference point and the strength of the endowment effect. Studies have shown that when the reference point is framed in different states such as terms of ownership, and physical possession of an object, then the magnitude of the endowment effect changes. Hong et al., (2015) field tests the effect of facing a loss by offering a pre-awarded bonus. The result of this experiment was that workers performed with higher effort as they did not want to lose the bonus they had been endowed with. Inspired by this finding, Brooks et al, (2012) uses laboratory experiments to compare effort between the framing of losses and gains. Their results showed that workers’ effort was more likely motivated by the desire to keep the bonus as they perceived it as the default state.

Ownership

Loss aversion is typically attributed to be the main driver of the endowment effect, although this traditional view is continuing to be challenged. Ownership in earlier studies is typically defined as the physical possession of an object. However, ownership may also manifest psychologically through feelings of ownership. This is factual actual ownership whereby the presence or physicality of an item is unnecessary; it only requires attachment to or the idea of ownership. Pierce (2003) defines psychological ownership as the state in which we think something is ours. For example, individuals when taking a new car for a test drive may imagine that they own the car. Similarly, buying stocks or shares, or being given a legally binding contract can produce feelings of ownership.

Ownership has been shown to create a link between the object and the individual creating a sense of possession in which the object is perceived as “mine” leading to an increase in valuation (Belk, 1988; Pierce et al., 2003). Some research suggests that ownership may offer a better explanation for endowment effects than loss aversion (Morewedge et al., 2009). Individuals who own an object may also hold higher valuations due to the self-threat construct, in which higher valuations strengthen egos (Sivanathan and Pettit, 2010). Some studies such as Ariely et al., (2005) consider the role of emotion as a singular construct in the endowment effect. However, in Shu & Peck (2011), it is proposed that emotional attachment is two separate constructs: affective reaction (emotion) and psychological ownership (possession). The loss of an object is perceived by possession, whereas emotion measures intensity.

The effects of factual and physical ownership are often confounded. For example, anticipatory possession on its own may induce similar psychological effects as legal ownership (Ariely & Simonson, 2003). This is because the individual emotionally invests into the object by means of deliberation and physical proximity. Furthermore, Ariely et al., (2005) suggests that changes in cognitive perspective can alter endowment effects. This is because when an individual takes upon the role of a seller (including in the absence of legal ownership) attachment is triggered through realising the potential positive qualities of an object.

Reb & Connelly (2007) examines the roles of subjective and factual ownership to extract the separate effects they may have on monetary valuation. Physical ownership had a greater effect on valuation, as feelings of ownership were stronger. In Knetsch & Wong (2009), the endowment effect is tested through varying the state of the reference point and the strength of ownership. In this study, ownership was defined by the participants being instructed whether they owned an object. The state of reference was determined as the participant's attachment to the object, which consisted of three measures; physical possession, the process by which the good was allocated (e.g., at random), and the framing of choice (loss or gain). The result of this study is that those exposed to the feeling of entitlement, rather than current ownership experienced a stronger disparity. This is attributed to a "probabilistic belief" of the right to access or acquire a good. Therefore, feelings of ownership created through attachment to an object are a key factor in determining one's monetary valuation of an object – even in the absence of factual or legal ownership.

Tangibility

Tangibility describes the physicality of an item, and it is often confounded or confused with physical ownership. Tangibility depicts rather, by how much we can perceive an item and can range from hearing, smell, sight, to touch. Qualitative research suggests that items that are more permanent or physical increase emotional connection and thus feelings of ownership (Belk 2021). Therefore, physical items benefit from value-enhancing effects and can increase the size of the endowment effect (Beggan, 1992; Morewedge et al., 2009).

There are many different renditions of tangibility in experiments. These range from giving participants a physical object (Gelman et al., 2012; Knetch, 1989), factual ownership of an object (Reb and Connolly, 2007) and hypothetical scenarios (Jaeger et al., 2020). Interestingly, Jaeger et al., (2020) found that tangibility produced an unexpected and opposite effects. Unable to offer a complete explanation for this, they offer ideas such as salience in regard to other qualities of the items offered. Furthermore, they consider that presenting an item as an abstraction (whereby there is some element of uncertainty, or imagination required to value the item) that individuals do not have the necessary cognitive capacity to value the item accurately or rationally.

3 Experimental Design

We use a 2x2 between-subject experimental design that varies subjects' perceptions of (1) the tangibility and (2) the ownership of university-branded coffee mugs. We define tangibility as the ability to physically hold and inspect the coffee mug. In the

tangible sessions, each participant was handed a coffee mug at their computer station. In the intangible sessions, each participant was shown a picture of the coffee mug on their computer screen. We define ownership as the ability to keep the coffee mug at the end of the experiment (i.e., property rights) and we operationalise ownership via the probability that subjects are allowed to keep the coffee mug at the end of the experiment ($p = 0.5 \text{ or } p = 1$). We conducted separate experimental sessions for "buyers" (i.e., subjects who are not endowed with a coffee mug) and "sellers" (i.e., subjects who are endowed with a coffee mug). While tangibility was varied for both groups, ownership was only varied for sellers. The BDM mechanism was used to elicit buyers' and sellers' WTP and WTA, respectively. In the experimental instructions, participants were told that reporting their true valuations was their best strategy since it would ensure that they would only buy or sell the mug when it was a "good deal." Examples were given to demonstrate this intuition.

Buyers received a £10 endowment at the beginning of the experiment. After inspecting or viewing the mug, buyers and sellers report their valuations (v). The computer would then draw a random price (p) between £0.00 and £10.00, rounded to the nearest pence.[3] Based on a comparison between the reported valuations and the random price, a buying or selling decision is made.

For the case of a seller, the coffee mug would be sold to the experimenter if and only if $p \geq \text{v}$. If the mug is successfully sold, then the seller receives $£(10 + p)$ in earnings. If the mug is not sold, then the seller takes home the mug with probability p (that depends on the treatment) and receives $£10$ in earnings. For the case of a buyer, the coffee mug would be purchased from the experimenter if and only if $p \leq \text{v}$. If the mug is successfully purchased, then the buyer takes home the mug and receives

[3] Reported valuations were also restricted to lie between £0.00 and £10.00.

£$(10 - p)$ in earnings. If the mug is not purchased, then the buyer receives £10 in earnings.

Only Subjects in buyer roles receive a cash endowment of £10. Subjects in sellers do not receive any cash endowment since they are endowed with the coffee mug (which can be sold for cash). In our experiment, the retail value of the coffee mug in the university campus store is £6.99. As such, the size of the cash endowment was carefully chosen since it represents a reasonable upper bound on subjects' valuations for the coffee mug.

Figures 1A and **1B** give examples of the experimental interface for a seller in the intangible treatments.

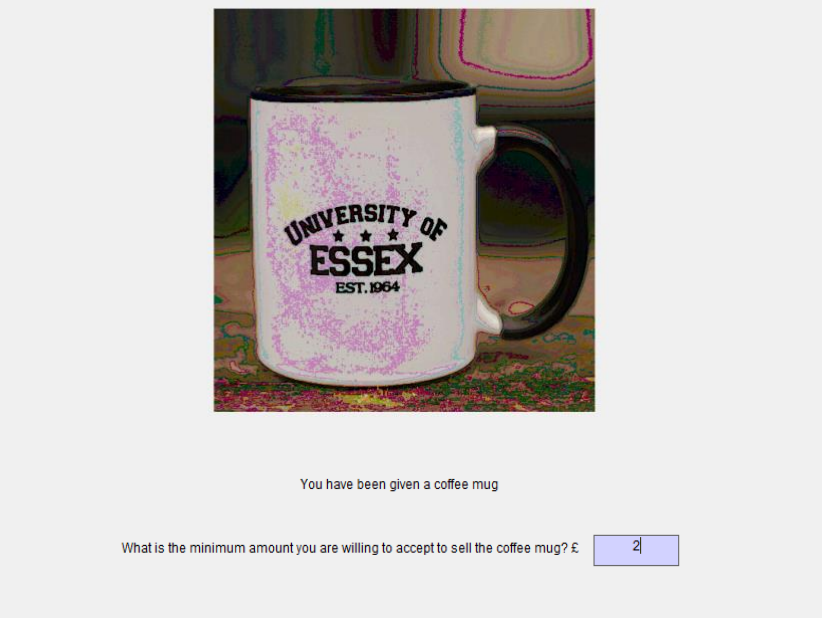


Figure 1A: the seller enters their maximum willingness to accept for the coffee mug. The text reads:

You have been given a coffee mug.

What is the minimum amount you are willing to sell the coffee mug?

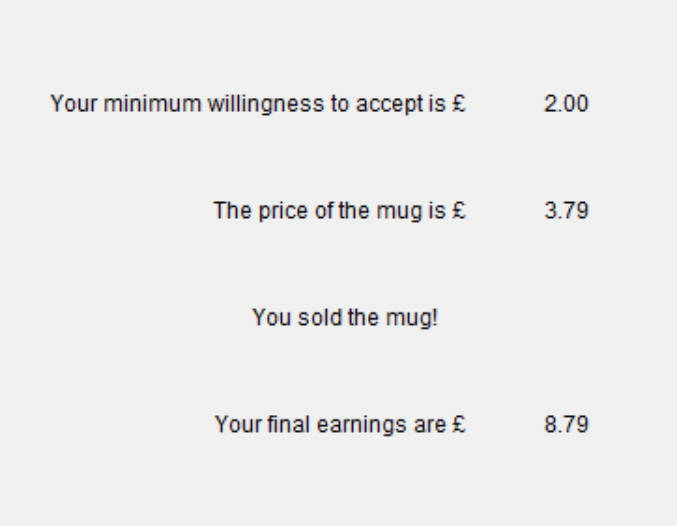


Figure 1B: the seller is successful in selling the mug.

Experimental Hypotheses

Our main variable of interest is a subject's valuation of the coffee mug (i.e., WTP for a buyer and WTA for a seller). We define the endowment effect as the difference between sellers' average WTA and buyers' average WTP.

Letting $e_{T,p} = WTA_{T,p} - WTP_{T,p}$ denote the size of the endowment effect in treatment (T, p), where $T \in \{tangible, intangible\}$ and $p \in \left\{\frac{1}{2}, 1\right\}$ represents the probability of ownership. We cast the following hypotheses:

1. $e_{tangible,p} > e_{intangible,p}$ for all p
2. $e_{T,p_1} > e_{T,p_2}$ for all T and $p_1 > p_2$

In other words, we predict the size of the endowment effect to be larger when (1) the coffee mug is tangible and (2) when the probability of ownership is higher.

Experimental Implementation

A total of 266 subjects participated across 14 experimental sessions at ESSEXLab, a social-science research laboratory at the University of Essex. The experiment was programmed and conducted with the software z-Tree (Fischbacher, 2007). **Table 1** shows the summary statistics for the experiment. In total, 120 coffee mugs were given to participants in the experiment: 22 purchased by subjects in "buyer" roles and 98 taken home by subjects in "seller" roles. Each coffee mug was bought from the University of Essex campus store for £6.99.

Treatment	Average Valuation (£)	Number of Subjects
Buyer, tangible, p = 1	2.80	39
Buyer, intangible, p = 1	3.47	37
Seller, tangible, p = 1	5.10	39
Seller, intangible, p = 1	4.51	37
Seller, tangible, p = 0.5	4.78	58
Seller, intangible, p = 0.5	4.84	56
Overall	4.33	266

Table 1: Average valuation by treatment. Valuations are ranked highest to lowest for buyers and sellers with the same probability of ownership

4 Results

Figure 1 shows buyers' and sellers' average valuations across treatments. The average valuation (£) to the nearest pence is our dependent variable in all treatments and regressions (see **table 3 and 4**). At a glance, buyer treatments clearly show the lowest means compared to sellers. What may not be expected however, is that intangibility seems to have an (albeit weak) opposite effect on buyers and sellers. For buyers in treatment (3), average valuations are £3.47 compared to tangible buyers who value the mug at £2.80 on average. For sellers, average valuations are generally lower – especially when intangibility is combined with sure ownership in treatment (4). Furthermore, treatment (6) with (intangibility, 0,5) poises the second highest valuations among sellers. This is a surprising result as one may expect treatment (3) with (intangibility, 1) to hold a higher valuation given the certainty of ownership. Possible explanations for this will be considered in the Discussion section of this paper.

Result 1: Replicating previous studies, we find evidence for the endowment effect.

Standard economic theory predicts that an individual's valuation for an object should be independent of their ownership. In other words, an individual's WTP (as a potential buyer) should be identical to their WTA (as a potential seller). To test this conjecture, experiments on the endowment effect typically compare buyers' average WTP with sellers' average WTA. In our experiment, we replicate the endowment effect by restricting attention to the comparable treatments (tangible and $p = 1$). **Table 2** shows the relevant figures. Consistent with previous studies, we find that sellers' average

WTA of of £5.10 is almost twice that of buyers' average WTP of £2.80. Indeed, the difference in the valuations of the two groups is also statistically significant at conventional levels (two-sided t-test, $p < 0.01$).

Result 2: Tangibility and Ownership do not have a significant effect on subjects' WTP or WTA.

Research suggests that objects that are tangible enhance valuations compared to those that are less physical. Ownership may also have increasing effects on valuations through creating a stronger "link" to objects. To analyse the effects of these variables we conducted OLS regressions of buyers' and sellers' valuations shown in **Table 3**. We also incorporated an interaction variable to decompose the effects of Tangibility and Ownership. Contrary to theory, we found that neither tangibility nor ownership have a significant effect on subjects' valuations ($\mathrm{p} > 0.1$). The interaction term has no statistically significant effect on a Sellers' WTA ($\mathrm{p} > 0.1$). This suggests that the strongest determinant of a subject's valuation of the mug is their role in the experiment (i.e., buyer or seller) and that the effect of ownership on valuation does not depend on the level of tangibility. Results of Tobit regressions are similar and are reported in the Appendix (see **Table 5**).

Result 3: The endowment effect persists under probabilistic ownership of the coffee mugs (among sellers) but disappears when the coffee mugs are no longer tangible.

Behavioural theory explains that the endowment effect occurs due to individuals valuing an item more when it is in their possession. Therefore, in our experimental context, the endowment effect should transpire through Sellers' overvaluations. To discern the endowment effect, we compare Buyers' WTP and Sellers' WTA in the six treatments. In **Table 4** we show the results of the four regressions. We find an assortment of results. Tangibility significantly increases Sellers' WTA regardless of Ownership ($p < 0.01$). On the other hand, we find very low levels of significance when the mugs are intangible ($p < 0.1$). Results of Tobit regressions are similar and are reported in the Appendix (see **Table 6**).

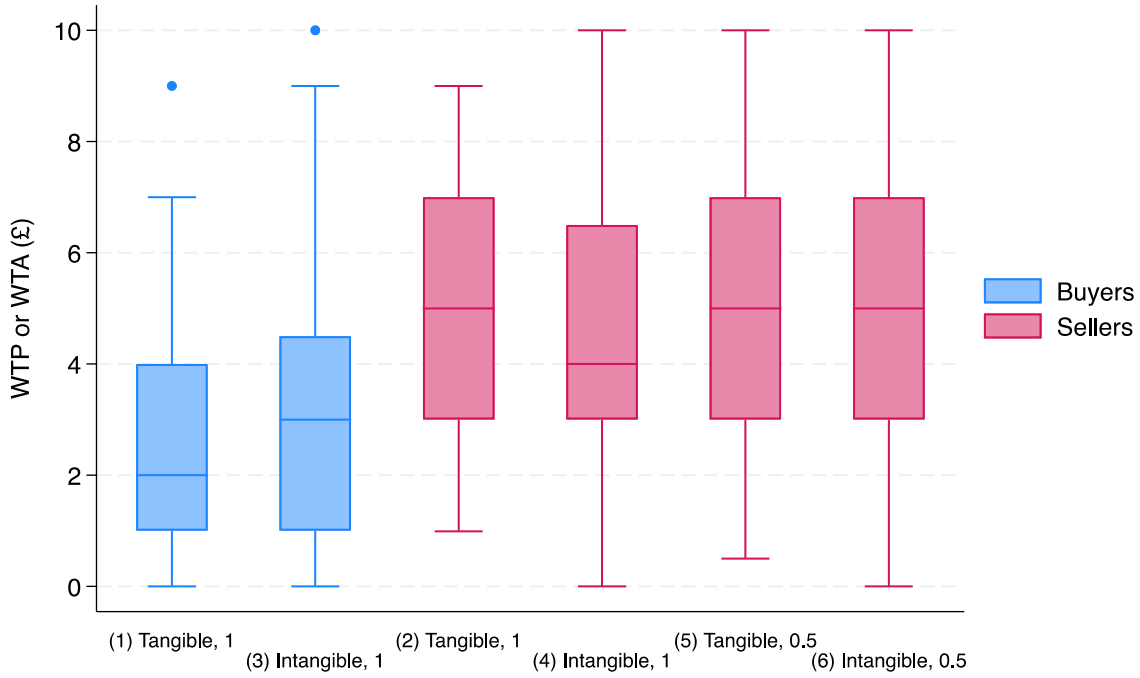


Figure 1: Average Valuations

Treatment	Number of Subjects	Average Valuation (£)
Buyer, tangible, p=1	39	2.80
Seller, tangible, p=1	39	5.10
Combined	78	3.95

Table 2: Replication of the Endowment Effect using the BDM method (Becker, 1964)

	(1) Buyer WTP (£)	(2) Seller WTA (£)
Tangible	-0.67	-0.06
(Dummy)	(0.53)	(0.49)
Probability of Ownership	-	-0.33
(Dummy)		(0.58)
Tangible x Ownership	-	0.65
(Interaction)		(0.79)
Constant	3.47***	4.84***
	(0.42)	(0.34)
R-squared	0.02	0.01
Number of subjects	76	190

Table 3: OLS regressions on subjects' WTA (Sellers) and WTP (Buyers)

Robust standard errors in parenthesis

Significance levels: ***p<0.01, **p<0.05, *p<0.1

	(1)	(2)	(3)	(4)
	Tangible, p = 1	Intangible, p = 1	Tangible, p = 0.5	Intangible, p =0.5
	WTA, £	WTA, £	WTA, £	WTA, £
Seller	2.31***	1.04	1.98***	1.37*
	(0.52)	(0.63)	(0.48)	(0.54)
Constant	2.80***	3.47***	2.80***	3.47***
	(0.33)	(0.42)	(0.32)	(0.42)

Table 4: OLS Regression results of being a Seller on subjects' valuation (WTA, £) in the four treatments.

Robust standard errors in parenthesis

Significance levels: ***p<0.01, **p<0.05, *p<0.1

5 Discussion and Conclusion

In the experiment, tangibility, and probabilistic ownership (property rights) of a coffee mug were manipulated. This was to test the robustness of the endowment effect under different circumstances and to deduce these variables effect on subjects' monetary valuations.

We find that there is a significant positive effect on Seller's valuations in treatments where the coffee mug is tangible, even when probability of ownership is uncertain. This is no surprise, as actual objects that are more tangible would be more likely to induce the endowment effect through feelings of ownership and association with the object. Uncertainty in these treatments, appears to reduce the effect on the seller's valuation although it is still significantly positively correlated. Uncertainty adds

an increased element of risk to the subject's decision. Reb and Connelly (2007) suggest that if the coffee mug is perceived as a potential loss rather than a foregone gain, then the high valuations could be caused by a shift in the reference point triggered by loss aversion (Reb & Connelly, 2007). It is possible then, that upon close physical examination, subjects value the item less due to individual preferences and the shift in the reference point is relatively less.

On the other hand, when ownership is uncertain, there is a statistically insignificant yet positive relationship. In **Table 1** where the average valuations are recorded, we can see that this treatment has the second highest valuation for Sellers. This result could be explained through choice uncertainty, which relates to the consumer's knowledge about the object they are receiving or selling. Greater choice uncertainty may lead to higher valuations for sellers as they fear undervaluing an item (Korting & Otto, 2019). In contrast, the "local thinker" effect may lead to a higher valuation. This is where the risk of loss is less salient due to intangibility, and thus the individual is more likely to take risks (Bordalo et al., 2012).

Moreover, Atasoy & Morewedge (2018) offer the theory that people tend to entertain unrealistically positive perceptions of themselves and as a consequence of this, association of a good with the self can lead to an increase in its perceived value. Lastly, subjects could have overestimated the quality and desirability of the mug as the subject could not hold the coffee mug to evaluate its true worth.

The above tries to explain the roles of probabilistic ownership and tangibility on the endowment effect. We should also consider the effect the object being offered to the subjects. In the literature, it is a consistent finding that different objects elicit different magnitudes of the endowment effect (Kanngiesser., et al 2011). This can be due to the utility of an item (for example, how useful it is perceived) and how much the

individual cares for the item, which could be subject to individual tastes. This has been described as evolutionary salience, which explains why we hold on to some objects that have a perceived greater cost if lost through trade (Jones & Brosnan, 2007). Therefore, it is possible that the coffee mug does not have a highly rated evolutionary salience since its usefulness is not unique, and given the experiment, was not able to demonstrate its full potential as subjects merely observed the mug and could not test it out.

A clear way forward for future studies would be to use other items that could vary in utility, probability of ownership, and tangibility. Items that are intangible could also be presented with its key qualities and benefits highlighted to subjects to assist them in rationally evaluating the item. For example, in presenting the coffee mug, we could have drawn attention to its size, material, featured artwork and many potential uses.

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6 Appendix

6.1 Tobit Regressions

	(1) Buyer WTP (£)	(2) Seller WTA (£)
Tangible (Dummy)	-0.69	0.56
	(0.53)	(0.67)
Probability of Ownership (Dummy)	-	0.01
		(0.64)
Tangible x Ownership (Interaction)	-	0.64
		(0.85)
Constant	3.49***	4.40***
	(0.43)	(0.39)
Number of subjects	75	179

Table 5: Tobit regressions on subjects' WTA (Sellers) and WTP (Buyers) in £. Upper limit set to £10.

Robust standard errors in parenthesis

Significance levels: ***p<0.01, **p<0.05, *p<0.1

	(1)	(2)	(3)	(4)
	Tangible, p = 1	Intangible, p = 1	Tangible, p = 0.5	Intangible, p =0.5
	WTA, £	WTA, £	WTA, £	WTA, £
Seller	2.31***	1.04	1.98***	1.37*
	(0.51)	(0.63)	(0.48)	(0.54)
Constant	2.80***	3.47***	2.80***	3.47***
	(0.33)	(0.42)	(0.32)	(0.42)

Table 6: Tobit Regression results of being a Seller on subjects' valuation (WTA, £) in the four treatments. Upper limit set to £10.

Robust standard errors in parenthesis

Significance levels: ***p<0.01, **p<0.05, *p<0.1

6.2 Experimental Instructions

(Begins on the next page).

Welcome to ESSEXLab!

- Thank you for participating in today's experiment.
- Please place all your personal belongings away so that we can have your complete attention.
- Please only use the computer as instructed. Do not attempt to browse the web or use any programs unrelated to the experiment.

Guidelines

- You have each earned a £5 payment for showing up on time to the experiment.
- Any additional earnings depend upon your decisions during the experiment.
- Please DO NOT talk or socialize during the experiment.

Structure of the Experiment

- At the beginning of the experiment, you will be given a university-branded coffee mug.
- The coffee mug is NOT yours to keep.
- At the end of the experiment, you will have to give back the coffee mug.

Structure of the Experiment

- During the experiment, you will receive an endowment of £10.
- You will have the opportunity to buy the coffee mug using your endowment.
- If you buy the coffee mug, you will be buying it from us (the experimenters) and not from other participants.

Buying the Coffee Mug

- We will ask you to state the maximum amount $\boldsymbol{M}$ that you are willing to pay to buy the coffee mug.

- The computer will then generate a random price $\boldsymbol{p}$ between £0.00 and £10.00, where each price between £0.00 and £10.00 is equally likely.

Buying the Coffee Mug

- If $\boldsymbol{p} \leq \boldsymbol{M}$, then you will buy the coffee mug. You will pay the price $\boldsymbol{p}$ and you will be able to take home the coffee mug.

- If $\boldsymbol{p} > \boldsymbol{M}$, then you will not buy the coffee mug.

Best Strategy

- It is in your best interest to truthfully report the maximum amount you are willing to pay.
- This guarantees that you will buy the coffee mug whenever you think it is a good deal (the price ends up being lower) and that you will not buy the coffee mug whenever you think it is a bad deal (the price ends up being higher).

Example #1

- Suppose you are willing to pay as much as £5.00 to buy the coffee mug ($\boldsymbol{M = 5}$).
- The computer generates a random price of £9.00 ($\boldsymbol{p = 9}$).
- Since $\boldsymbol{p > M}$, you will not buy the coffee mug.

Example #2

- Suppose you are willing to pay as much as £5.00 to buy the coffee mug ($\boldsymbol{M = 5}$).
- The computer generates a random price of £1.00 ($\boldsymbol{p = 1}$).
- Since $\boldsymbol{p \leq M}$, you will buy the coffee mug.
- You will pay £1.00 and you will be able to take home the coffee mug.

Final Earnings

- If you ***buy*** the coffee mug, then you will leave the experiment with the following items:
  - coffee mug
  - £10 endowment minus the price of the coffee mug ($\boldsymbol{p}$)
  - £5 show-up payment
- If you ***do not buy*** the coffee mug, then you will leave the experiment with the following items:
  - £10 endowment
  - £5 show-up payment

Let the experiment begin!

Welcome to ESSEXLab!

- Thank you for participating in today's experiment.
- Please place all your personal belongings away so that we can have your complete attention.
- Please only use the computer as instructed. Do not attempt to browse the web or use any programs unrelated to the experiment.

Guidelines

- You have each earned a £5 payment for showing up on time to the experiment.
- Any additional earnings depend upon your decisions during the experiment.
- Please DO NOT talk or socialize during the experiment.

Structure of the Experiment

- At the beginning of the experiment, you will be given a university-branded coffee mug.
- The coffee mug is yours to keep.
- At the end of the experiment, you will be able to take home the coffee mug.

Structure of the Experiment

- During the experiment, you will have the opportunity to sell the coffee mug in exchange for cash.
- If you sell the coffee mug, you will be selling it to us (the experimenters) and not to other participants.

Selling the Coffee Mug

- We will ask you to state the minimum amount $\boldsymbol{m}$ that you are willing to accept to sell the coffee mug.

- The computer will then generate a random price $\boldsymbol{p}$ between £0.00 and £10.00, where each price between £0.00 and £10.00 is equally likely.

Selling the Coffee Mug

- If $\boldsymbol{p} \geq \boldsymbol{m}$, then you will sell the coffee mug. You will receive the price $\boldsymbol{p}$ and you will give up the coffee mug.

- If $\boldsymbol{p} < \boldsymbol{m}$, then you will not sell the coffee mug.

Best Strategy

- It is in your best interest to truthfully report the minimum amount you are willing to accept.
- This guarantees that you will sell the coffee mug whenever you think it is a good deal (the price ends up being higher) and that you will not sell the coffee mug whenever you think it is a bad deal (the price ends up being lower).

Example #1

- Suppose you are willing to accept as little as £5.00 to sell the coffee mug ($\boldsymbol{m} = \mathbf{5}$).
- The computer generates a random price of £9.00 ($\boldsymbol{p} = \mathbf{9}$).
- Since $\boldsymbol{p} \geq \boldsymbol{m}$, you will sell the coffee mug.
- You will receive £9.00 and you will give up the coffee mug.

Example #2

- Suppose you are willing to accept as little as £5.00 to sell the coffee mug ($\boldsymbol{m} = \mathbf{5}$).
- The computer generates a random price of £1.00 ($\boldsymbol{p} = \mathbf{1}$).
- Since $\boldsymbol{p} < \boldsymbol{m}$, you will not sell the coffee mug.

Final Earnings

- If you ***sell*** the coffee mug, then you will leave the experiment with the following items:
  - the price of the coffee mug ($\boldsymbol{p}$)
  - £5 show-up payment
- If you ***do not sell*** the coffee mug, then you will leave the experiment with the following items:
  - coffee mug
  - £5 show-up payment

Let the experiment begin!

Welcome to ESSEXLab!

- Thank you for participating in today's experiment.
- Please place all your personal belongings away so that we can have your complete attention.
- Please only use the computer as instructed. Do not attempt to browse the web or use any programs unrelated to the experiment.

Guidelines

- You have each earned a £5 payment for showing up on time to the experiment.
- Any additional earnings depend upon your decisions during the experiment.
- Please DO NOT talk or socialize during the experiment.

Structure of the Experiment

- At the beginning of the experiment, you will be shown an image of a university-branded coffee mug.

Structure of the Experiment

- During the experiment, you will receive an endowment of £10.
- You will have the opportunity to buy the coffee mug using your endowment.
- If you buy the coffee mug, you will be buying it from us (the experimenters) and not from other participants.

Buying the Coffee Mug

- We will ask you to state the maximum amount $\boldsymbol{M}$ that you are willing to pay to buy the coffee mug.

- The computer will then generate a random price $\boldsymbol{p}$ between £0.00 and £10.00, where each price between £0.00 and £10.00 is equally likely.

Buying the Coffee Mug

- If $\boldsymbol{p} \leq \boldsymbol{M}$, then you will buy the coffee mug. You will pay the price $\boldsymbol{p}$ and you will be able to take home the coffee mug.

- If $\boldsymbol{p} > \boldsymbol{M}$, then you will not buy the coffee mug.

Best Strategy

- It is in your best interest to truthfully report the maximum amount you are willing to pay.
- This guarantees that you will buy the coffee mug whenever you think it is a good deal (the price ends up being lower) and that you will not buy the coffee mug whenever you think it is a bad deal (the price ends up being higher).

Example #1

- Suppose you are willing to pay as much as £5.00 to buy the coffee mug ($\boldsymbol{M = 5}$).
- The computer generates a random price of £9.00 ($\boldsymbol{p = 9}$).
- Since $\boldsymbol{p > M}$, you will not buy the coffee mug.

Example #2

- Suppose you are willing to pay as much as £5.00 to buy the coffee mug ($\boldsymbol{M = 5}$).
- The computer generates a random price of £1.00 ($\boldsymbol{p = 1}$).
- Since $\boldsymbol{p \leq M}$, you will buy the coffee mug.
- You will pay £1.00 and you will be able to take home the coffee mug.

Final Earnings

- If you ***buy*** the coffee mug, then you will leave the experiment with the following items:
  - coffee mug
  - £10 endowment minus the price of the coffee mug ($\boldsymbol{p}$)
  - £5 show-up payment
- If you ***do not buy*** the coffee mug, then you will leave the experiment with the following items:
  - £10 endowment
  - £5 show-up payment

Let the experiment begin!

Welcome to ESSEXLab!

- Thank you for participating in today's experiment.
- Please place all your personal belongings away so that we can have your complete attention.
- Please only use the computer as instructed. Do not attempt to browse the web or use any programs unrelated to the experiment.

Guidelines

- You have each earned a £5 payment for showing up on time to the experiment.
- Any additional earnings depend upon your decisions during the experiment.
- Please DO NOT talk or socialize during the experiment.

Structure of the Experiment

- At the beginning of the experiment, you will be shown an image of a university-branded coffee mug.
- The coffee mug is yours to keep.
- At the end of the experiment, you will be given the coffee mug to take home.

Structure of the Experiment

- During the experiment, you will have the opportunity to sell the coffee mug in exchange for cash.
- If you sell the coffee mug, you will be selling it to us (the experimenters) and not to other participants.

Selling the Coffee Mug

- We will ask you to state the minimum amount $\boldsymbol{m}$ that you are willing to accept to sell the coffee mug.

- The computer will then generate a random price $\boldsymbol{p}$ between £0.00 and £10.00, where each price between £0.00 and £10.00 is equally likely.

Selling the Coffee Mug

- If $\boldsymbol{p} \geq \boldsymbol{m}$, then you will sell the coffee mug. You will receive the price $\boldsymbol{p}$ and you will give up the coffee mug.

- If $\boldsymbol{p} < \boldsymbol{m}$, then you will not sell the coffee mug.

Best Strategy

- It is in your best interest to truthfully report the minimum amount you are willing to accept.
- This guarantees that you will sell the coffee mug whenever you think it is a good deal (the price ends up being higher) and that you will not sell the coffee mug whenever you think it is a bad deal (the price ends up being lower).

Example #1

- Suppose you are willing to accept as little as £5.00 to sell the coffee mug ($\boldsymbol{m} = \mathbf{5}$).
- The computer generates a random price of £9.00 ($\boldsymbol{p} = \mathbf{9}$).
- Since $\boldsymbol{p} \geq \boldsymbol{m}$, you will sell the coffee mug.
- You will receive £9.00 and you will give up the coffee mug.

Example #2

- Suppose you are willing to accept as little as £5.00 to sell the coffee mug ($\boldsymbol{m = 5}$).
- The computer generates a random price of £1.00 ($\boldsymbol{p = 1}$).
- Since $\boldsymbol{p < m}$, you will not sell the coffee mug.

Final Earnings

- If you ***sell*** the coffee mug, then you will leave the experiment with the following items:
  - the price of the coffee mug ($\boldsymbol{p}$)
  - £5 show-up payment
- If you ***do not sell*** the coffee mug, then you will leave the experiment with the following items:
  - coffee mug
  - £5 show-up payment

Let the experiment begin!

Welcome to ESSEXLab!

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- Please place all your personal belongings away so that we can have your complete attention.
- Please only use the computer as instructed. Do not attempt to browse the web or use any programs unrelated to the experiment.

Guidelines

- You have each earned a £5 payment for showing up on time to the experiment.
- Any additional earnings depend upon your decisions during the experiment.
- Please DO NOT talk or socialize during the experiment.

Structure of the Experiment

- At the beginning of the experiment, you will be given a university-branded coffee mug.
- There is a 50% chance that you own the coffee mug.
- You will learn whether you own the coffee mug at the end of the experiment.

Structure of the Experiment

- If you ***own*** the coffee mug, then you will be able to take it home with you at the end of the experiment.
- If you ***do not own*** the coffee mug, then you will have to give it back to the experimenter at the end of the experiment.

Structure of the Experiment

- During the experiment, each participant who owns the coffee mug will have the opportunity to sell it in exchange for cash.
- If you sell the coffee mug, you will be selling it to us (the experimenters) and not to other participants.

Selling the Coffee Mug

- The instructions below are for ***all participants***.
- We will ask you to state the minimum amount $\boldsymbol{m}$ that you are willing to accept to sell the coffee mug.
- The computer will then generate a random price $\boldsymbol{p}$ between £0.00 and £10.00, where each price between £0.00 and £10.00 is equally likely.

Selling the Coffee Mug

- The instructions below are for ***participants who own coffee mugs.***
- If $\boldsymbol{p} \geq \boldsymbol{m}$, then you will sell the coffee mug. You will receive the price $\boldsymbol{p}$ and you will give up the coffee mug.
- If $\boldsymbol{p} < \boldsymbol{m}$, then you will not sell the coffee mug.

Best Strategy

- It is in your best interest to truthfully report the minimum amount you are willing to accept.
- If you own the coffee mug, then this guarantees that you will sell the coffee mug whenever you think it is a good deal (the price ends up being higher) and that you will not sell the coffee mug whenever you think it is a bad deal (the price ends up being lower).

Example #1

- Suppose you are willing to accept as little as £5.00 to sell the coffee mug ($\boldsymbol{m = 5}$).
- The computer generates a random price of £9.00 ($\boldsymbol{p = 9}$).
- Since $\boldsymbol{p \geq m}$, you will sell the coffee mug.
- You will receive £9.00 and you will give up the coffee mug.

Example #2

- Suppose you are willing to accept as little as £5.00 to sell the coffee mug ($\boldsymbol{m = 5}$).
- The computer generates a random price of £1.00 ($\boldsymbol{p = 1}$).
- Since $\boldsymbol{p < m}$, you will not sell the coffee mug.

Final Earnings

- If you ***own*** the coffee mug and ***sell*** it, then you will leave the experiment with the following items:
  - the price of the coffee mug ($\boldsymbol{p}$)
  - £5 show-up payment

- If you ***own*** the coffee mug and ***do not sell*** it, then you will leave the experiment with the following items:
  - coffee mug
  - £5 show-up payment

- If you ***do not own*** the coffee mug, then you will leave the experiment with the £5 show-up payment.

Let the experiment begin!

Welcome to ESSEXLab!

- Thank you for participating in today's experiment.
- Please place all your personal belongings away so that we can have your complete attention.
- Please only use the computer as instructed. Do not attempt to browse the web or use any programs unrelated to the experiment.

Guidelines

- You have each earned a £5 payment for showing up on time to the experiment.
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- Please DO NOT talk or socialize during the experiment.

Structure of the Experiment

- At the beginning of the experiment, you will be shown an image of a university-branded coffee mug.
- There is a 50% chance that you own the coffee mug.
- You will learn whether you own the coffee mug at the end of the experiment.

Structure of the Experiment

- If you ***own*** the coffee mug, then you will be able to take it home with you at the end of the experiment.
- If you ***do not own*** the coffee mug, then you will have to give it back to the experimenter at the end of the experiment.

Structure of the Experiment

- During the experiment, each participant who owns the coffee mug will have the opportunity to sell it in exchange for cash.
- If you sell the coffee mug, you will be selling it to us (the experimenters) and not to other participants.

Selling the Coffee Mug

- The instructions below are for ***all participants***.
- We will ask you to state the minimum amount $\boldsymbol{m}$ that you are willing to accept to sell the coffee mug.
- The computer will then generate a random price $\boldsymbol{p}$ between £0.00 and £10.00, where each price between £0.00 and £10.00 is equally likely.

Selling the Coffee Mug

- The instructions below are for ***participants who own coffee mugs.***
- If $\boldsymbol{p} \geq \boldsymbol{m}$, then you will sell the coffee mug. You will receive the price $\boldsymbol{p}$ and you will give up the coffee mug.
- If $\boldsymbol{p} < \boldsymbol{m}$, then you will not sell the coffee mug.

Best Strategy

- It is in your best interest to truthfully report the minimum amount you are willing to accept.
- If you own the coffee mug, then this guarantees that you will sell the coffee mug whenever you think it is a good deal (the price ends up being higher) and that you will not sell the coffee mug whenever you think it is a bad deal (the price ends up being lower).

Example #1

- Suppose you are willing to accept as little as £5.00 to sell the coffee mug ($\boldsymbol{m = 5}$).
- The computer generates a random price of £9.00 ($\boldsymbol{p = 9}$).
- Since $\boldsymbol{p \geq m}$, you will sell the coffee mug.
- You will receive £9.00 and you will give up the coffee mug.

Example #2

- Suppose you are willing to accept as little as £5.00 to sell the coffee mug ($\boldsymbol{m = 5}$).
- The computer generates a random price of £1.00 ($\boldsymbol{p = 1}$).
- Since $\boldsymbol{p < m}$, you will not sell the coffee mug.

Final Earnings

- If you ***own*** the coffee mug and ***sell*** it, then you will leave the experiment with the following items:
  - the price of the coffee mug ($\boldsymbol{p}$)
  - £5 show-up payment

- If you ***own*** the coffee mug and ***do not sell*** it, then you will leave the experiment with the following items:
  - coffee mug
  - £5 show-up payment

- If you ***do not own*** the coffee mug, then you will leave the experiment with the £5 show-up payment.

Let the experiment begin!

Chapter 3

Risk Preferences

Abstract

There is a large body of research in experimental economics on the elicitation of risk preferences. However, risk preferences are often modelled as an immutable characteristic of an individual. In this project, we investigate whether risk preferences vary across settings and how sensitive they are to different features of the economic environment. To do so, we conduct a laboratory experiment where each subject participates in a version of the Gneezy and Potters (1997) investment task. Our treatments vary whether the task is conducted across one or two rounds and whether insurance is provided to offset potential losses. Our results can help to shed light on the robustness of individual preferences more generally.

Section 1: Introduction

The study of risk preferences is paramount to understanding choices as it is one of the key considerations in individual decision-making. Almost all decisions we face involve risk or conditions of uncertainty. In economic studies, these problems are commonly presented as gambles, however, real-life applications may include (but are not limited to) investment, saving, migration, and consumption (see for example, Dawson and Henley, 2015; van Praag, 2017). Our paper focuses on the significance of the environment in determining risk preferences and if different states of insurance can lead to inconsistent choices. Therefore, we seek to further understand the role of insurance (or loss coverage) and exposure to risk may play in risk preferences by studying their robustness in an experimental setting. We focus on these two conditions firstly, as those who are insured typically demonstrate a higher degree of risk aversion than those who are not. Secondly, classical models assume that risk preferences are stable over time and that individuals are risk-averse (Stigler and Becker, 1977). In our experiment, we explore whether the amount invested into a risky project is affected by the level of insurance, and the time granted to evaluate risk (the number of rounds). We also examine the role of an initial success in a subsequent investment. These measures are important as the amount invested represents the level of risk aversion of the individual. The length of the evaluation period allows us to study any changes in risk preferences over time, and insurance explains the role of insurance on risk-taking. Success plays a role both in terms of monetary payoff and potentially in psychological effect (such as positively by the hot hands fallacy, Ayton and Fischer, 2004). Without these measures, there is no context for

risk preferences to evolve. Risk-neutral agents will remain risk neutral and vice-versa for risk-averse agents.

Influential theories of choice can help explain risk preferences. First-order risk aversion implies that small risks matter, whereas second-order risk aversion implies approximately risk-neutral behaviour in these conditions. Second-order risk aversion can be explained by loss aversion, and reference dependence, as preferences over binary lottery choices are proven consistent under certain hypotheses. The economic agent is typically expressed as either being strictly risk-loving, risk-averse, or risk-neutral. Stigler and Becker (1977) claims that changes in individual behaviour do not occur from preferences but stem from more quantifiable variables such as changes in prices and constraints. However, in real-life and experimental settings, individuals have demonstrated inconsistent risk preferences. Furthermore, in experiments, subjects will often self-report themselves as risk-seeking but contradict themselves in subsequent hypothetical gambles (Rolison, 2023). Behavioural and social scientists suggest that risk attitudes are made up of three components; cognitive; affective; and behavioural (Stangor et al., 2022).

Risk preferences can be influenced by factors such as demographics (age, income), psychology (traits, biases, heuristics), and social and cultural factors (influence from family and friends).[1] In the risk paradigm, a single parameter is considered sufficient to describe an individual's risk preferences, and this parameter is assumed to stay constant across time. Yet, there is a large body of empirical evidence in the form of panel and cross-sectional data that suggests we become more risk averse as we get older,

[1] https://www.financestrategists.com/wealth-management/risk-profile/risk-preference/

mainly due to the development of cognitive and noncognitive skills (Deckers et all., 2015; Paulsen et al., 2011). This can lead to prudent savings and investment decisions. Furthermore, risk aversion is counter-cyclical in times of economic crisis with higher equity-risk premiums during recessions. In recent studies, preferences may also be influenced by very powerful negative shocks such as violence or natural disasters. Gong et al., (2013) for instance, finds that post-2008 recession preferences are more risk averse. However, these studies are often conflicting even within the same context, and it is unknown if changes are transitory or persistent. It is important to understand the robustness of risk preferences as it may provide insight into an individual or society's recovery after a shock. For example, Hanaoka et al. (2018) studies the effect of the Great Japanese Earthquake of 2011 using a large panel data set. They found that men's risk tolerance increased and persisted for up to 5-years after the earthquake. According to this study, it meant that these men would stay in the area – vital for economic recovery.[2] Similar studies focusing on natural disasters such as Cameron and Shah (2015), find the opposite effect with earthquakes and flooding in Indonesia heightening risk aversion. People who have recently experienced a disaster predict a higher probability of it occurring again. Even in less life-threating scenarios such as economic recessions, it is important to understand the effect on risk preferences to employ correct macroeconomic policy.

When we think of insurance, we generally consider it in the context of insuring house or car, which in most countries is a requirement by law. Aside from legality, what

[2] To measure risk preferences, the authors used the impact that the event had on attrition and migration. For example, risk averse men may be more likely to leave the area after an earthquake .They also used data concerning risky activities such as gambling.

causes an individual to purchase insurance? It has been demonstrated that wealthier individuals also demonstrate higher risk aversion (Kagaigai & Grepperud, 2023). Although, a subject's insurance status is often taken endogenously in these studies. The standard model of economic behaviour assumes that we calculate subjective risk probabilities (SEUT), although we may often underestimate the risk. Underestimation of the risk at hand may lead to individuals not insuring themselves. An obvious determinant of purchasing insurance in the context of this paper is perhaps individuals' risk preferences. Those who are risk averse are more likely to purchase disaster protection. In Gul (1991) an alternative theory is brought forward called disappointment aversion. This theory aims to be consistent with EUT and the Allais Paradox by explaining that the decisions made in this thought experiment, which famously violate the independent axiom, are chosen to avoid disappointment. Thus, we can also think of insurance as not only a risk-averse decision, but also a disappointment aversion decision. There are few studies which examine contexts in which insurance meets assets and investments. Einav et al., (2012) analyses the patterns exhibited by individuals' choices over different insurance coverage decisions (health, dental etc.,) when met with a 401(k)-investment decision. They find that, an individual's choice in one domain is a strong predictor in others, especially if they are closely related (i.e., health and dental). On the other hand, investment decisions have less predictive power for insurance choices. Barseghyan et al., (2011) is another study which considers risk preferences across different domains. However, they find that in their smaller scope, risk preferences may vary in different domains.

A potential alternative to the framework of the robustness of risk preferences is regarding the stability of personality traits. In psychology, stability refers to the constancy of one's behaviours or characteristics over their lifetime and can be measured against the criteria of *rank-order* and *mean-level*.[3] Rank order measures the trait against others, whereas the latter describes the consistency of the average level over time. Therefore, there is some similarity as risk preferences as both are measured as distributions with mean and variance and are comparable on an individualistic level. They are also reliable and predictive in individual decision-making. Schildberg-Hörisch (2018) argues that economists could benefit from the psychometric standards applied to the psyche by using measures with high re-testability and taking measurements over various time intervals. All in all, it seems that risk preferences may be initially not well-defined but become clearer over time, especially in the case of novel situations. It also seems to be the case that once defined only severe shocks have an effect. Even so, it cannot be said if negative shocks make risk preferences consistently more or less averse. Traditionally, economists have assumed risk preferences fulfil a certain criterion. In recent years, efforts have been made to try and measure their external and internal validity. Credible examples of this include Gneezy and Potters' (1997) investment task, Holt and Laury's (2002) price list approach, and Eckel and Grossman's (2002) choice between gambles. Some of these methods require self-reporting from participants which has the unsurprising disadvantage that they can suffer from response bias due to factors such as social desirability and misunderstanding. Of course, surveys can be recalibrated, however, researchers must

[3] https://dictionary.apa.org/stability

take care in doing so as changing framing or references can have confounding treatment effects with attempted bias recalibration (Rosenman et al., 2011).

Furthermore, choices under uncertainty are arguably described by three components: threat, vulnerability, and the risk itself. The threat is the danger or unfavourable outcome that the decision-maker might face (e.g., making a loss or being in an accident). Whereas vulnerability is the weakness in the infrastructure to mitigate risk. In real-world applications, it is the vulnerability of risk that increases the demand for insurance. In the context of economic gambles, this vulnerability is defined as the tendency for risk-averse individuals to act more risk-averse when there exists an additional unfair background risk. This is an endogenous risk of some kind that cannot be avoided or insured against. Gollier and Pratt (1996) state that “the willingness to bear risks is vulnerable to the introduction of another unfair risk”. This, therefore, gives reasoning for the value of equity premium to be undervalued.

We collect empirical evidence to shed light on these questions by altering the context in which individuals take part in a risky investment. To do this, we conduct a laboratory experiment in which subjects take part in one of three versions of the Gneezy and Potters (1997) investment task. In their paper, each subject receives an endowment of w tokens and decides how many tokens x to invest in a risky project with a probability p of success. If the project is successful, then the subject earns kx tokens (where $k > 1$). If the project is unsuccessful, then the subject earns 0 tokens. The $w – x$ tokens that are not invested are kept by the subject. The values of p and k are typically chosen such that $pk > 1$, which implies that a risk-neutral subject should invest her full endowment. Experimental economists have developed a variety of methods for eliciting risk

preferences. In this study, we use the Gneezy and Potters (1997) risky investment task. We use this method because it has been used comprehensively in various risk elicitation experiments and it is simple to implement and easy for subjects to understand. Furthermore, unlike the Holt and Laury (2002) multiple price list, it only requires that subjects make a single decision. Subjects' risk preferences are measured based upon their allocation in a risky investment.

In our experiment, the three treatments are Static (S), Dynamic (D), and Dynamic Insurance (DI) in which the degree of the risk evaluation period and insurance are differed. In all three treatments, the subjects are presented with the opportunity to invest tokens (our experimental currency) into a risky project with a 50% chance of success. In the S and D treatments, there are two rounds and no insurance. In DI, there are two rounds and 50% of the subjects' initial investment in round 1 is protected. In all treatments, subjects earn three times the amount invested in all rounds if successful. The dynamic treatment captures the economic situation of sequential decisions under risk where initial gains and losses may affect future decisions. Examples include "reinforcement behaviour", where early losses cause more risk averse behaviour to occur later (Liu et al., 2010). Alternatively, individuals could exhibit "loss chasing", an opposite effect where losses increase risk loving behaviour to recover early losses (Verbruggen et al., 2017). Imas (2016) conducts a series of tasks involving a risky investment, varying paper and realised losses to test the "realisation effect" which is the theory that prior losses decrease risk taking when losses are realised but increase when losses are only on paper. His findings show that realisation of losses mitigates risk taking behaviour when gambles are positively skewed. In Neilsen (2019), a large-scale test of dynamic risk preferences is

conducted using the bomb risk elicitation task (BRET) in which subjects choose to open boxes trying to avoid the one containing a "bomb".[4] The realisation of gains and losses is varied exogenously to test the "realisation effect". Neilsen (2019) finds strong evidence for the reinforcement effect and history-dependent risk preferences. However, the interaction of realisation is not significant in this study. They attribute this to their negatively skewed gambles, which is an opposite distribution to the gambles found in Imas (2016).

To measure risk preferences, we initially look at the number of tokens (and percentage) invested in round 1 in all treatments. We then investigate behaviour changes in round 2 for treatments D and DI by observing the number of tokens invested in round 2. Predictors of interest include round 1 investment, round 2 wealth (the number of tokens the subject possesses at the beginning of the second round), and round 1 success alongside the main analysis of insurance and risk exposure period. Our initial results show that risk preferences are robust under the conditions given by our treatments. This is consistent with the literature. The presence of the second round does not affect round 1 investment, and insurance also does not significantly affect round 1 investment. This is true for investment in terms of the number of tokens and the percentage of endowment invested. However, proceeding to the second part of our analysis we find that Round 1 investment, success, and Round 2 wealth play a large role in Round 2 behaviour. However, this is only when investment is measured as nominal wealth, describing wealth effects. Furthermore, only a handful of subjects exhibit risk-neutral preferences, which is demonstrated by investing all their tokens in both rounds (or round) in all treatments.

[4] The BRET was first introduced and validated by Crosetto and Filippin (2012).

This research calls attention to the reality of the robustness of risk preferences and contributes with experimental methods to measure them in seemingly relatable conditions. Many emerging publications analyse data in panel and cross-sectional format and support the notion that risk preferences are not stable – however, the results often lie on opposite ends of the risk spectrum. Our work is most closely related to Gneezy and Potters (1997) and builds upon this study predominately by offering insight into the role of insurance in risk-taking, rather than taking risk-averse preferences being taken as given, leading to the decision to purchase insurance.

The paper proceeds in the following format: Section 2 explains our experimental design in greater detail. Section 3 provides theoretical background under our experimental context. Section 4 presents results, and finally in Section 5 we discuss these results and their implications concluding with ideas for improvement in further studies in this area.

Section 2: Experimental Design

During the experiment, we use a fictitious currency called “tokens” to track subjects’ earnings. At the end of the experiment, tokens are converted to pounds at an exchange rate of 1 token = 0.05p.

The experiment uses a between-subject experimental design where each subject participates in one of the following three conditions:

1. Static risk elicitation (S)
2. Dynamic risk elicitation (D)
3. Dynamic risk elicitation with insurance (DI).

The S treatment is a version of the Gneezy and Potters (1997) task for eliciting risk preferences. Each subject is given an endowment of 100 tokens. They can decide how many tokens to invest in a risky project that has a 50% chance of success. If the project is successful, then the subject receives three times the amount invested. If the project is unsuccessful, then the subject loses the amount invested. The parameters are chosen such that it is optimal for a risk-neutral subject to invest her full endowment.

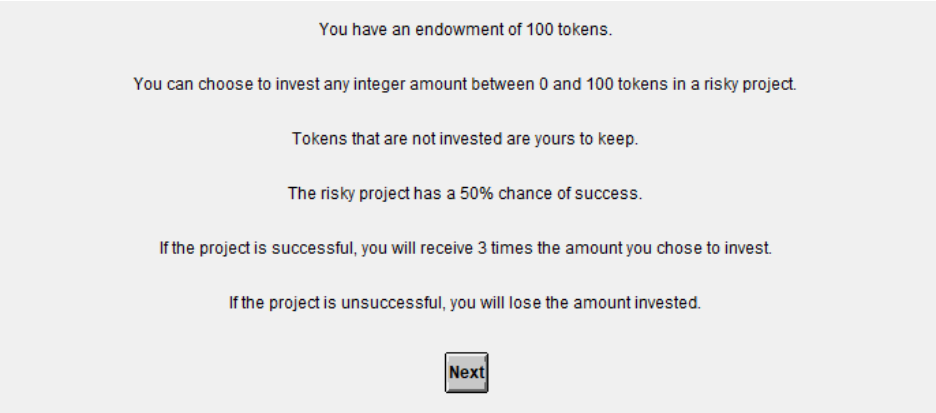

Figure 1: a description of the task at hand at the beginning of the experiment.

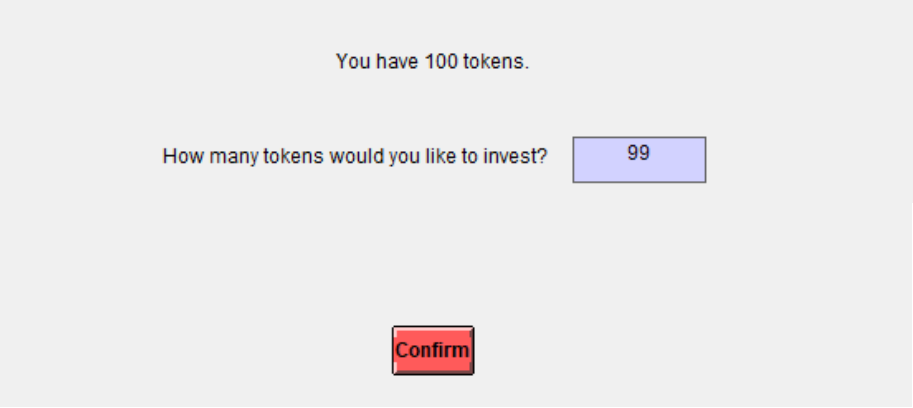

Figure 2: the participant chooses how much they would like to invest.

In the D treatment, each subject participates in a sequence of two risk elicitation tasks (called “rounds”) with the same parameters as the S treatment. At the end of Round 1, each subject’s token balance is carried forward and becomes her endowment in Round 2. If a subject goes bankrupt in Round 1 (i.e., loses her entire endowment), then the experiment is over. This treatment introduces a tension between survival and profit maximisation.

The DI treatment is identical to the D treatment, with the caveat that each subject receives 50% insurance coverage for their Round 1 losses. Importantly, we do not use the framing of “insurance”: in the experimental instructions, subjects are instead told that they will lose half the amount invested if the risky project is unsuccessful. **Figures 1** and **2** give examples of the interface presented to subjects in the S treatment.

Section 3: Theoretical Benchmarks

In this section, we introduce the theoretical framework that supports our experimental design. First, we assume CRRA utility and provide the theoretical predictions for two canonical agents in our experiment. Then, we cast our experimental hypotheses. Throughout, let w denote an agent’s token balance.

1. Risk-neutral: $u(w) = w$

In any round, a risk-neutral participant will invest her entire endowment.[5]

2. Risk-averse: $u(w) = \sqrt{w}$

This participant's expected utility can be expressed as follows:

$$U(i) = (1-p)(w-i)^{\frac{1}{2}} + p(w-i+3i)^{\frac{1}{2}}, \quad 1$$

where w is the participant's token balance, p is the probability of success, and i is the number of tokens invested.

The objective of the participant is to choose i to maximise their expected utility. This yields the following FOC:

$$-\frac{1-p}{2(w-i)^{1/2}} + \frac{p}{(w+2i)^{1/2}} = 0 \quad 2$$

Letting $p = \frac{1}{2}$, we have that

[5] This is a function of our choice of experimental parameters: given the probability of success (p) and the return on investment (k), a risk-neutral agent will invest her entire endowment whenever $pk > 1$.

$$i = \frac{1}{2}w. \qquad 3$$

Therefore, this particular risk-averse subject will invest 50% of her token balance.

Experimental Hypotheses

Our main outcome variable of interest is a subject's investment decision. This variable serves as a proxy for a subject's risk preferences and allows us to make treatment comparisons. We cast the following hypotheses:

1. Subjects will be more risk-averse under dynamic risk elicitation than under static risk elicitation. That is, in Round 1, subjects will invest a smaller fraction of their endowments in treatment D than in treatment S.

2. Subjects will be more risk-loving in the presence of insurance. That is, subjects will invest a larger fraction of their endowments in treatment DI than in treatment D.

Section 4: Results

Implementation

The experimental sessions were run at ESSEXLab, a social science research laboratory at the University of Essex. We recruited a total of 231 participants across 16 sessions in

June 2024. Each session lasted approximately 30 minutes. The experiment was programmed and conducted with the z-Tree software (Fischbacher, 2007). **Table 1** provides more detailed summary statistics.

Result 1: The presence of Round 2 does not affect Round 1 investment.

We start by comparing Round 1 investment between the static and dynamic settings. On average, subjects invest 34.31 tokens in treatment S and 38.97 tokens in treatment D. We find that average Round 1 investment is not significantly different between the two treatments (two-sided t-test, $p = 0.2504$). Figure 2 shows participants' investments (as a fraction of their token balances) across all treatments and rounds. We also fail to reject the null hypothesis that median Round 1 investments are equal between the S and D treatments (Wilcoxon-Mann-Whitney test, $p = 0.12$). Given that participants behave similarly in Round 1 of the S and D treatments, this suggests that the presence of Round 2 does not affect Round 1 investment. In other words, subjects' risk attitudes are not affected when moving from a static to a dynamic setting.

Result 2: The presence of insurance does not significantly affect Round 1 investment.

We now compare Round 1 investment in dynamic settings with and without insurance coverage. On average, subjects invest 38.97 tokens in treatment D and 45.10 tokens in treatment DI. We find that the average Round 1 investment is not significantly different

between the two treatments (two-sided t-test, p = 0.1762). We also fail to reject the null hypothesis that median Round 1 investments are equal between the D and DI treatments (Wilcoxon-Mann-Whitney test, p = 0.30). The similar average investment levels in Round 1 of treatments D and DI suggests that the presence of insurance coverage does not affect participants' levels of risk-aversion. A two-sided variance test finds that the variance between these treatments is significantly different (p = 0.0398) which can be seen in **Figure 3**.

	Number of Subjects*	Risk Neutral Subjects**	Risk Averse Subjects†	Round 1 Mean Investment (£)	Round 2 Mean Investment (£)	Bankruptcies	Average Earnings‡ (£)
Treatment S	80	4	9	34.31	-	2	10.84
Treatment D	72	1	4	38.97	41.74	6	12.88
Treatment DI	69	7	1	45.10	49.38	0	12.51
Overall	221	12	14	39.19	45.48	8	12.08

Table 1: Descriptive statistics of subjects' risk preferences, mean earnings (£), average investments (£), and bankruptcies.

*Of 231 subjects, 10 subjects either did not invest in Round 1 or went bankrupt in Round 1. We omit these 10 subjects from the data analysis. In treatment D, subjects who went bankrupt in Round 1 were unable to continue to Round 2.

**Risk neutral subjects are defined as those who invested all their endowment in all periods.

†Risk averse subjects are defined as those who invested 50% of their endowment in all periods.

‡Including £5 show up payment.

Result 3: Round 1 investment, Round 1 success, and Round 2 wealth are key determinants of Round 2 investment.

Our initial analysis investigated participants' behaviour in Round 1. We now focus attention on the determinants of Round 2 behaviour. **Tables 2 and 3** present the results of OLS regressions on Round 2 investment with Round 1 investment and a dummy variable for whether the risky project was successful in Round 1. **Table 2** measures investment in terms of the number of tokens that a subject invests, while **Table 3** measures investment in terms of the percentage of a subject's token balance that is invested. Several findings emerge. First, Round 1 investment is a significant predictor of Round 2 investment. Although not surprising, this reinforces the fact that the experiment is measuring a meaningful feature of an individual's preferences: subjects are not behaving randomly across the two rounds. Second, while Round 1 success increases

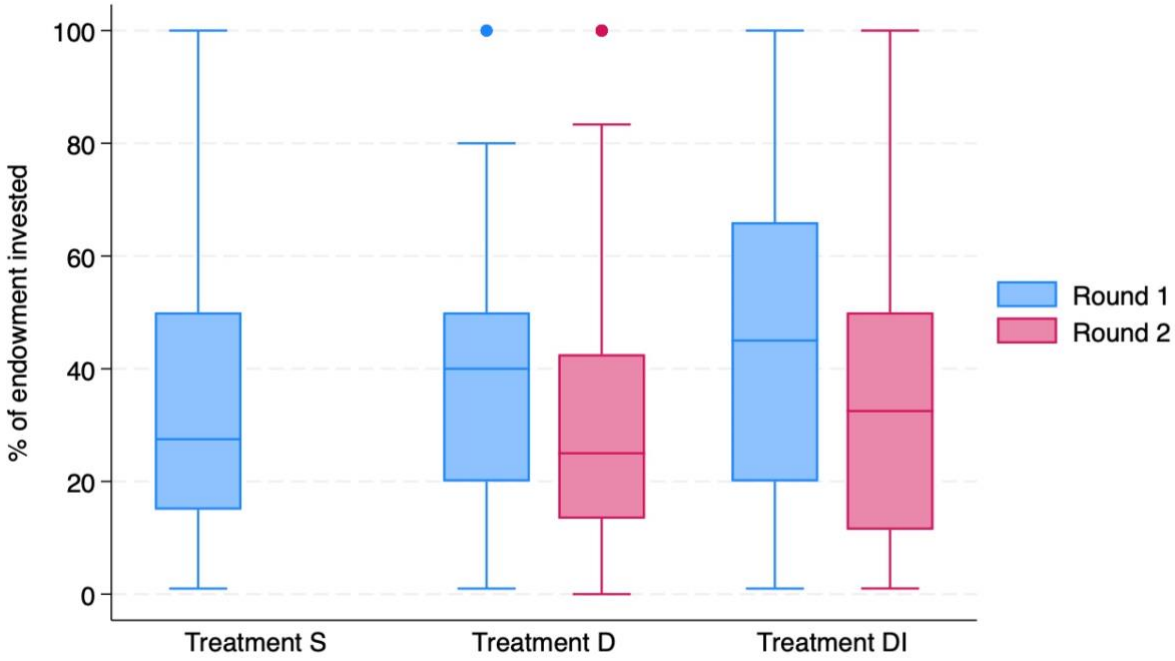

Figure 3. The spread of investments in each treatment in each round.

the number of tokens invested in Round 2, it does not increase the fraction of wealth that is invested in Round 2. This suggests that there is a “wealth effect” in nominal but not real terms: that is, a subject’s risk preferences appear to be independent of their wealth level.

To further test this conjecture, we test the effects of Round 2 wealth on Round 2 investment as tokens, and as a percentage of Round 2 wealth. **Table 4** presents the results of the OLS regression of Round 2 investment on Round 2 wealth in terms of the number of tokens. We find that Round 2 wealth is a highly significant predictor of Round 2 investment. On the other hand, **Table 5** shows that when investment is measured in terms of a percentage of tokens, Round 2 wealth is not statistically significant. This is consistent with our previous finding, such that risk preferences are stable but investment is subject to wealth effects.

	(1) Treatment D Average investment (tokens)	(2) Treatment DI Average investment (tokens)
Round 1 investment	1.13***	0.94***
	(0.32)	(0.18)
Round 1 success	38.44***	40.10***
(dummy)	(7.68)	(10.38)
Constant	-26.38***	-10.58
	(12.88)	(8.87)
Number of subjects	72	69
R-squared	0.46	0.44

Table 2: OLS regressions on Round 2 investment with Round 1 invested in terms of tokens.

Robust standard errors in parenthesis

Significance levels: ***p<0.01, **p<0.05, *p<0.1

	(1)	(2)
	Treatment D	Treatment D
	Average investment (% tokens)	Average investment (% tokens)
Round 1 investment	0.64***	0.81***
	(0.12)	(0.07)
Round 1 success	-8.05	-14.56***
(dummy)	(5.45)	(4.69)
Constant	11.69**	7.50*
	(5.74)	(3.85)
Number of subjects	72	69
R-squared	0.36	0.62

Table 3: OLS regressions on Round 2 investment with Round 1 investment in terms of percentage of token balance.

Robust standard errors in parenthesis

Significance levels: ***p<0.01, **p<0.05, *p<0.1

	(1)	(2)
	Treatment D	Treatment DI
	Average investment (tokens)	Average investment (tokens)
Round 2 investment	0.96***	0.81***
	(0.15)	(0.08)
Constant	94.12***	92.93***
	(8.58)	(7.07)
Number of subjects	72	69
R-squared	0.43	0.42

Table 4: OLS regressions on Round 2 wealth with Round 2 investment as number of tokens.

Robust Standard errors in parenthesis

Significance levels: ***p<0.01, **p<0.05, *p<0.1

	(1) Treatment D Average investment (% tokens)	(2) Treatment D Average investment (% tokens)
Round 2 investment	-0.07	-0.08
	(0.44)	(0.34)
Constant	136.43	135.85
	(12.95)	(11.88)
Observations	72	69
R-squared	0.00	0.00

Table 5: OLS regressions on Round 2 wealth with Round 2 investment in terms of percentage of token balance.

Robust standard errors in parenthesis

Significance levels: ***p<0.01, **p<0.05, *p<0.1

Section 5: Discussion & Conclusion

We begin our discussion with the effect of moving from a static to dynamic environment. The results of the WCM test confirm that the presence of Round 2 did not affect Round 1 investment as there is no statistical difference between investments when moving from a static to dynamic setting. This is in line with current economic theory and research. One possible explanation is that two rounds are insufficient time for subjects' risk preferences to change. Some emerging studies have shown a change in risk preferences over a longer time frame or series of sequential decisions. This accounts for 'real-time' and

experimental settings. Nonetheless, in future studies, it could be worthwhile to conduct longer experiments with many rounds.

Next, we look at the role of insurance. Our results show that insurance had no significant effect on subjects' risk preferences although we observe variation in investments. It is possible that this result could be explained by subjects' lack of trust as there is a large negative opinion in society which contributes to mistrust in insurance companies' willingness to pay out.[6] That said, it is important to emphasize that we do not refer to the loss coverage as 'insurance' in the DI treatment. We simply state that subjects will "lose half of their investment" if they are unsuccessful in the experimental instructions. It is far more likely that this framing had a negative effect on subjects' investment. On that account, future experiments should consider changing the phrasing to be more positive i.e., "half of your investment will be protected" and this could encourage subjects to invest more of their endowment.

Following this, we consider the determinants of Round 2 investment. The consensus is that absolute relative risk aversion *should* decline with wealth. However, according to the theory of Constant Relative Risk Aversion (CRRA; Arrow, 1971), risk aversion increases as wealth increases. In our analysis we considered investment in two different regards: as the absolute amount of tokens, and as a percentage of wealth. Our findings show that increased investment from Round 1 to Round 2 implies that subjects were not acting randomly and that although success in Round 1 increased the number of tokens invested in Round 2, there was negligible effect on the percentage of tokens

[6] According to Which? (2023) Only 21% of customers trust their insurance companies to pay out, whilst 44% said they do not. https://www.which.co.uk/policy-and-insight/article/trust-in-the-insurance-industry-falls-to-new-low-which-warns-aucyM5X9u4Kq

invested. In other words, subject risk preferences are independent of their wealth. Similarly, we find wealth effects regarding Round 2 investment on Round 2 wealth.

To conclude, neoclassical economics theorizes that risk preferences are robust and do not change over time regardless of setting. However, there are numerous experimental and quantitative literature that bring this assumption into question. Regardless, the effect of specific contexts on risk preferences is unclear. Our experiment aims to shed light on the stability of risk preferences by changing the parameters of the evaluation period (rounds) and loss coverage (insurance). Analysis of the results from our experiment shows that neither of these variables had a significant impact effect in our environment. That said, much has been learned from the context that we chose to put our subjects in. For example, it might be that more rounds are needed to create a longer evaluation period to determine if preferences change over time. The effect of the realisation of losses and gains (real vs paper) also warrants further research. Furthermore, the framing of our 'loss coverage' could be implemented more positively by focusing on the fact that the loss coverage *protects* subjects' investments. Finally, comparing results from a different elicitation method such as the BRET could help capture risk loving preferences and avoids confounding risk and loss attitudes (due to prospect theory).

Despite our determinants' insignificance, we did find that success played a large significant (and negative) part in subjects' risk aversion. We theorize this could be due to prospect theory where subjects' desire to protect gains in the first round by being cautious in the second round. This could also be explained by the 'taxi driver' theory when subjects reach a certain level of wealth and effectively withdraw themselves from the experiment.

In future studies, it is worthwhile to test the robustness of the experimental findings along several dimensions. First, both the procedure used to elicit subjects' risk preferences (e.g., the multiple price list) and the details of the implementation (e.g., whether subjects receive feedback about their payoffs in each round) can be varied. Second, it would be interesting to investigate whether increasing the time-horizon (i.e., the number of rounds in the experiment) affects subjects' risk preferences.

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Section 6: Appendix

Section 6.1: Experimental Instructions

(Begins on the next page).

Welcome to ESSEXLab!

- Thank you for participating in today's experiment.
- Please place all your personal belongings away so that we can have your complete attention.
- Please only use the computer as instructed. Do not attempt to browse the web or use any programs unrelated to the experiment.

Guidelines

- You have earned a £5 payment for showing up on time to the experiment.
- Any additional earnings depend upon your decisions during the experiment and random chance.
- Please DO NOT socialise or talk during the experiment.

Structure of the Experiment

- During the experiment, we will use a fictitious currency ("tokens") to keep track of your earnings.

- At the end of the experiment, tokens will be converted to cash at the following exchange rate:

1 token = 5p.

Investment Decision

- At the beginning of the experiment, you will receive an endowment of 100 tokens.

- You can choose to invest any integer amount between 0 and 100 tokens in a risky project.

- Tokens that are not invested in the risky project are yours to keep.

Investment Decision

- The risky project has a 50% chance of success.
- If the project is successful, you will receive **3 times** the amount you chose to invest.
- If the project is unsuccessful, you will lose the amount invested.

Final Earnings

- Your final earnings will consist of the following items:
  1. £5 show-up payment
  2. your remaining token balance (converted to pounds)
- You will be paid privately and in cash at the end of the experiment.

Let the experiment begin!

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Structure of the Experiment

- During the experiment, we will use a fictitious currency ("tokens") to keep track of your earnings.

- At the end of the experiment, tokens will be converted to cash at the following exchange rate:

1 token = 5p.

Structure of the Experiment

- The experiment consists of two rounds.

- At the beginning of Round 1, you will receive an endowment of 100 tokens.

Round 1 Investment Decision

- You can choose to invest any integer amount between 0 and 100 tokens in a risky project.
- Tokens that are not invested in the risky project are yours to keep.

Round 1 Investment Decision

- The risky project has a 50% chance of success.
- If the project is successful, you will receive **3 times** the amount you chose to invest.
- If the project is unsuccessful, you will lose the amount invested.

Round 1 → Round 2

- Your token balance will be updated at the end of Round 1.
- If you have 0 tokens, then the experiment will be over.
- Otherwise, you will advance to Round 2 and your token balance will be carried forward.

Round 2 Investment Decision

- You can choose to invest any integer amount between 0 and your token balance in a risky project.
- Tokens that are not invested in the risky project are yours to keep.

Round 2 Investment Decision

- The risky project has a 50% chance of success.
- If the project is successful, you will receive **3 times** the amount you chose to invest.
- If the project is unsuccessful, you will lose the amount invested.

Final Earnings

- Your final earnings will consist of the following items:
  1. £5 show-up payment
  2. your remaining token balance (converted to pounds)
- You will be paid privately and in cash at the end of the experiment.

Let the experiment begin!

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- Any additional earnings depend upon your decisions during the experiment and random chance.
- Please DO NOT socialise or talk during the experiment.

Structure of the Experiment

- During the experiment, we will use a fictitious currency ("tokens") to keep track of your earnings.

- At the end of the experiment, tokens will be converted to cash at the following exchange rate:

1 token = 5p.

Structure of the Experiment

- The experiment consists of two rounds.

- At the beginning of Round 1, you will receive an endowment of 100 tokens.

Round 1 Investment Decision

- You can choose to invest any integer amount between 0 and 100 tokens in a risky project.
- Tokens that are not invested in the risky project are yours to keep.

Round 1 Investment Decision

- The risky project has a 50% chance of success.
- If the project is successful, you will receive **3 times** the amount you chose to invest.
- If the project is unsuccessful, you will lose **half** the amount you chose to invest.

Round 1 → Round 2

- Your token balance will be updated at the end of Round 1.
- You will advance to Round 2 and your token balance will be carried forward.

Round 2 Investment Decision

- You can choose to invest any integer amount between 0 and your token balance in a risky project.
- Tokens that are not invested in the risky project are yours to keep.

Round 2 Investment Decision

- The risky project has a 50% chance of success.
- If the project is successful, you will receive **3 times** the amount you chose to invest.
- If the project is unsuccessful, you will lose the amount invested.

Final Earnings

- Your final earnings will consist of the following items:
  1. £5 show-up payment
  2. your remaining token balance (converted to pounds)
- You will be paid privately and in cash at the end of the experiment.

Let the experiment begin!